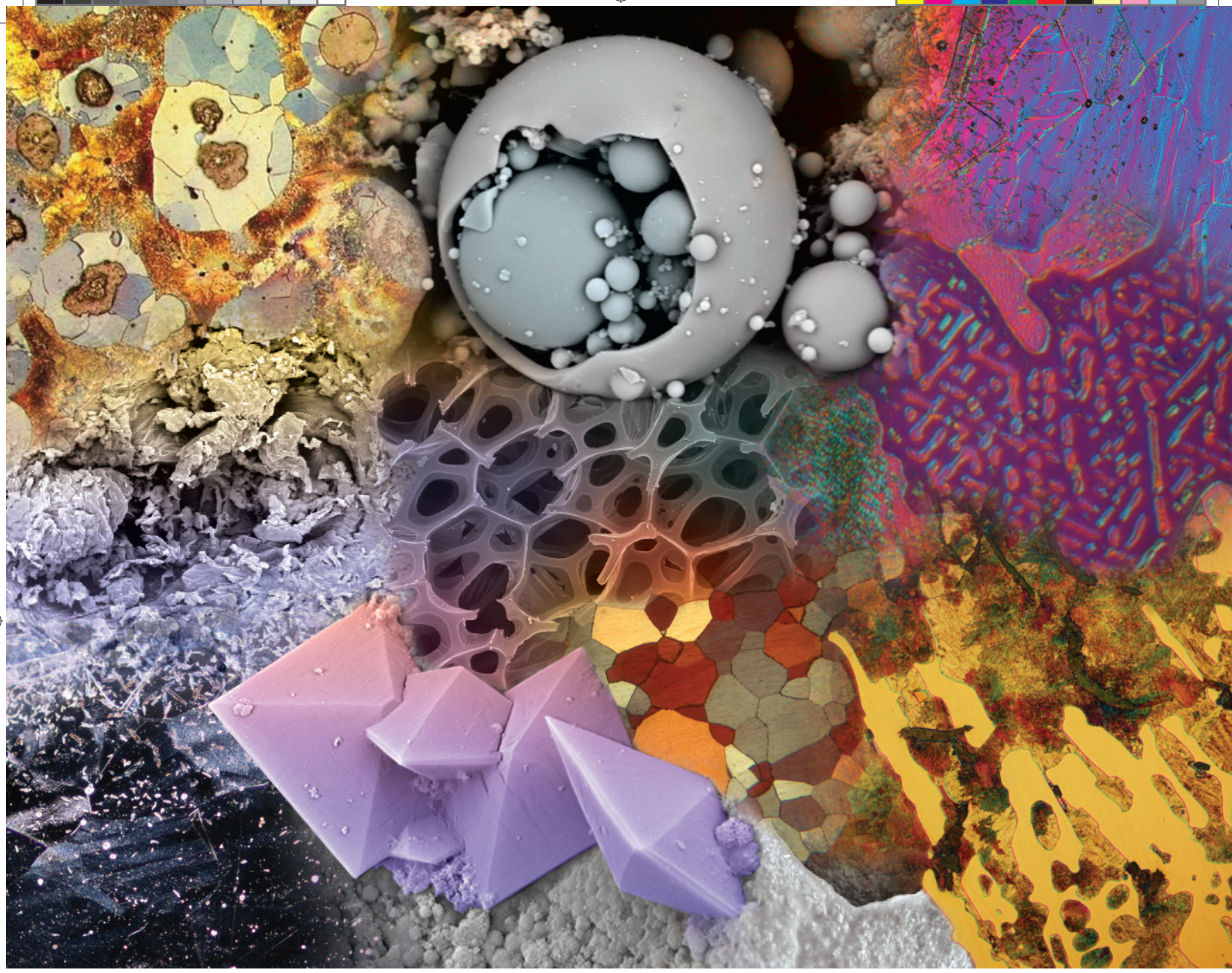
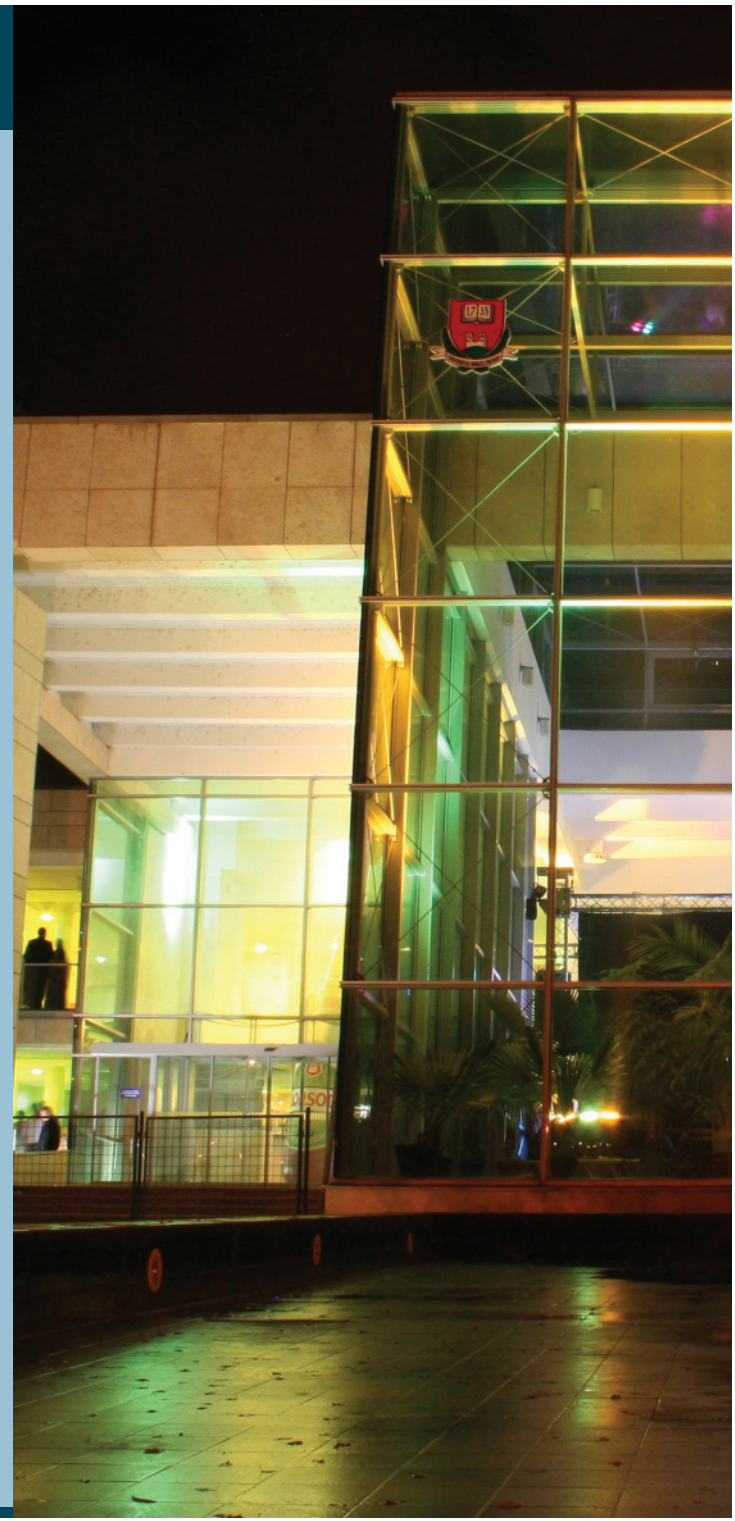


