

INVESTMENTS IN EDUCATION DEVELOPMENT

**The VŠB-Technical University of Ostrava
is searching for suitable candidates for
post-doctoral research positions**

The VŠB-Technical University of Ostrava is a technical and economic institution providing bachelor's, master's and doctoral levels of education, based on free and internationally oriented research. It has the right of conferring academic and scientific degrees, as well as doctoral honorary degrees.

The VŠB-Technical University of Ostrava ranks among the top technical universities in the Czech Republic. It is equipped with excellent research infrastructure and modern laboratory facilities. The scientific and teaching staff collaborate with research and academic institutions and experts on both national and international levels, number of multinational research teams evolve the science and development at the University.

Currently we offer 38 post-doctoral (postdoc) research positions on the following twelve themes (project modules), supported by the EU Operational Program Education for Competitiveness and the Czech state budget:

- A. [Energetics and raw materials](#)
(2 postdoc positions; contact: Professor Cermak, tomas.cermak@vsb.cz)
- B. [Decontamination of acid mining water](#)
(1 postdoc position; contact: Professor Dirner, vojtech.dirner@vsb.cz)
- C. [Energetics, efficiency and the environment](#)
(2 postdoc positions; contact: Assoc. Professor Ochodek, tadeas.ochodek@vsb.cz)
- D. [Measurement-taking, transmission and data processing in distributed industrial and biomedical applications](#)
(2 postdoc positions; contact: Assoc. Professor Koziorek, jiri.koziorek@vsb.cz)
- E. [Bio-inspired computations, artificial intelligence and logic](#)
(2 postdoc positions; contact: Professor Snasel, vaclav.snasel@vsb.cz)
- F. [Problems with reliability and power supply of electric traction](#)
(3 postdoc positions; contact: Assoc. Professor Styskala, vitezslav.styskala@vsb.cz)
- G. [Development of new methods for the design, modelling and evaluation of the safety and reliability of steel structures](#)
(2 postdoc positions; contact: Professor Strnadel, bohumir.strnadel@vsb.cz)
- H. [Advanced materials, preparation and technology of their processing](#)
(7 postdoc positions; contact: Professor Kursa, miroslav.kursa@vsb.cz)

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- I. [Nanomaterials and nanostructures for progressive applications](#)
(3 postdoc positions; contact: Professor Pistora, jaromir.pistora@vsb.cz)
- J. [Safety technology](#)
(2 postdoc positions; contact: Professor Danihelka, pavel.danihelka@vsb.cz)
- K. [Controlling mechatronic systems and the lifetime prediction of advanced metallic materials](#)
(8 postdoc positions; contact: Professor Noskievic, petr.noskievic@vsb.cz)
- L. [Managing, decision-making and modelling of economic and financial processes](#)
(4 postdoc positions; contact: Professor Zmeskal, zdenek.zmeskal@vsb.cz)

A basic description of each project module, the contents of the postdoc's work and specific project module requirements for the candidate (expected education, knowledge, experience and skills) are specified below in [Part II](#).

The positions will be located in Ostrava, the third-largest city in the Czech Republic. The employer will be The VŠB-Technical University of Ostrava. Postdocs will be employed full-time for a fixed period of up to 3 years. The gross salary ranges between 40 – 50 thousand CZK a month (EUR 1600 – 2000). The main postdoc activities are: participation in research activities in a relevant team of experts, preparation of new joint research projects, publication activities, teaching, active participation in workshops and conferences, foreign internships or internships in the application sphere for 3 – 6 months.

For informal enquiries about any aspect of the positions, please contact the relevant investigator mentioned in the parentheses above.

PART I: THE SELECTION PROCEDURE

The candidate shall apply to one main project module and can add another project module or modules as an alternative(s). If not selected for their main project module, the candidate will be evaluated for their alternative project module or modules.

Interested candidates should send the following documents in the Czech or English language to daniela.vedrova@vsb.cz by no later than March 23, 2012:

1. An application containing the candidate's contact information incl. e-mail address, chosen project module (or alternative modules) and additional specialization if it is mentioned in the chosen project module.
2. A Curriculum Vitae including a brief description of research and educational experience
3. A copy of their Ph.D. degree or similar degree if they studied abroad
4. A certificate proving their level of knowledge of the English language
5. A bibliography containing all information relevant to determine the value of partial evaluation criterion Nos. 1 and No. 2 (an article in an impact journal; an article in a reviewed magazine; a professional book; an article in a collection of

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proceedings; patents; pilot plants, verified technology, variety, breed; utility model; industrial patterns; prototypes, functional samples; results realized by the provider; certified methodology and procedures, specialized maps with expert contents; software; research reports that contain classified information). The articles accepted into print by the publisher or the articles sent to the publication may also be mentioned.