FACULTY OF MATERIALS SCIENCE AND ENGINEERING

UNIVERSITY OF MISKOLC, HUNGARY

Contents



UNIVERSITY OF MISKOLC

FACULTY OF MATERIALS SCIENCE AND ENGINEERING

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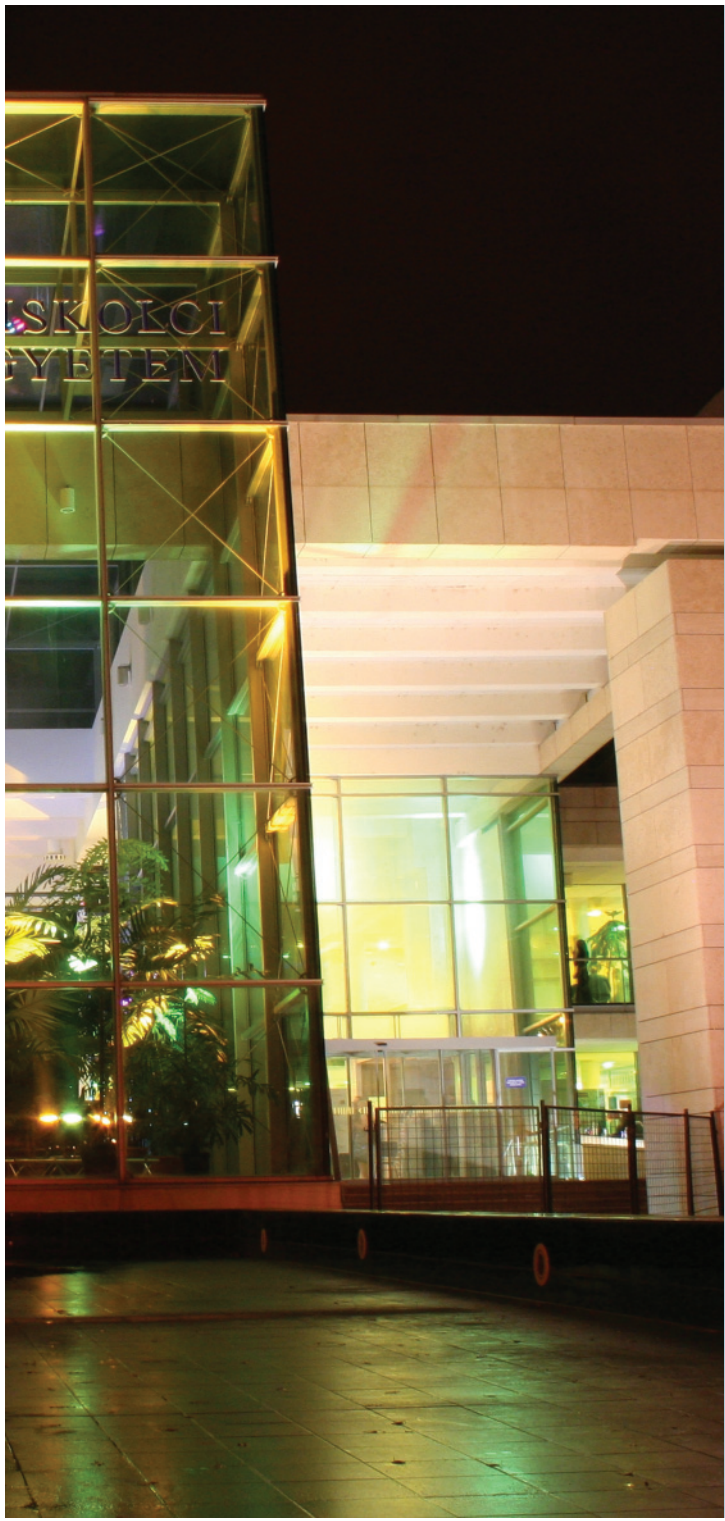


MESSAGE FROM THE DEAN

Today, materials science – the study of the structure and properties of materials, as well as environmental protection and energy-efficient material technology based on materials – is an extremely rapidly developing professional field worldwide. The Faculty of Materials Science and Engineering of the University of Miskolc is one of the oldest university faculties of Hungary (founded in 1735), which, while preserving its abundant experience obtained in various branches of metallurgy, has also conquered new fields (energy management, ceramic and silicate technology, quality assurance, nanotechnology, polymer technology, and chemical industrial technology) in response to changes in the last decades. As part of the reform of technical and engineering higher education, the Faculty has pioneered the adoption and propagation of materials engineering programs in Hungary, and has developed into its national centre.

In the materials engineering program, our students acquire fundamental knowledge related to the structure and properties of materials, as well as to various material technologies. In the bachelor program (BSc) they can choose a specialization focusing on one material or technology. During their studies students also develop an attachment to the profession and preserve the Selmec traditions, which strengthens their sense of belonging to a professional community. They can become involved in the activities of the students' scientific societies, of an outstanding standard even at national level. Having obtained a first degree, students can pursue their studies in master programs (MSc) and doctoral programs (PhD) in a variety of universities in Europe and the world – including the University of Miskolc.

Students who end their studies with a first degree have no reason to worry about the future either. Entrants with high-standard technical knowledge are in demand in the labor market; talented young people are even awarded firm-sponsored scholarships during their studies. Materials engineers graduating from our university enjoy a good reputation and major companies are specifically looking for engineers from Miskolc!

I am convinced that our Faculty, with its valuable historical traditions, is facing a bright future, for it trains specialists meeting the demands of the 21st century in programs in accordance with the Bologna process: engineer assistant, bachelor, master and doctoral programs.

Prof. Dr. Zoltán Gácsi, Dean

SEVERAL-HUNDRED-YEAR-OLD ROOTS

The Faculty was founded in 1735 under the name 'Berg-schola', and its success led Empress Maria Theresa to promote the institution to the rank of higher education with the name 'Academia Montanistica' on 22 October 1762. The term 'Montanistica' covered both mining and metallurgical activities. Namely, in the 18th century transportation of the ore extracted was difficult, therefore furnaces were built directly beside mines.

The Academy, almost from the moment of its establishment, was a workshop of mining and metallurgical knowledge and related natural sciences that was well-known and recognized all over Europe. Later, the mining and the metallurgical faculty became two separate faculties – first the Faculty of Mining Engineering and the Faculty of Metallurgical Engineering, and after many decades, the Faculty of Earth Science and Engineering and the Faculty of Materials Science and Engineering.

FIRST PROFESSORS OF OUR ALMA MATER

Sámuel Mikoviny (1700-1750): the first teacher of the institution, the designer of "Hungária Nova", the court cartographer and architect of His Majesty, the Roman Emperor, and member of the Prussian Scientific Society. He constructed the water-trap system of Selmec, the sweat furnace, a crossing waterwheel, and invented a hydraulic press.

Heinrich David Wilckens (1763-1832): the first teacher of the forestry institution. He gave priority to practical training, and his proposals were adopted almost without exception by the authorities. The development of higher education in forestry is due to his activities.

Christian Doppler (1803-1853): eminent professor of the department of mathematics and physics from 1848 to 1850. He discovered the Doppler effect named after him.

A UNIQUE HERITAGE

At the Selmec Academy a great variety of colorful student traditions were born. Since the Academy was a unique institution, almost all of its students came from far away, from the provinces of the Habsburg Empire and from other countries in Europe. Experienced, older colleagues helped the younger students to make a living and a career. Naturally, this required 'testing' the new-comers as to whether they were worthy of trust, or whether they could meet the requirements later on. This has been the purpose of 'dupe-education' ever since, together with some crasser jokes, for serious rules cannot exist without some fun.

The students set up their own mutual benefit funds, from which they supported the students in need. They held dances and charity balls. In the course of time, the traditions have changed somewhat, but the essence has remained the same: to teach the fellow students a love for the profession, to help them, and to live a merry student life.