6. Research plan (max. 3 000 letters) in which the candidate specifies his/her idea about the technical contents, focus and goals in the postdoc position and the candidate's motivation for seeking the particular position. The research plan is essential to determine the value of partial evaluation criterion Nos. 3 and No. 4.
7. Information (max. 2 000 letters) about attended internships that lasted a minimum 1 month in a foreign academic workplace (foreign candidates may state Czech workplaces): the name and the address of the workplace, the length of the internship, specialized contents, obtained knowledge and skills and the outputs of the internship. The information is essential to determine the value of partial evaluation criterion No. 5.

The selection procedure has two phases. In the first phase, the candidates' following qualifications will be verified:

1. If the candidate successfully completed and obtained a Ph.D. degree or similar degree if they studied abroad as defined by Czech regulation 111/1998, the Higher Education Act.
2. If the candidate successfully completed and obtained a Ph.D. degree or similar degree if they studied abroad on or after March 29, 2008; the decisive point is the day that the doctoral thesis was defended.
3. Good knowledge of the Czech or English language (CAE or the equivalent)
4. The minimum number of articles published in impact journals or other publications is **2**.
5. The minimum number of other outputs defined in the RIV¹ methodology is **3**.

Those candidates who do not meet the above mentioned criteria will be excluded from the selection procedure. Those candidates meeting these qualifications will be assessed by a special evaluation committee (the second phase). Selected suitable candidates will be invited for interviews taking place in Ostrava, Czech Republic in April 2012 (a specific date and location will be provided). Interviews will be held in Czech and English.

Candidates will be assessed separately for each project module. The assessment of the candidates will be performed according to the partial evaluation criteria and their rate for each partial evaluation criterion separately. For all partial evaluation criteria, the candidate shall obtain points according to the following formula:

¹ For candidates, who don't have their outputs in RIV (Register information on the results), their outputs will be evaluated according to the structure and evaluation system in RIV.

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The value of partial evaluation criterion
 ----- x 100 points
 The highest value of partial evaluation criterion

The points scored in each partial evaluation criterion will be multiplied by the rate of each partial evaluation criterion. This score will be rounded to 3 decimal places. The sum of the points for all partial evaluation criteria will determine the position of the candidate in the overall assessment. The most suitable candidate is the candidate who was the most points.

Candidate assessment criteria and the rates:

| Partial evaluation criteria | | Rate |
|-----------------------------|--|------|
| No. 1 | The number and quality of articles in impact journals and other publications | 50% |
| No. 2 | The number of other outputs defined in the RIV methodology | 25% |
| No. 3 | The quality of the presented research plan | 10% |
| No. 4 | The relevance of the theme / scientific importance | 5% |
| No. 5 | Internships in a foreign academic workplace | 5% |
| No. 6 | Language skills | 5% |

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PART II: BASIC INFORMATION ABOUT THE PROJECT MODULES, POSITIONS AND REQUIREMENTS

A PROJECT MODULE A: ENERGETICS AND RAW MATERIALS

A.1 A basic description of the project module

Three different research activities are joined into one undivided whole –the treatment and processing of input sources, i.e. alternative fuels, the development of corresponding machinery and activities focused on fuel transformation (especially gasification, pyrolysis and even combined combustion and fermentation) into more efficient products, like H₂.

The project also concerns a research group concentrating on the R&D of new cogeneration units, problems of energy accumulation and problems of electric generators - their operational controls and connections to an off-grid island system. The section concerning fuel transportation and processing and its transformation into gases that can be used in turbines with electric generators is supported by a group focusing on research and development of nano-composite materials for purifying all output products of the transformation process.

The project also focuses on monitoring the usability of produced electricity in the Czech grid and do not ignore the use of stored electric power after it is produced – hybrid technology.

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It concerns the research and development of technologies for fuel transformation, especially of waste products and alternative fuels, into heat energy and electricity, and their further effective use.

The objective is the research and development of units (technology and energy units) for waste treatment and alternative fuels and increasing their transformation into heat energy and electricity while ensuring the purity of combustion products, monitoring the quality and quantity of final products and monitoring of the possibility of energy accumulation and the parallel or serial cooperation of various resources.