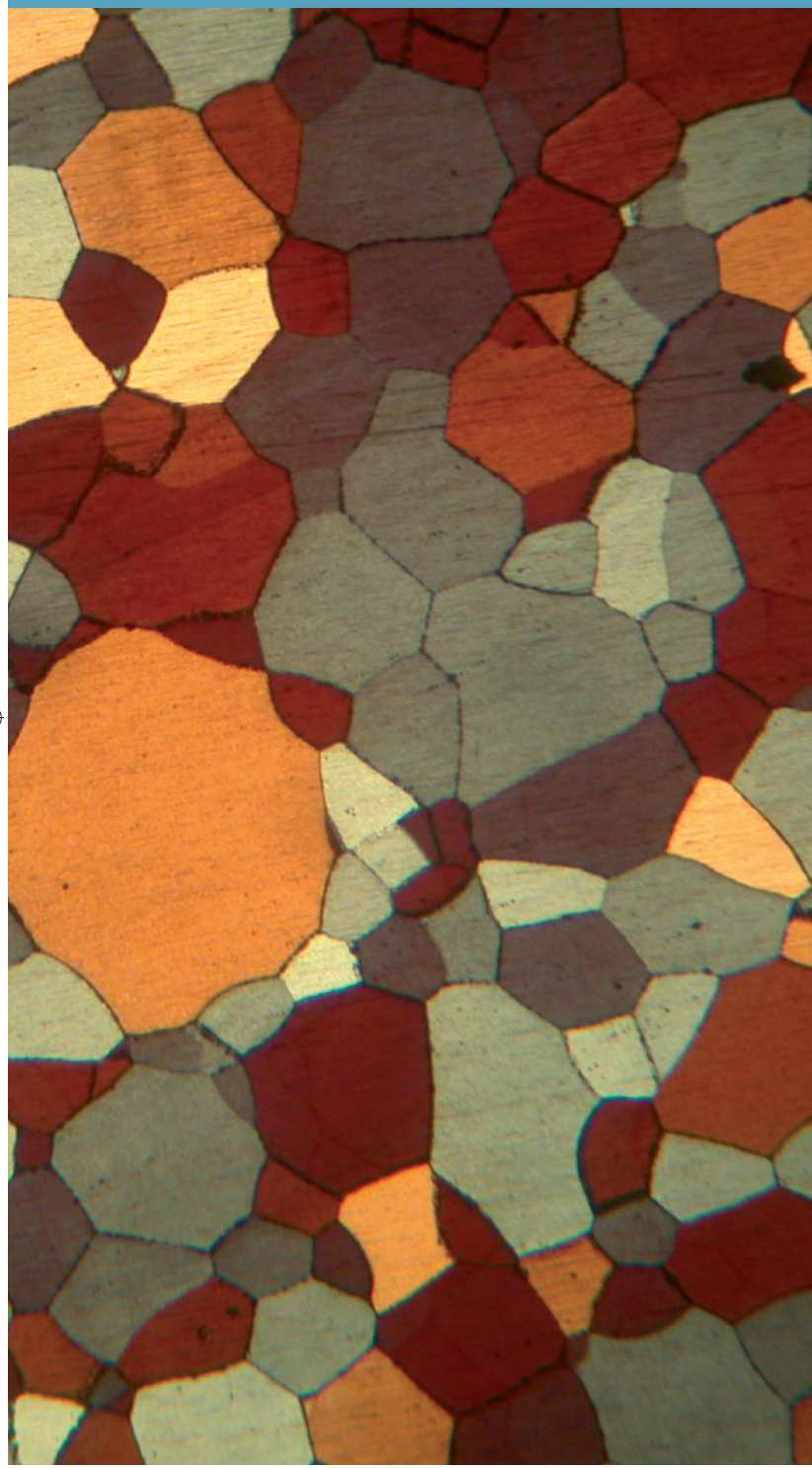
STUDENT LIFE

When in September the freshmen arrive in the campus of the University of Miskolc, they are amazed to see it. Although the campus of the University of Miskolc is a vital element of the city, their everyday life takes place on one of the most beautiful campuses in Europe, in the scenic Dudujka-Valley park of about 85 hectares.

This park houses one of the largest dormitory complexes of the nation with its seven buildings, providing accommodation for about 2,300 students in rooms with 2, 3, or 4 beds.

The interests of the young 'citizens' of the university are represented by the Student and PhD Student Union. Students who are interested in studying abroad and obtaining scholarships can take advantage of the assistance provided by several student organizations. There are also a number of societies, clubs, and associations on campus.

The university sports club (MEAFC) is more than fifty years old. At present the students can be involved in competitive sports in 13 divisions, in addition to their physical education classes included in the curriculum. The sports hall is surrounded by handball, tennis, and basketball courts, athletics tracks and fields and football grounds, and the university sports facilities are made complete by the municipal swimming-pool. The 'Deer-hunters' relay race of university and college students and the 'Selmec Memorial Tour' are held annually. The sports day of the Materials Engineering program, where the students pit themselves against the teams of the academic staff in different sports, is also an important Faculty event.



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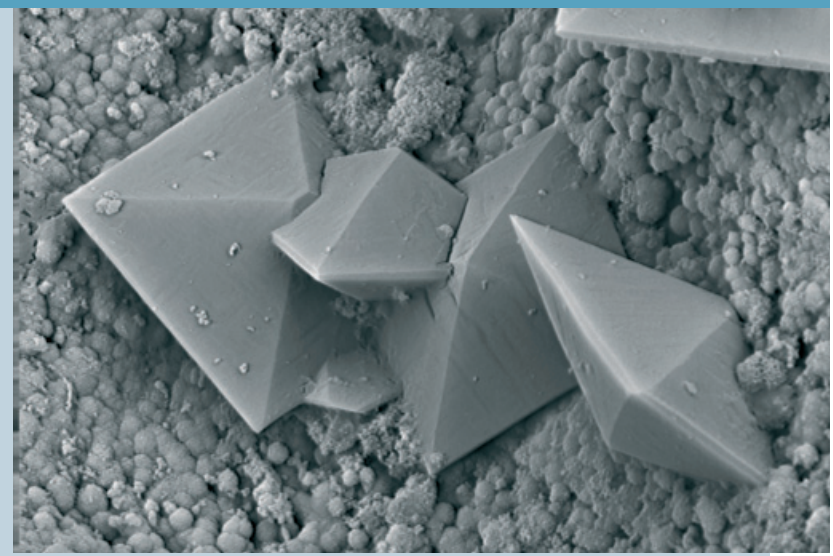

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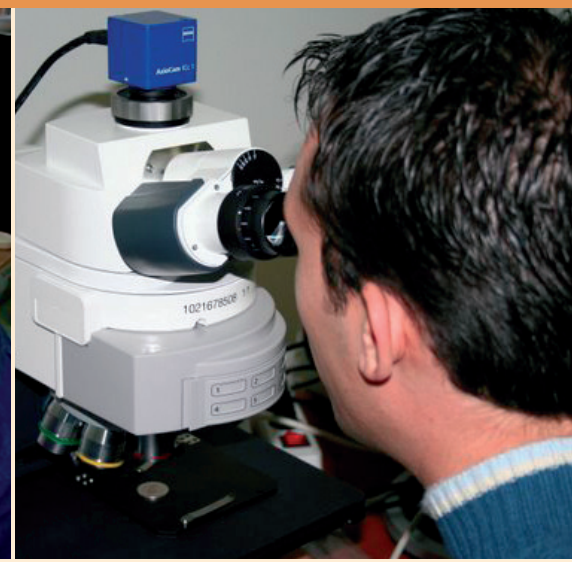


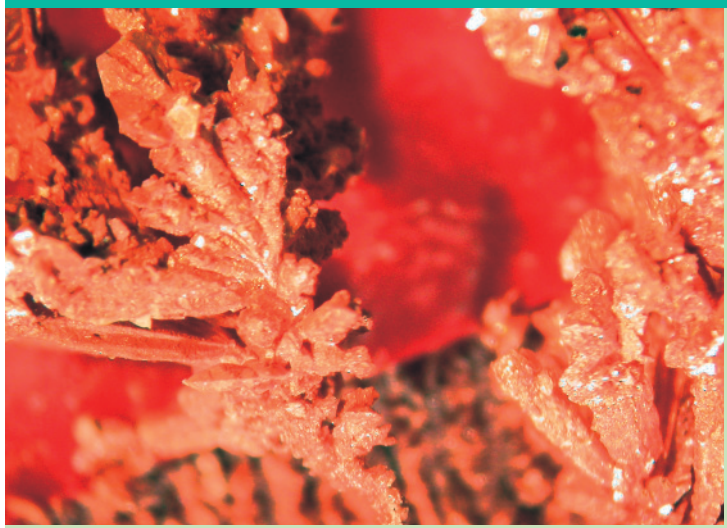
In Hungary, higher education institutes offer the linear education system (or parts of it) introduced in the Bologna process. Our Faculty offers the complete range of programs.

HIGHER LEVEL VOCATIONAL TRAINING PROGRAM FOR ENERGETICS ENGINEER ASSISTANTS
In the energetics engineer assistants program we train technicians who can be of practical help to engineers working in the field of the energy utilization. Our students, in addition to their narrower vocational knowledge, acquire human resources and economic skills as well. The entry requirement is passing the secondary school leaving examination; there is no entrance examination.

BACHELOR PROGRAM IN MATERIALS ENGINEERING (BSC)
The Bachelor program in engineering is seven semesters and offers practice-oriented training. Following the general courses, it is possible for students to choose a specialization in metal production, heat treatment, plastic deformation, casting, thermal energetics, polymer technology, silicate technology, chemical technology, or nanotechnology.

MASTER PROGRAM IN MATERIALS ENGINEERING (MSC)
The MSc (Master of Science) degree can be obtained through two additional years of study and represents a deeper, mostly theoretical knowledge of the given specialization. The MSc program offered by the Faculty also follows a structure of specializations. The entry requirement is a first degree obtained in a technical-engineering field (a BSc degree or a degree obtained in a university or college program). Specializations are thermal and surface treatment of metals, ceramic and silicate engineering, polymer engineering, and chemical technological engineering.