A.2 The contents of the postdoc's work

The postdoc will spend 3 years as a full-time researcher in electric power systems that are an integral part of renewable energy systems that combine traditional and new technology for controlling the flow of electricity and can adapt to varying power consumption and storage. Research will be focused on: integrating variable energy resources in a control centre with variable consumption and storage possibilities; developing a new synchron generator of electricity with permanent magnets integrated with a new type of turbine; developing a micro-cogeneration unit with thermal storage; increasing the efficiency of the different types of renewable energy systems; developing an interaction between short term and long term energy storage systems (batteries, supercapacitors, fuel cell storage, electromobility); research and development of micro-grids; research and development of new smart and interactive inverters (DC to AC Converters) for renewable energy systems. Research will be in collaboration with our industrial partners: Dodávky automatizace, a.s., Arrowline, a.s., Bohdalečské strojírny, Trimmer, GWRD and others and part of these research activities will be located at our industrial partners' facilities. International cooperation with TU Dresden, RWTH Aachen (Germany), TU Wien (Austria), SIU Carbondale (USA) and others open the possibilities of an exchange stay.

A.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Applicants must have a degree in electrical or mechatronic engineering (dipl. Ing., Ph.D.); professional experience focused on power electronics, energy generators, renewable energy systems, electromechanical systems is preferable.

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B PROJECT MODULE B: DECONTAMINATION OF ACID MINING WATER

B.1 A basic description of the project module

Mining water represents a significant problem in the extraction of mineral raw materials. Mining water accumulation, retention and drainage belong to the fundamental conditions of mining activities. In coal opencast mining (in our condition brown coal opencast mining) significant attention should be paid to this problem with regard to the extent and relief of coal opencast mines that are very sensitive to inflows of surface water, groundwater and precipitation. That is why every opencast mine should have a system of drainage structures for controlled drainage of mining waster

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from the mining claim of the opencast mine. The objective of the drainage is to ensure the continuous and safe operation of the coal opencast mine.

According to relevant legislation, the discharge of mining water into surface watercourses is subject to the permit of state water administration bodies. Part of the permit is limits on the pollution of mining water; it is thus necessary to treat the discharged mining water. For this reason, all mining companies dealing with the extraction of brown coal operate mining water treatment plants; however, the extents of treatment are different and commercial utilization of treated water in principle does not exist. The improved treatment of mining water assumes incurring greater costs. This means then search for commercial applications of mining water as well.

It is acid mining water accompanying mainly the extraction of sulphide ores and the mining of brown coal that represents a big problem as well as an environmental risk. This extremely mineralized water is characterised by a low value of pH and a high concentration of sulphate ions. The main factors influencing the chemistry of acid mining water are the content of Fe disulphides (pyrite, marcasite) and the kinetics of chemical and bacterial decomposition in the mining claim, considerably influenced by the availability of dissolved oxygen.

Significant producers of acid mining water in the Czech Republic are companies concerned with the mining of brown coal. In addition to mining operations themselves, the continuous solving of the issue of environmental impacts of mining and associated problems of mining water use belong to the main priorities of activities of these companies.

With reference to the experience of the research workplace – Faculty of Mining and Geology, in the development of a technology for the treatment of acid sulphate mining water the attention focuses on research into the total demineralization (controlled demineralization) of mining water of selected brown coal localities.

Through one of possible demineralization techniques, electrochemical processes (henceforth referred to as EP) can be utilized. The goal of EPs can be to obtain products only from one part of the solution (diluate or concentrate); however, in some cases qualitative requirements are put on both the products (especially in mining water treatment), e.g. when the diluate must fulfil conditions for discharging into a watercourse and the concentrate must have maximum suitable parameters for further treatment. Before EPs themselves, it is necessary to propose suitable pre-treatment for the selected mining water entering the EP. The urgency of the solution of this problem is given by the overall need to increase hydrosphere protection and environmental protection, and also by the expected economic benefit of their utilization.

B.2 The contents of the postdoc's work

The content of 3 year work of the postdoc would be as follows:

- balance evaluation of acid mining water from selected brown coal localities (sampling and initial analyses in time series, hydrological regime),
- study of and proposal for acid mining water pretreatment before the application of electrochemical processes (electrodialysis),

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- testing of acid mining water in “batch” and “feed and bleed” modes using an electro dialysis unit to concentrate the mining water and to decrease the load (input-diluate-concentrate mass balance, concentrate salinization degree).

B.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Applicants must be graduated in chemical, water treatment or environmental engineering (dipl. Ing., Ph.D.), professional experience oriented to mine waters, decontamination technics. Basic knowledge of electrochemical processes is invited.

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C PROJECT MODULE C: ENERGETICS, EFFICIENCY AND THE ENVIRONMENT

C.1 A basic description of the project module

The project module is aimed at supporting human resources development in the research and development areas of the regional centre for Innovation for Efficiency and the Environment (INEF). It focuses on the issues of combustion and gasification and on energy security and related areas. Research is concentrated on equipment for heat production and cogeneration by using fossil fuels, especially biomass, in small decentralized units and the development of new technology for biomass gasification, including the production of second generation liquid fuels.

C.2 The contents of the postdoc's work

Specialization: The research and development of alternative fuels

The research and development of methods and processes for preparing alternative fuels in gaseous and liquid states; the production and modification of alternative fuels; building an experimental facility for the development, preparation and testing of alternative fuels; completing one foreign and one domestic fellowship similar to the project and the program. Output: pilot-plant, publications, functional samples. It is a full-time position lasting 3 years.

Specialization: The analysis and evaluation of alternative fuels

Development and implementation methods for analyzing alternative fuels and their combustion products; the study of their properties in terms of energy utilization, operational safety and environmental protection; building and providing an analytical background in modern energetics; completing one foreign and one domestic fellowship similar to the project and the program. Output: publications, functional samples. It is a full-time position lasting 3 years.

C.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Specialization: The research and development of alternative fuels

Postgraduate education in energy or chemical sciences; experience with the thermo-chemical conversion of solid fuels; experience with identifying pollutants in gas produced by the thermo-chemical conversion of solid fuels.

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Specialization: The analysis and evaluation of alternative fuels

A postgraduate education completed at a foreign university in the sciences or chemical energy; experience with analytical chemistry techniques or methods of the physico-chemical study of material properties; experience with testing combustion equipment and measuring emissions.

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D PROJECT MODULE D: MEASUREMENT-TAKING, TRANSMISSION AND DATA PROCESSING IN DISTRIBUTED INDUSTRIAL AND BIOMEDICAL APPLICATIONS

D.1 A basic description of the project module

Information technology in measurement-taking, transmission and data processing in distributed industrial and biomedical applications. The aim of the project module is to build a scientific research group dedicated to applied research in measurement-taking, transmission and data processing in distributed industrial and biomedical applications or in biomedical engineering. The group will participate in research and development activities with the aim of producing results according to the RIV methodology and their transfer into practice and also preparing new researchers for doctoral programs.

D.2 The contents of the postdoc's work

Research and development activities will be focused on biomedical engineering in biotelemetry systems in remote home care environments and measuring non-electric quantities in large distributed systems, the transmission of measured values, archiving and evaluating measured data. Expected results are R & D findings published in an internationally renowned impact journal and results subject to the protection of intellectual property rights according to the RIV methodology. Throughout the project, a number of work placements in institutions and companies engaged in biotelemetry research and development will also be provided both in the Czech Republic and abroad. It is a full-time position lasting 3 years.

D.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Specialization: Biomedical engineering

The candidate should have knowledge of biomedical engineering, medical instrumentation equipment and knowledge systems as well as remote home care. Candidates' previous research activities should be centered on remote systems and home care that demonstrates their expertise in this area. The candidate should have experience in national projects with experience in biomedical engineering and scientific-research and application in technical cybernetics. Presentation skills and project management in biomedical engineering, such as educational projects or a thesis is one of the practical expertise requirements for the applicant. Preferably, the candidate with have at least two professional awards from previous scientific and research activities by international organizations outside the Czech Republic and Slovakia. The minimum experience required for university study is three years in research and development.

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Requirements:

- At least 15 scientific publications in ISI WOK.
- At least one journal in the ISI IF WOK in the last 3 years.
- At least two registered intellectual property rights registered in the Office of Industrial Property (OIP) in the last three years.
- Submitted at least one patent with a national scope registered in the OIP.
- A citation index of at least $H = 3$.
- At least two requested lectures in English abroad.

Specialization: The measurement of non-electric quantities

The candidate should have experience in measuring non-electrical quantities, communication systems, designing electronics based on microprocessors and basic knowledge on data archiving and processing. Candidates' previous research activities should be focused on the aforementioned areas and show the candidates' expertise in these areas. The candidate should have experience in national research projects and industrial projects. The candidate has to demonstrate working in research teams for at least 2 years. The candidate has to demonstrate experience with submitting research and educational projects in the aforementioned areas.

Preferred are professional awards given by international organizations, international activities, requested lectures etc.

Requirements:

- At least 5 scientific publications in ISI WOK.
- Publications in journals with IF are advantageous.
- At least two registered intellectual property rights registered in the Office of Industrial Property (OIP) in the last three years.
- Good knowledge of the English language.