MASTER PROGRAM IN METALLURGICAL ENGINEERING (MSC)
As in the Master Program in Materials Engineering, the MSc degree in Metallurgical Engineering can also be obtained through studies of two additional years. The entry requirement is also identical, and the structure of the program is also similar in following a structure of specializations. Specializations are metal production and waste processing, thermal energetics, plastic deformation, and casting.
Supplementary specializations can also be chosen in both MSc programs from the following range: material testing, surface technology, waste management, environmental protection, quality management, nanotechnology, materials informatics, material and structure diagnostics, and industrial marketing management.



BACHELOR PROGRAM IN MATERIALS ENGINEERING

The knowledge in the bachelor program corresponds to the knowledge included in the programs of materials engineering and metallurgical engineering of the previous training system. Materials engineers have a good knowledge of the structure and properties of materials: metals, ceramics and plastics. They develop, design and produce new materials with up-to-date structures, e.g. high-purity metals, high-strength metal alloys, glasses, adhesives, and they seek possibilities for their application. For this purpose the students have to acquire a thorough knowledge of describing the chemical composition, structure and properties of metallic and non-metallic materials, including how they relate to each other.

SPECIALIZATIONS

METALLURGY

Head: **Prof. T. Kékesi** – Department of Metallurgical and Foundry Engineering

Metals have always had a special significance among industrial materials. Without them there would be no electronics, modern technology or civilization. The extraction of metals is possible not only from ores, but from solid or liquid secondary raw materials; moreover, the processing of wastes with a metal content is also important from an environmental aspect, as well as for extraction of valuable materials. The curriculum of this specialization lays a great emphasis on the processing methods of materials with a metal content, as well as high-purity metals and surface treated metals considered to be up-to-date modern materials. Our students get to know the characteristics and the operation of the physico-chemical processes providing the basis for high-temperature metallurgical processes or those including wet media.

HEAT TREATMENT

Head: **Prof. A. Roósz** – Department of Physical Metallurgy and Metalforming

The properties of metals and alloys are affected not only by their composition but are also significantly influenced by their microstructure (the phases present and their size and distribution). Microstructure can be modified by heat treatment. Our students get to know the processes taking place in the heat treatment of ferrous metals (steels, cast iron) and nonferrous metals (e.g. copper, aluminum, magnesium, and wolfram), as well as the practical aspects of heat treatment, heat treating furnaces and their automation. They acquire knowledge concerning methods for testing the microstructure of materials as well as their mechanical and physical properties. They study the processes taking place during heat treatment through simulation, and learn the relevant standards.

METAL-FORMING

Head: **Dr. I. Zupkó** – Department of Physical Metallurgy and Metalforming

In our everyday life we often encounter metal or metal alloy objects and products made by plastic deformation (e.g. bars, tubes, sheets). These products are used by every industry from construction to electronics. The task of the program of the specialization is to impart the engineering knowledge necessary for the shaping of metals by plastic deformation. The curriculum of the specialization includes, in addition to the theoretical foundations of plastic deformation, testing methods for ductility properties of the metals, the typical production technology of plastic deformation plants, and the operation principles and features of machines used in forming.

CASTING

Head: **Dr. J. Dúl** – Department of Metallurgical and Foundry Engineering

The objective of this specialization is to train professionals who are familiar with the production of components with complex geometry, with the casting of liquid metal alloys into moulds, with the methods, equipment and materials of form-giving using high technology. The foundry industry is looking for engineers who, in addition to their scientific knowledge and knowledge of material structure, material testing, language and economics, have a wide range of knowledge in foundry technology, including the processes and equipment of mould preparation, melting and the treatment of metals, mould filling and solidification, and who can utilize their knowledge on the basis of practical experience under industrial conditions.

The Faculty of Materials Science and Engineering of the University of Miskolc, specifically the Department of Metallurgical and Foundry Engineering, is the only higher education and research centre of foundry technology in Hungary to offer a program training such specialists.

THERMAL ENERGY

Head: **Prof. I. Szűcs** – Institute of Energy, Department of Combustion Technology

The objective of this specialization is to train engineers with a comprehensive knowledge of high-temperature technologies in thermal energy release and utilization. Our graduates will be able to ensure the thermal technical conditions required for the technological processes in high temperature equipment, to perform the innovative modernization of furnaces, boilers, dryers, heating equipment, heat recovery units, to develop and operate new, efficient devices, to introduce and apply economic and up-to-date energy utilization processes and to perform combustion and thermal technology as well as environmental tasks, related to the release and utilization of thermal energy.

POLYMER TECHNOLOGY

Head: **Prof. K. Marossy** – Department of Polymer Technology

Students in this specialization get to know a variety of polymer materials, the production, processing and application mechanism of plastics made from them, as well as the additive systems of plastics. They will acquire skills in the testing of properties of plastics that are essential from a technological viewpoint.

SILICATE TECHNOLOGY

Head: **Prof. L. A. Gömze** – Department of Ceramic and Silicate Technology

The objective of this specialization is to impart to the students, on the basis of a wide range of scientific, technical and materials science foundations, first the basic principles and then the details of the production technology of different ceramic materials (building materials, rough ceramics, fine ceramics, technical ceramics, glasses, ceramic composites) and their products, and the operation of machines and equipment applied in the technology. The practical training is held in our newly built laboratory, supported and recognized by industry, where our students can use state-of-the-art equipment independently, though under supervision.

CHEMICAL TECHNOLOGY

Head: **Dr. J. Lakatos** – Department of Chemistry

One of the special features of this specialization, developed by the university with the participation of experts from the chemical industrial companies of the region, particularly BorsodChem and TVK (Tiszai Chemical Co.), is that practicing professionals working for the companies of the region are invited to impart the industrial, practical and scientific knowledge of their fields, to broaden professional relations, and to participate further in the program. The objective is to train engineers who, having a good knowledge of properties of the products to be produced, are able to manage chemical industrial technologies in

a safe and environment-friendly way, to develop the optimum equipment and technologies necessary for economic operation, and to optimize the operation on a system-theoretical basis. The program enables the student to perform professional tasks involved in general chemical technologies, chemical raw material production, the plastics industry, the food industry, and biotechnological and medical chemical technologies. The education is supported by the two major chemical companies BorsodChem and TVK and to provide institutional form for the cooperation two new departments have been formed within the Institute of Chemistry: the Department of Chemical Technology "BorsodChem" and the Department of Petrol-Chemical Technology "TVK".

NANOTECHNOLOGY

Head: **Prof. G. Kaptay** – Department of Nanotechnology

Material production processes in which the material structure contains at least some units of a size smaller than 100 nanometers are called nanotechnology. This is not typical of materials produced by the classical production technologies in the 20th century (and before), and if it happened to be the case, it was only due to chance, and not even those developing the given material were aware of it. The materials engineer of the 21st century improves the structure and properties of more and more materials by nano-sized phases. In this specialization our students learn how to create materials (metals, polymers, ceramics and composites) with nano-structures and how to investigate such structures using nanometer resolution.

The students of the Faculty of Materials Science and Engineering can choose from two master programs.

MASTER PROGRAM IN MATERIALS ENGINEERING

The objective is to train engineers who, based on their knowledge in the fundamental sciences dealing with the structure, properties and behavior of materials (e.g. metals and their alloys, ceramics and silicates, polymers and plastics), are able to design and operate relevant technologies and to perform research and development activities.
In the course of their studies all master program students choose a specialization and also a supplementary specialization.

SPECIALIZATIONS

HEAT TREATMENT OF METALS

Head: **Prof. A. Roósz** – Department of Physical Metallurgy and Metalforming
The students choosing this specialization get to know the modifications taking place in the material structure during the heat treatment of metals and their alloys. They become familiar with the effects of these modifications on the properties of the metals and alloys. In addition to the heat treatment of bulk materials, they obtain detailed information also on the heat treatment processes involving the surface. They study other methods of surface modification, from painting to laser surface treating processes. They get to know the testing methods of heat treated and surface treated products.

CERAMIC AND SILICATE ENGINEERING

Head: **Prof. L. A. Gömze** – Department of Ceramic and Silicate Technology
Our students can become familiar with production and testing methods used in the production and research of traditional ceramics and high-tech materials. These can currently be studied only at a very few European universities. In addition to materials science, our students acquire skills in control engineering and operation techniques. They study the foundations of hydraulic and pneumatic systems, and they learn to use CAD software at user level in their design and simulation tasks.

POLYMER ENGINEERING

Head: **Prof. K. Marossy** – Department of Polymer Technology
In this specialization the students can add to their knowledge of the production technology of plastics and the processes of compounding, and can acquire high level knowledge in the "alloying" of polymers, in the application of special plastics, and in the theory necessary for plastics processing.