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E PROJECT MODULE E: BIO-INSPIRED COMPUTATIONS, ARTIFICIAL INTELLIGENCE AND LOGIC

E.1 A basic description of the project module

We will pursue research in three areas that have much in common. In particular, we will aim at computer-aided modelling of human reasoning and rationality in the multi-agent world.

Bio-inspired computation is an umbrella term for different computational approaches that are based on principles or models of biological systems. This class of methods includes inter alia evolutionary algorithms, ant colony optimisation and modelling swarm intelligence algorithms. These methods can be applied to large-scale applications where little is known about the underlying problem and where the traditional approaches encounter difficulties. Therefore, bio-inspired methods are becoming increasingly important, and accordingly they have been successfully used in various

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fields ranging from computer engineering and mechanical engineering to chemical engineering and molecular biology.

Artificial Intelligence (AI) is the subfield of Computer Science devoted to developing programs that enable computers to display behaviour that can broadly be characterized as intelligent. Most research in AI is devoted to fairly narrow applications, such as planning or speech-to-speech translation in limited, well defined task domains. But substantial interest remains in the long-range goal of building generally intelligent, autonomous agents. The agents must be able to communicate with their fellow agents in order to meet their particular goals as well as global goals of the system. To this end they are equipped with ontology based on a common conceptualization and master some deduction rules in order to infer computable knowledge from their explicitly stored pieces of knowledge. Thus logic plays an important role in their rational reasoning. It provides techniques for analysing inferential properties of a language as well as rules of reasoning. There are three main uses of logic in AI: as a tool of language analysis, a basis for knowledge representation and a tool of reasoning. A large part of the effort of developing limited-objective reasoning systems goes into the management of large, complex bodies of declarative information. It is generally recognized in AI that it is important to treat the representation of this information, and the reasoning that goes along with it, as a separate task, with its own research problems.

E.2 The contents of the postdoc's work

Suitable candidates must have a background in computer science and logic. Highly motivated candidates with programming skills or theoretical skills in mathematics and logic are required. The candidates should be also able to cooperate in a teamwork setting as well as to pass their skills to other students and researchers. Research results will be published in high-level international journals. It is a full-time position lasting 3 years.

E.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

We prefer candidates who graduated in some of these or similar disciplines: computer science, mathematics, economics, etc. Highly motivated candidates with programming skills or theoretical skills in mathematics and logic are preferred. The candidates should be able to cooperate in a teamwork setting as well as to pass their skills to other students and researchers. Therefore, English knowledge and publication skills are presupposed. The candidates should be also able to present their results in an international forum, take an active part in international workshops and conferences.

Specific requirements:

- At least five scientific publications
- Publications in international journals with an impact factor are preferred

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F PROJECT MODULE F: PROBLEMS WITH RELIABILITY AND POWER SUPPLY OF ELECTRIC TRACTION**F.1 A basic description of the project module**

Characteristics: Tackling electrochemical corrosion (EHC) in connection with the analytic solution of transitional rail-grounds in industrial DC and AC power lines.

Objectives: Resolving methodological causality of traction power supply and the EHC of storage facilities.

Schedule: analysis, calculations and modelling of flow fields; models of ferroconcrete structures and contact rails-ground and also ground – storage facility, etc.; modelling the problems of contact transmission of electrical energy supply reliability; verification in laboratory conditions; verification of large-scale representative measurements on electrified lines.

F.2 The contents of the postdoc's work

Prerequisite: one postdoc for full-time up to 36 months and two full-time postdocs up to 6 or 12 months. The plan of research and development activities will be thematically complemented by other ideas from research projects obtained by the preparation team. Research work according to the instructions of the main researcher and mentors, at least Jimp output (3 times), Jneimp (4 times), article (WoS – 6 times), the methodology and utility models (S-3 times). Internships in foreign institutions – four times as long traineeships, internships in the application sphere – 6 times throughout the project.

F.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

A university degree in electrical engineering (preferred), or applied physics and applied mathematics, etc., a Ph.D. focused on the issues of electromagnetic fields, electrical power engineering and electrical engineering in transport, or related to knowledge of analytical methods, modelling and experimental electrical measurements, excellent orientation in solid problems, professional experience in electric traction systems and experience in solving problems is welcomed. Long-term foreign internships, knowledge of English, good German or other languages is welcomed. Required communication skills in both Czech and a foreign language, teamwork, responsibility, hard-working. Organizational skills for regularly presenting the outputs of the project module's activity.

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G PROJECT MODULE G: DEVELOPMENT OF NEW METHODS FOR THE DESIGN, MODELLING AND EVALUATION OF THE SAFETY AND RELIABILITY OF STEEL STRUCTURES

G.1 A basic description of the project module

The project module involves research into new methods for evaluating the degree of material damage to structural components, structures and equipment for the purpose of increasing their reliability and more precisely determining their remaining lifespan. The research will devise new testing methods requiring only small samples of material to be taken in order to determine the material's micro-structural state and the properties of the entire structure. The results of the proposed tests and monitoring methods will lead to new proposals for methods of managed ageing of structures and equipment, bringing significant economic benefits. The key goal of the project module will thus be achieved: i.e. an increase in the quantity and quality of new findings in applied research with immediate opportunities for technical application. The project module incorporates interdisciplinary topics – encompassing materials mechanics, fracture mechanics, application of computation methods, methods of physical metallurgy, fractography, metallography, methods involving the processing of extensive data sets, and mathematical-statistical methods. The research will bring new, original findings in the design of steel structures and equipment used in the power industry and chemical production. The development of new methods to extend lifespan and increase reliability of steel structures and equipment by using new monitoring methods will lead to a significant reduction in material and energy consumption and will improve the functional properties of new products and equipment. Increased safety, speed, capacity and quality of data transfer systems used in the operation of steel structures and equipment – in order to maximize the strength characteristics and toughness of materials – is one of the most important benefits that will be brought about by the project module.

G.2 The contents of the postdoc's work

The position will last for one year. It will involve research and development-related activities in the field of fracture mechanics, stress calculations, and predictions of structural lifespan. The results will be presented at international conferences and published in international impact-factor periodicals.

G.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Graduate of applied mechanics, materials engineering or related fields. The candidate must be capable of independent research work in fracture mechanics, numerical calculations of stress, and selected disciplines of materials engineering. The candidate must be able to plan scientific and technical tasks and experiments. The candidate must have experience of presenting research results at an international forum and publication of findings in widely renowned periodicals.

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H PROJECT MODULE H: ADVANCED MATERIALS, PREPARATION AND TECHNOLOGY OF THEIR PROCESSING

H.1 A basic description of the project module

Specialization 1-4

The development, preparation and evaluation of special alloys and inter-metallic compounds with a defined structure and physical properties for applications in electronics, medical science, machinery and the chemical industry. The development and optimisation of processes of powder technologies for preparing selected kinds of materials (magnetic, friction, materials for automotive industry). Structural and micro-structural analyses of experimental materials and products. The preparation of ultra-fine grained and nano-structural metallic materials by severe plastic deformation; the study of their structure and properties.

Specialization 5

Attention of the research team, which will be institutionally part of the vast regional research centre “Regional Materials Science and Technology Centre” (RMSTC), will be focused on the perspective of the occupied position, namely on applied research in steelmaking technology in accordance with the specified objectives:

1. To develop a methodology for numerically modelling processes of the casting and crystallisation of steel with an emphasis on the use of the synergic effect of collaboration in experimental development (for industrial partners), related to the application of research (in collaboration with the colleagues from RMSTC – methods of thermal analysis and other related methods connected with expanding knowledge of the physical properties of steels and accessory materials).
2. To contribute to a more precise specification of numeric modelling in the simulation of key processes aimed at the casting and crystallisation of steel in such a manner that they would enable optimisation development of new technological processes or industrial partners with a simultaneous reduction of costs with an emphasis on a significant economy of energies (that are otherwise necessary for vast industrial-scale experiments).

Specialization 6

The attention of the research team, which will be institutionally part of the vast regional research centre “Regional Materials Science and Technology Centre” (RMSTC), will be focused on the perspective of the occupied position on applied research in steelmaking technology in accordance with the specified objectives:

1. To develop a methodology for the experimental investigation of the physical properties of iron based metallic materials with an emphasis on the usability of results in applied research and innovation/ the development of related industrial technologies by combining methods of modern industrial-scale experiments, dynamic methods of investigating thermo-physical properties or laboratory experiments on high-temperature equipment.

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2. To contribute to a more precise specification of the scope of knowledge on the behaviour of multi-component iron based systems or oxides contained in materials directly connected with the technology of ironmaking and steelmaking. The synergic potential of obtained results will be used, which is related to their applicability in other modern methods of applied research and development.

Specialization 7

A methodological comparison of the results of a simulation of the thermal-mechanical treatment of steel by laboratory rolling and by plastometric experiments.