CHEMICAL TECHNOLOGY

Head: **Dr. J. Lakatos** – Department of Chemistry
This region of Hungary is of decisive importance concerning the nation's chemical industry. The master program of materials engineering for the chemical industry is designed to offer a higher training program to graduates of the BSc chemical technological engineering program. It enables students to control and improve chemical technologies in a safe way, to determine experimentally the optimum conditions necessary for economic operation, and to perform model calculations. The chemical industry in the region, which will increase its capacity and product range in the future, offers secure jobs to students choosing this specialization.

MASTER PROGRAM IN METALLURGICAL ENGINEERING

The students studying in this program acquire up-to-date knowledge of metal industrial technologies, metal production, the processing of metal waste, plastic deformation and casting. Graduates with a master's degree in metallurgical engineering are able to produce metals and alloys with the utilization of metallic raw materials and metal-containing waste as well as to process these materials into products with the form and size specified by the processing industry. Production and output in the industry of metal production and metal processing are growing continuously, and it is necessary to produce metal components and structures meeting ever stricter requirements.

SPECIALIZATIONS

METAL PRODUCTION AND WASTE PROCESSING

Head: **Prof. T. Kékesi** – Department of Metallurgical and Foundry Engineering
Our students get to know in detail the physico-chemical processes which provide the basis for chemical metallurgical technologies. This program lays great emphasis on hydro- and pyro-metallurgical meth-

ods suitable for the processing of waste materials of varied composition and state. The students learn the skills to design and control the methods suitable for the selective extraction and purification of any valuable metals. The program also covers the production of up-to-date metallic materials of special purity, a particular surface, or special alloying requirements. Graduates with an MSc degree can find favorable positions in several areas of the industry.

THERMAL ENERGY

Head: **Prof. Á. B. Palotás** – Institute of Energy, Department of Combustion Technology

The objective of this specialization is to train industrial energetics experts who, bearing environmental protection concerns in mind, are able to design new equipment as well as to optimize the technological and economic aspects of existing facilities. Our students are familiar with cost-efficient thermal energy production and the instruments for the rationalization of thermal energy utilization. Besides conventional energy sources, emphasis is made on the options of alternative and renewable energy sources, focusing on the benefits and difficulties associated with them. Students in this specialization also acquire knowledge about tools necessary for mathematical and/or computer based modeling of complex equipment and processes.

METAL FORMING

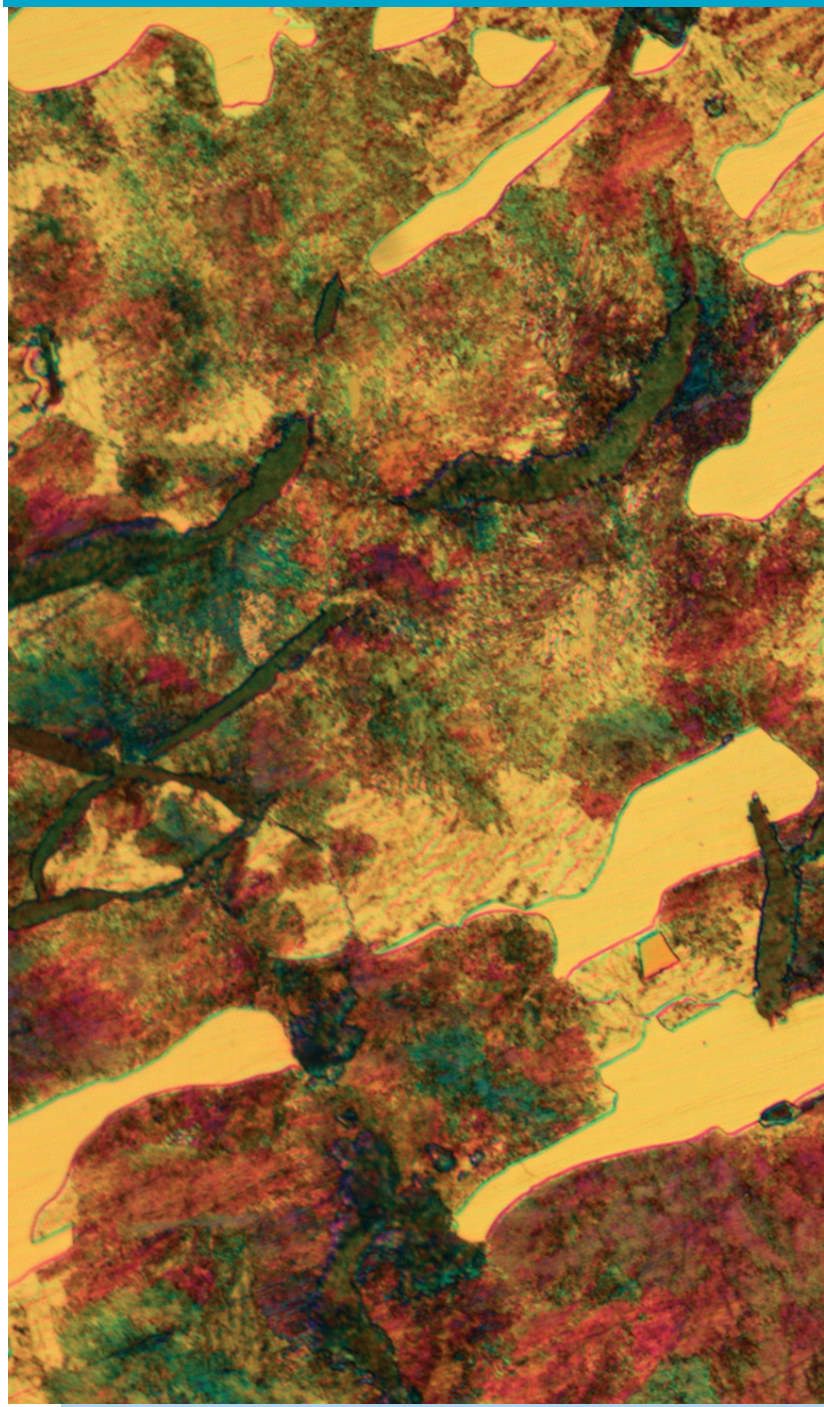
Head: **Dr. I. Zupkó** – Department of Physical Metallurgy and Metal forming

One of the most frequent shape-giving processes of metals and alloys is plastic deformation. For example, the elements of car bodies and railway rails are produced this way. In this specialization students study the theoretical background of plastic deformation and then, making use of this, prove their acquired knowledge in solving technological problems. The program intends to provide as broad an insight as possible into the technological solutions applied in the factories involved in plastic deformation in Hungary.

CASTING

Head: **Dr. J. Dúl** – Department of Metallurgical and Foundry Engineering

Our objective is to train engineers who have knowledge of science, material structures and technology and who are able to interpret and influence the processes taking place in the materials, to operate and develop casting technologies, to master and adopt the newest results, to collaborate in research and development activities, and to organize and manage production processes. The proportion of students taking part in programs abroad is significant. Students can become involved in faculty research and development activities during their studies.



In both of our master programs students also choose a supplementary specialization. The choice is the same for the two MSc programs:

SURFACE TECHNOLOGY

Head: **Prof. T. Török** – Department of Metallurgical and Foundry Engineering

One cannot imagine the production of semi-finished and finished products – from a steel billet to a gold watch – without the surface technical finishing procedures which make a workpiece truly ready for its planned utilization. In our age exciting possibilities are opening up for the combining of materials, e.g. by surface modification and by the forming of special coatings. The primary objective of this specialization is to raise awareness of the widest range of these possibilities through examples taken from engineering practice.

MATERIAL TESTING

Head: **Dr. V. Mertinger** – Department of Physical Metallurgy and Metal-forming

In our everyday life, if we buy or make something we always test whether it will meet the requirements. This is no different in industry, either, but there the suitability of materials is also determined by other aspects. Students choosing this supplementary specialization get to know the most frequent material testing methods used in industrial practice.

WASTE MANAGEMENT

Head: **Dr. J. Lakatos** – Department of Chemistry

We train engineers who are able to develop and operate the optimum equipment and technologies necessary for the environment-friendly and economic utilization of wastes and secondary raw materials. They can help to transform current technologies into waste-less technologies, on the one hand, and on the other, can develop new production systems keeping environmental management issues in mind for processing accumulated industrial, communal and hazardous wastes, creating an environmental protection industry. The most important environmental protection task for engineers is the protection of the technical environment; our specialization prepares its students to solve this complex technical task.