H.2 The contents of the postdoc's work

Specialization 1

It is full-time employment lasting up to 12 months. The scope of work and planned outputs: the development, preparation, modelling and optimisation of alloys alloyed by other metals modifying service properties; the application of unconventional metallurgical technologies for the synthesis of special alloys of non-ferrous metals and their inter-metallic compounds; the use of modern technologies in the future conditions of the production of special alloys; the conducting of tests and modelling of monitored processes; the technological interpretation of obtained experimental data and their use in practice by their utility design, attested technology, or by patenting. Internships abroad: TU Dresden, RWTH Aachen, Politechnika Czestochowska, SGA Liebenburg. Internships in the application sphere: Technological centre Ostrava, Vítkovice Group, other industrial companies will be chosen in accordance with the orientation of the involved workers and current situation in industry.

Specialization 2

It is full-time employment lasting up to 12 months. The scope of work and planned outputs: the development, preparation, modelling and optimisation of alloys alloyed by other metals modifying the service properties of bio-compatible materials; the specification of modern metallurgical technologies for preparing defined alloys based on Ni-Ti, Ti-Al...; proposing procedures for centrifugal casting, mechanical treatment (forming) and heat treatment for optimising service properties of final products; model melting trials in various smelting units; the optimisation of processes of forming and heat treating alloys for bio-medical applications; structural and micro-structural analyses of experimental samples, including phase analyses; determining the porosity of alloys, evaluating mechanical properties; corrosion tests of products identified for bio-medical applications; conducting industrial-scale tests of products (customers' companies); developing a unified procedure (methodology) for evaluating the structural and mechanical properties of the samples and materials manufactured in laboratory, pilot and industrial conditions; the technological interpretation of results and recommendations for practice by way of the utility model, attested technology or by patenting. Internships abroad: Internships have been preliminarily planned preliminary manner in some organisations abroad, such as in Germany - TU Dresden, RWTH Aachen, BA Freiberg, that deal with the above mentioned types of materials. The Institution will be chosen after the completion of a selection procedure for the postdoc – his/her scope

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of work will consist of conducting tests on pilot and testing equipment. Internships in the application sphere: Company Medin, Nové Město na Moravě, policlinics in Ostrava, etc. The scope of work of the postdoc will include comparing the obtained results with the requirements of practice and implementation of new types of alloys in practice.

Specialization 3

It is full-time employment lasting up to 12 months. Research activities will be focused on investigating processes for creating ultra-fine grained micro-structures (150 to 300 nm) by severe plastic deformation ($e = 4$ to 20). Physical-metallurgical substances for developing ultra-fine grained structures will be investigated, as well as the possibilities for maintaining its stability and mechanical properties related to it even at elevated temperatures. The following technologies will be investigated and used for preparing ultra-fine grained structures (nano-structures): extrusion through two channels connected at a 90° angle (Equal Channel Angular Pressing – ECAP); High Pressure Torsion – HPT; Accumulative Roll Bonding – ARB; combination of methods of rapid solidification and severe plastic deformation (SPD). Various ferrous and non-ferrous metals and alloys will be used for investigating and analysing the effects of severe plastic deformation. Internships abroad: The National University of Science and Technology MISIS, Moscow, Russia, The London Centre for Nanotechnology, UK, The Technical University Czestochowa (Politechnika Czestochowska) Poland, Žilina University, Slovakia. The scope of work will include conducting tests on pilot and testing equipment. Internships in the application sphere: COMTES FHT, The Technical University in Liberec – The Institute of Nano-materials, The Central European Technological Institute CEITEC, Brno), The Institute of Nuclear Research. The study of nano-technologies, structure and properties of nano-materials.

Specialization 4

It is full-time employment lasting up to 12 months. The plan of research activities: investigating structure development and the degradation of properties of heterogeneous welded joints of heat-resistant steels upon exposure to increased temperatures. The scope of work and planned outputs: characterising the structure and properties of heterogeneous welded joints after welding and after exposure to elevated temperatures. A description of the evolution and degradation of properties of welded joints. The output of the research activities will consist in the publishing of obtained results.

Specialization 5

It is full-time employment lasting up to 12 months. The scope of work: the numeric modelling of the processes of the casting and crystallisation of steel: active participation in applied research projects; active participation in implementing projects; communication with industrial partners, acquisition of data and materials for creating a numeric model; communication with other members of the investigatory team, data acquisition, defining the required scope of outputs of numeric simulation; creation of 3D objects and meshed, setting of software, defining the boundary and initial conditions according to the needs of the tasks; conducting numeric simulations and their fine-tuning; evaluating the results of numeric simulations and their incorporation into research reports; publication activities in peer-reviewed or in impact journals (1),

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presenting results at national and international conferences (1), presenting results within the framework of collaboration with the application sphere and also within the publicity of activities of the research team, active participation in supervising / consulting bachelor, graduation, or doctoral degree theses (1). Internships lasting at least 3 months at a Czech steelmaking partner are planned.