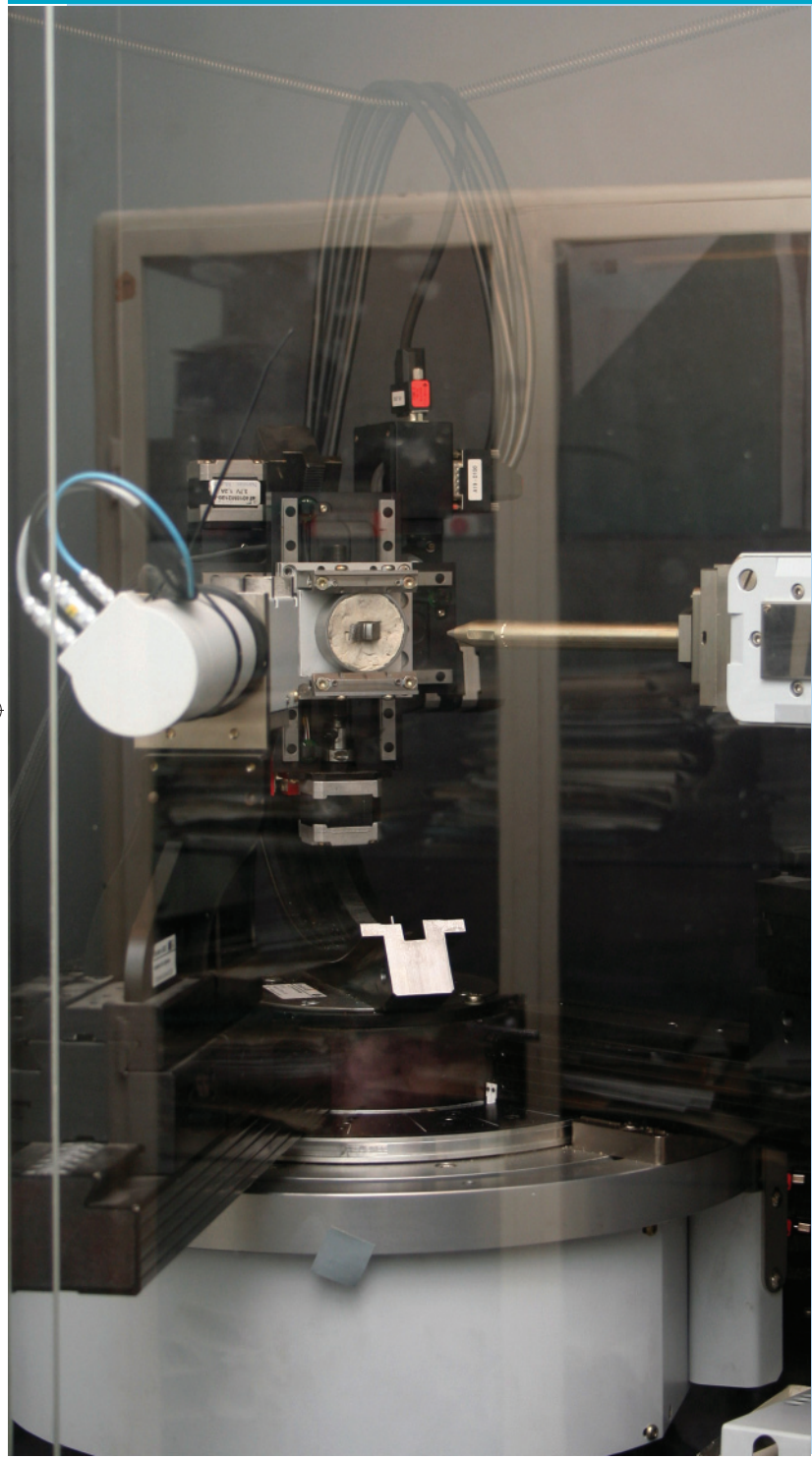
ENVIRONMENTAL PROTECTION
Head: **Dr. O. Bánhidi** – Department of Chemistry
Our students get to know the fundamental principles of water, air, soil and noise protection, as well as the main principles of waste management, and master methods for the evaluation of the environment.

The objectives are to be able to discover environmental contamination, to recognize the composition of waste, and to survey the state of the environment. Students acquire experience in analytical and other techniques via laboratory and on-site measurements and corresponding in-depth analyses.

QUALITY MANAGEMENT
Head: **Dr. J. Koncz** – Department of Quality
Quality assured production processes require identical end products in every respect, regardles of where the production process takes place. This can be ensured only by a comprehensive quality management system. The operation of such systems should be performed by well-trained professionals with thorough knowledge. The task of this specialization is to impart such knowledge to our students, and to present the practical operation of a variety of systems.

NANOTECHNOLOGY
Head: **Prof. G. Kaptay** – Department of Nanotechnology
The objective is to train engineers who, instead of the classical microstructure materials, are able to design technological changes with the help of which the material will change into a nano-structure, and therefore will have improved quality from different aspects. Naturally, the engineers graduating here will be able not only to design nanotechnologies, but they will be able to implement them, and also to investigate the structure and properties of nano-structure materials and answer the inevitable question: "has it become nano, and if so, has it become better compared to the stage when it was not nano?"

MASTER PROGRAM FOR VOCATIONAL TEACHER (MATERIALS ENGINEERING)
Techn. Head: **Dr. Z. Lovrity** – Department of Chemistry
The objective of the program is to prepare students for the pedagogical tasks involved in vocational training. Vocational teachers are able to teach the subjects requiring materials engineering theoretical knowledge, in programs within the school system, outside the school system and in accredited vocational training programs. Application for the program is handled by the Faculty of Arts of the University of Miskolc.



Students have access to state of the art facilities and laboratories with machinery and instrumentation matching the needs of a 21st century engineering education

The well-equipped laboratories are an important venue of our practice-oriented training. Here, modern devices applied in the industry are available to our students. One of our major endeavors is that our students should have a thorough knowledge of the use of industrial equipment and should be able to operate and improve it.

All of our specializations have more than one laboratory – here we offer you a glimpse into them. Our staff in charge of the laboratories use continuous development to keep up with industrial trends and for the development of the relevant disciplines.

LIST OF OUR LABORATORIES

INSTITUTE OF MATERIALS SCIENCE
- X-Ray laboratory for the analysis of fine structure
- Scanning electron microscopy laboratory
- Conventional (light) microscopy laboratory
- Computer laboratory for image analysis

INSTITUTE OF ENERGY AND QUALITY ISSUES
- Combustion technology laboratory
- Fuel test laboratory
- Experimental combustion facility (furnaces, boilers, burners)
- Thermo analitycal laboratory

INSTITUTE OF CHEMISTRY
- Chromatography laboratory for environmental analysis
- Elemental analysis laboratory

INSTITUTE OF METALLURGICAL AND FOUNDRY ENGINEERING
- Foundry facility
- Metallurgical laboratories
- Surface treatment laboratory

DEPARTMENT OF CERAMIC AND SILICATE ENGINEERING
- Ceramics and silicates laboratory

DEPARTMENT OF POLYMER ENGINEERING
- Polymer laboratory

KERPELY ANTAL DOCTORAL SCHOOL OF MATERIALS SCIENCE AND TECHNOLOGIES

Chair: **Prof. András Roósz**
Member of the Hungarian Academy of Sciences

Core members:

Prof. Dr. Sándor Bárány
Prof. Dr. Pál Bárczy
Prof. Dr. Gábor Buza
Dr. Jenő Dúl
Prof. Dr. Zoltán Gácsi
Prof. Dr. György Kaptay
Prof. Dr. Tamás Kékesi
Dr. Valéria Mertinger
Prof. Dr. Árpád B. Palotás
Prof. Dr. András Roósz
Prof. Dr. István Szűcs
Prof. Dr. Tamás Török

Students with excellent achievements in the master programs can continue their studies in the Kerpely Antal Doctoral School of Materials Science and Technologies at the Faculty of Materials Science and Engineering of the University of Miskolc and obtain a doctoral degree. In the Doctoral School, as in all other doctoral schools, the doctoral programs are offered in full-time, part-time, and individual preparation forms. Successful completion is shown by obtaining the absolutorium (a certificate of course completion). Following this, students can take the doctoral examination, then submit and defend the dissertation. After the successful accomplishment of these requirements and fulfilling other conditions (e.g. knowledge of foreign languages, publications), the doctoral degree can be awarded.

THE DOCTORAL SCHOOL COVERS NINE FIELDS:

- physical metallurgy,
- chemical metallurgy,
- forming as metallic materials via casting,
- interfacial and nanotechnologies,
- material informatics,
- space materials and technology,
- high temperature equipment and thermal energy utilization,
- silicate technology,
- polymer technology.

Higher education in Hungary provides an organized framework for students to get involved in research activities of their educational institution: this is done through the Students' Scientific Societies (with the Hungarian abbreviation TDK). Our Faculty, in terms of Students' Scientific Society activities, is one of the most active and most successful university faculties on the national level. This is also shown by that fact that among the students awarded the Pro Scientia prize, which is awarded for outstanding academic achievements and TDK-activities, there are many students from our faculty. This prize is awarded to 3-4 students in engineering programs every two years in Hungary.

Successful TDK papers often make it possible for the students to take part in programs abroad or to submit applications for projects. Our Faculty gives priority to supporting the participation of students in different programs in Europe and the USA. By taking the required courses, the semester requirements can be met and the results achieved abroad are recognized in the home institution.

Students of the Faculty have studied in programs in Germany, France, Belgium, the Netherlands, the Czech Republic, Canada, the United Kingdom, Sweden, and in the United States.

As a result of the small number of students of the Faculty of Materials Science and Engineering, which is due to historical reasons, there is a constant excess demand for graduates in the labor market. The unemployment rate of new graduates is far below the national average; practically all of our engineers can find jobs without any delay.

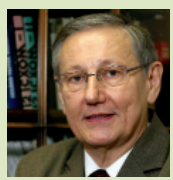
In addition, our program structure is very wide: it matches the profiles of around 1,000-1,500 domestic production companies. Our departments receive requests and offers from Hungarian and European companies for thesis topics and for graduating engineers. For many years our Faculty has not been able to provide engineers in sufficient numbers for the industry and there is a constant demand for more well-trained engineers with language proficiency and IT knowledge. Therefore, companies directly support the training of our students through different foundations.

Our academic staff has longstanding, close connections with these companies, so our students can do their summer internships, their TDK studies, and research their theses in their prospective workplaces.

The high standards of the training provided by the Faculty of Materials Science and Engineering are guaranteed by our academic staff and professors, who enjoy national and international recognition and reputations in their professional fields.

PROF. DR. PÁL BÁRCZY

The main topic of research groups around Professor Bárczy are cellular materials particularly foams either from water-base or from polymer, carbon or metal. As a project lead of a five member consortium he is the key person of developing a new type shaped metal foam technology which is recently combined also by space experiment on board of the ISS. The self life of foamability of nano particle stabilized aqueous suspension in water or in sponges was and is the topic of many extended studies. The correlations between foam structure and compressive strength were studied on polymer macro lattices built by a super precision rapid prototyping technology. Extended investigation was fulfilled on the development of carbon foam structures by pyrolitic treatments of surface treated PUR foams.



PROF. DR. ZOLTÁN GÁCSI

Prof. Gácsi is the current dean of the faculty of Materials Science and Engineering and similarly to a number of our other professors, is an alumnus of the University. He is a renowned expert on ceramic particle reinforced metal-matrix composites and a leading domestic expert in the field of computer based image analysis. He is teaching courses on the mechanical, electrical and magnetic properties of metals. Professor Gácsi advises undergraduate and graduate students and his research group also includes doctoral students.

PROF. DR. LÁSZLÓ A. GÖMZE

Assoc. Professor Gömze and his students carry out research on traditional ceramics, on ceramic matrix composites reinforced with submicron and nanoparticles and the relationship between mechanical, wear and thermal shock properties and microstructures of complex materials as ceramics. One area of special interest is the development and fabrication of high porosity ceramic materials for metal matrix composites (MMC-s) as well as of heteromodulus ceramics and ceramic matrix composites (CMC-s) having several Young's moduli, extreme mechanical properties and dynamic strength. Another area of particular focus is phase transformation in ceramic particles during high speed collisions and development of diamond-like ceramic materials as *c-Si3N4 *with extreme hardness, mechanical strength and thermal shock resistance. Other major topics in Dr. Gömze's research are friction and rheology of non-linear viscoelastic-plastic materials like ceramics as well as changes of their friction and rheological properties during technological processes of forming, compacting, drying and sintering.

PROF. DR. GYÖRGY KAPTAY

Professor George Kaptay and his students carry our research in scientific areas like thermodynamics of materials, interfacial phenomena, nanotechnology, electrochemical synthesis and modeling thermo-physical properties of materials. In terms of materials types his group works with liquid metallic alloys, molten salts, ceramics, metal matrix composites and particles stabilized metallic foams and emulsions. One of his and his students latest achievements are the 4th law of materials thermodynamics, a method to calculate surface phase transition lines for monotectic phase diagrams, a method to achieve perfect wettability of carbon surfaces by liquid aluminum, a method to produce particles stabilized metallic emulsions and monotectic alloys, a new technology to produce metallic foams and carbon micro- and nano-phase reinforced Al-matrix composites.

PROF. DR. GYULA KÁROLY

Among various theoretical and technological issues of steel metallurgy Professor Károly primarily focuses on improving steel cleanliness. He investigates the effects of complex de-oxidation, the role of ladle metallurgy as well as the possible sources of re-oxidation from tapping to casting and its effect on the inclusion balance in steel and on the castability of special steel grades (e.g. ball bearing steels, micro-alloyed steels, Si deficient Al-killed steels). Examination of inclusions requires a deep knowledge of the usage and applicability of different examination methods. In this regard, he examines the role of sampling to make an assessment for the cleanliness (quantity of inclusions) from the samples taken from the melt. Special areas of his research include the role of rare earth metals in steel metallurgy as well the effects of vacuum arc and electro-slag re-melting on cleanliness.

PROF. DR. TAMÁS KÉKESI

Professor Kékesi gives lectures in all fundamental fields of extractive/chemical metallurgy, including high-temperature and aqueous methods, waste processing and metal refining. His dominant research activity encompasses the purification and extraction of metals. Industrial processes of molten metal production and melt refining are examined and optimized by theoretical and experimental methods. A special field of his major scientific interest is the preparation of ultra-high purity metals and the processing of secondary raw materials. This is mainly achieved by anion exchange separations in hydrochloric solutions using a controlled formation of chloro-complex species of different oxidation states. Important related fields are electrowinning from the purified eluates or direct electro-refining of scrap materials. Conditions of electrolysis are improved by electric current modulation and separation of the anodic and cathodic compartments by ion-exchange membranes often coupled with the simultaneous purification of the circulated electrolyte solution. Ultra-high purity metals are tested in cooperation with Japanese research partners and new technologies are developed for advanced materials processing.

PROF. DR. KÁLMÁN MAROSSY

Professor Kálmán Marossy graduated from the Technical University Budapest as chemical engineer in 1972. He started his career at BVK, the legal predecessor of BorsodChem Zrt and dealt with the research and development of PVC and PVC related polymers. He obtained his dr.univ. degree in 1983, PhD in 1998 from the TU Budapest and professorship at the University of Miskolc in 2008. He deals with the structure-property relationship and relaxation phenomena of polymers by thermally stimulated discharge and dynamic-mechanical methods; and was awarded the Dennis Gabor award for his research in his field. Recent research projects are polymer nano-composites, compatibility of polymers, polymer blends. He has been teaching at the University of Miskolc since 1995 and is the head of the Polymer Engineering Department since 2006. Research projects of the department are: plastic processing, polymer composites, polyurethane chemistry, natural polymers, etc.

PROF. DR. ÁRPÁD B. PALOTÁS

Árpád B. Palotás is both a metallurgical engineer (University of Miskolc) and a chemical engineer (MIT, Cambridge, USA). In his role as head of the Institute of Energy and Quality Issues, as well as the Department of Combustion Technology and Thermal Energy he is responsible for several research facilities, resources and research projects. His research activities include various aspects of the field of combustion, including, e.g., the use of high resolution scanning electron microscopy on soot particulates for the purpose of tracing the samples back to the sources responsible for their emission. Due to his commitment to a sustainable society, he is working on projects to expand the research scope at the Institute to a wider utilization of renewable energy by, e.g., establishing a new solar laboratory in addition to further developing the Department's capabilities in the field of biomass combustion and related issues (e.g., ash fusion).

PROF. DR. ANDRÁS ROÓSZ

Professor Roósz is also an alumnus of our faculty, he graduated in 1968. He is member of the Hungarian Academy of Sciences, former director of the Institute of Materials Science, founder of the physics-engineering education in Hungary and a world renowned expert on the solidification of metals and their alloys. His research group forms the base of the domestic space materials research. He is teaching the rules of transformation processes occurring in metals and their alloys as well as their computer based simulation. Students are often involved in his research projects.

PROF. DR. ISTVÁN SZŰCS

The research activity of Professor Szűcs includes the development of furnace and boiler structure, efficiency enhancement, optimization of their operation. He has decades of activity in the area of refractory lining optimization and increasing their life span as well as operational safety by investigating the application technology of refractories. He is known for his expertise on solid air pollutant formation from industrial activities, as well as on the mathematical modeling of air pollutants' transmission in open atmosphere. He has been leading projects on the enhancement of the operation of waste incinerators and the reduction of their air pollution. He is the lead researcher in the enhancement of thermal utilization of biomasses. Professor Szűcs teaches subjects on high temperature equipment (furnaces, boilers, etc.), refractory materials and air pollution control.

PROF. DR. TAMÁS TÖRÖK

Within the fields of Chemical Metallurgy and Surface Engineering Professor Tamás I. Török and his interested colleagues and students have recently been concentrating both on some application oriented tasks and fundamental research topics. In the departmental Surface Treatment Laboratory Professor Török's students are testing different samples coated by protective metallic and/or organic layers. Among the experimental techniques applied the in depth profile analysis by GD-OES has been one of the newest development used in collaboration with an industrial partner. Corrosion studies are also performed by means of various electrochemical and chemical testing devices in different atmospheres and/or aqueous solutions. Development of some novel pretreatment procedures as well as studying the mechanism of electroless nickel deposition onto several metallic (steel, aluminum and magnesium alloys) substrates has also been dealt with for a few years now. Other important topics in Professor Török's research are process developments in the treatment and recycling of metals and metal containing wastes, first of all in the aqueous systems.

AT INTERNATIONAL LEVEL

The Institute of Materials Science of the University of Miskolc (and its predecessor, the Department of Metallography) started to research solidification processes in the 1970s. These research activities provided the foundation for the BEALUCA space material technology program, which was implemented in 1980 for joint Soviet-Hungarian space flight. One of the lessons of the program was that the crystallization equipment used on the SALIUT-6 space station was not up-to-date; therefore the results obtained were not very accurate. In 1987, the Department was invited to design and build a new, a so-called poly-zonal type of crystallization equipment, at that time with a Soviet partner for a Soviet space device. Following the changes in the political system, this connection has come to an end, but at the same time experts at NASA showed an interest in the equipment.

This was the background to the organization of the first Solidification and Gravity international conference. The conference was held in Miskolc-Tapolca, with the participation of 35 research specialists from 10 countries. The success of the equipment and the internationally acknowledged research results of the Department, have made a conference series possible. Following conferences in 1995, 1999 and 2004, we organized the Fifth International Conference on Solidification and Gravity in 2008 in Lillafüred, the chairman of the organizational committee being Dr. András Roósz, member of the Hungarian Academy of Sciences.

The number of participants is growing continuously: the last conference was attended by about 90 research specialists from 25 countries (including the USA, India, China, Australia, Germany, France, England, and Austria), as well as 30 domestic researchers. These experts reported on the most interesting research results of the four years, from different areas of the solidification of metals and alloys, in 12 sections and with 120 presentations.

D. J. Jarvis, representative of the European Space Agency (ESA), in his paper entitled "Metallurgy in Space," summarized the most important results of space-material technology. Presentations were held on topics such as the production possibilities of amorphous metals, the simulation of various solidification processes, metal foams, the production of monocrystals, and the effect of magnetic stirring, as well as about interesting problems of mould casting and continuous casting.

The final discussions of two ESA projects (MICAST, CETSOL) were also connected to the conference. The MICAST project, which deals with the effects of magnetic stirring, involves researchers of the Institute for Materials Science as active participants. The participants have chosen to meet again for the sixth conference in 2012, in Miskolc-Lillafüred.

FOR PROSPECTIVE STUDENTS

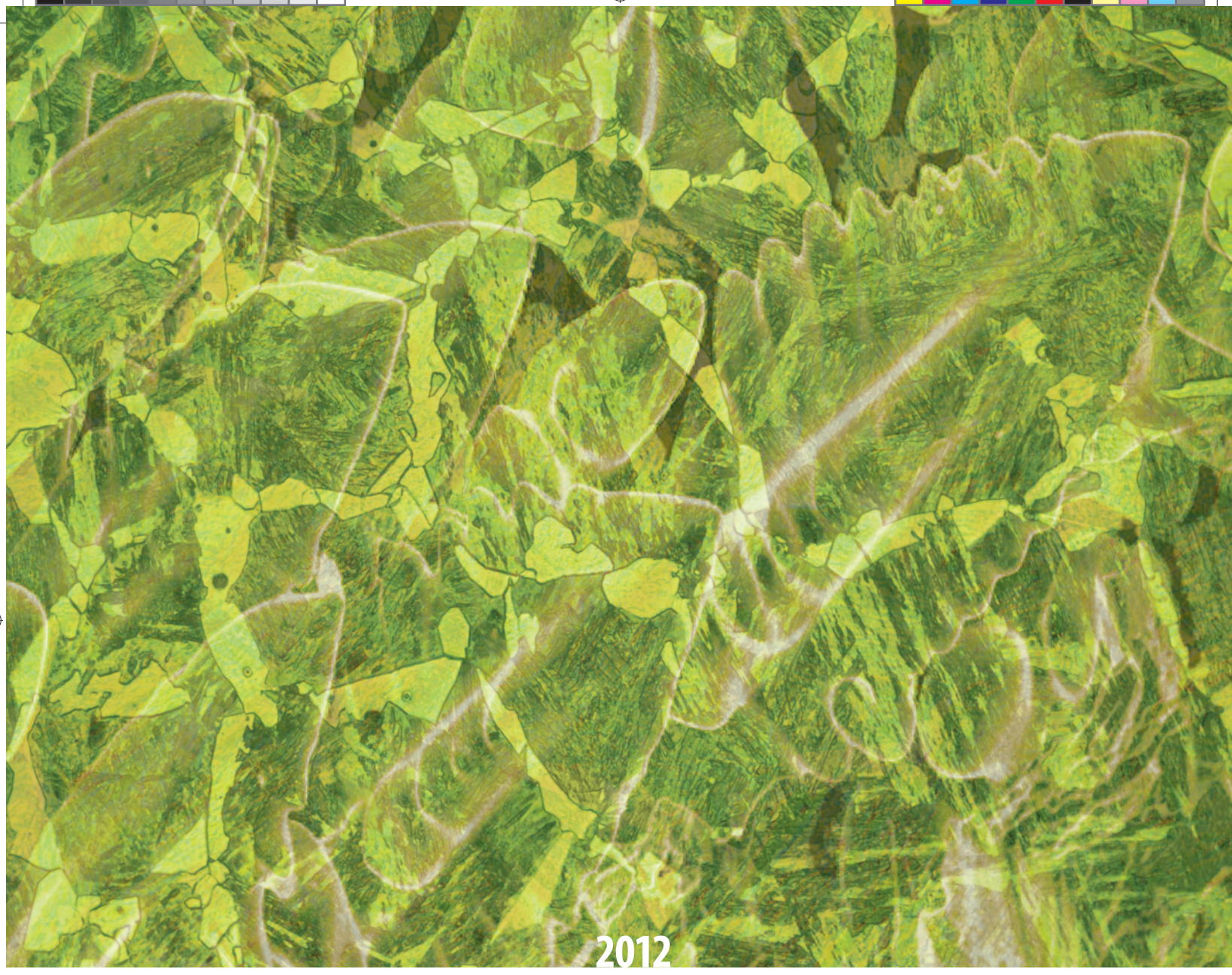
There are various opportunities for secondary school students to get acquainted with the potentials of the Faculty of Materials Science and Engineering.

Our young and not so young teaching and research staff (from doctoral students to professors) regularly visit secondary schools and not only provide information on university life in Miskolc, but also present various interesting lectures and perform exciting experiments.

The National Competition on Materials Science is organized yearly and is always a great success amongst those who make the finals. Usually 12 teams of 5 pupils + a their coach teacher arrive on campus and present their view on the topic of the year (e.g., solar energy utilization, the role of polymers in our life, etc.) try their knowledge on a quiz and participate in hands-on experiments.

Since 2009 the national finals of the Irinyi János Secondary School Chemistry Competition are organized at our Institute of Chemistry. Through these conferences the brightest secondary school and university students find opportunities to establish connections with each other as well as with distinguished scientists and key industry leaders in their fields of interest.

The annual Researchers' Nights as well as Open Days organized twice a year provide additional opportunities to bring prospective students and the general public closer to the various exciting research projects of the university. These events are often attended by full secondary school classes and children-parents-grandparents from Miskolc, neighboring villages and cities as well as from remote parts of the country, reinforcing the general opinion: **The Hungarian capital of Materials Science and Engineering is Miskolc.**



FACULTY OF MATERIALS SCIENCE AND ENGINEERING

UNIVERSITY OF MISKLOC

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