Specialization 6

It is full-time employment lasting up to 12 months. The scope of work: The study of the physical properties of metallurgical materials with the use of sophisticated experimental methods: active participation in applied research projects; active participation in the implementation of projects; communication with industrial partners, acquisition of data and materials for experimental activities; development and optimisation of methodologies for researching the properties of investigated materials; communication with other members of the investigatory team, data acquisition, defining the required scope of outputs of experimental activities; preparing and conducting experiments based on the needs of the tasks; evaluating the results of experimental activities and incorporating them into research reports; publication in peer-reviewed or in impact journals (1), presentation of results at national and international conferences (1), presentation of results within the framework of collaboration with the application sphere and also within the publicity of activities of the research team; active participation in supervising / consulting bachelor, graduation or doctoral degree theses (1). Internships lasting at least 3 months at a Czech steelmaking partner are planned.

Specialization 7

It is full-time employment lasting up to 12 months. Planning and conducting experiments, evaluating their results, comparing the structural and mechanical properties of final samples, formulating conclusions and recommendations from the application of results of physical modelling in industrial practice, preparing 2 publications in reviewed journals, out of which at least one in an impact journal. We assume collaboration with plastometric laboratories in Poland (the execution of comparison experiments, traineeships).

H.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Specialization 1 – 4:

A Ph.D. degree in material engineering, chemical technology, physical metallurgy, or similar.

Specialization 4:

Practical skills: structural analysis of materials with the use of techniques of light and electron microscopy, basic knowledge of Thermocalc and Dictra software.

Specialization 5:

A Ph.D. degree in material engineering, chemical technology, metallurgy, or similar; at least 1 year of practice in the field of numeric modelling of processes; at least 2 publications from the given field in peer-reviewed / impact journals; knowledge of SW

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for creation of 3D objects and meshed for numeric modelling; good knowledge of English (communication level, ability to publish and present results in English).

Specialization 6:

A Ph.D. degree in material engineering, chemical technology, metallurgy, or similar; at least 1 year of practice in experimental activities aimed at metallurgy or similar technology; knowledge of work with instruments serving for execution of high-temperature experiments with metallic materials, or related to oxidic systems – documented by publication activities (at least 2 publications from the given field in peer-reviewed / impact journals); good knowledge of English is an advantage (communication level, ability to publish and present results in English).

Specialization 7:

Completed doctoral studies in metallurgical technology or material engineering, experimental experience with the physical modelling of processes connected with the rolling of metallic materials, experience with scientific-research projects and with publishing in learned journals. Active knowledge of the Polish language is welcome.

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I PROJECT MODULE I: NANOMATERIALS AND NANOSTRUCTURES FOR PROGRESSIVE APPLICATIONS

I.1 A basic description of the project module

The cardinal idea of this module is fundamental and applied research focused on 1D, 2D, and 3D nanostructures and nanosystems: the development of new magnetophotonic nanostructures (identifying new materials and principles for sensors related to all frequencies from DC to UHF, unidirectional magneto-optics for IT, magnetic and MO recording), specification of new approaches in nondestructive testing, new medicine forms modelling, advanced nanocomposite design with defined nanocomponents (metallic and metal-oxide nanoparticles, polymeric nanotubes, organic supermolecular nanostructures, inorganic nanotubes and carbon nanomaterials).

I.2 The contents of the postdoc's work

The postdoc study stay is planned from 12 to 24 months. The applicant should come from a scientific laboratory focused on the aforementioned research and development. The research outputs have to be published in IF journals and have patents filed. Research stages in the USA and Canada are planned in conjunction with the postdoc stays at The VŠB-Technical University of Ostrava.

I.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

The fundamental pre-condition is a completed Ph.D. in physics, chemistry, material engineering, applied mathematics, electronics, and related fields. Research is conducted on theoretical and experimental levels and applicants are assumed to thrive in both research branches.

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J PROJECT MODULE J: SAFETY TECHNOLOGY

J.1 A basic description of the project module

The project module is focused on aspects related to occupational safety and safety of industrial processes, chemical safety, process reliability and major accidents prevention and preparedness including environmental protection with emphasis on new materials. A specific topic will be the issue of energy production safety and security and other related areas (links to the project module Energetics, efficiency and environment). Research activities will follow on the experience from previous projects orientated on the complex research and management of natural and technological risks and other activities.

J.2 The contents of the postdoc's work

Specialization: Ultrafine particles and nanoparticles in industry and combustion processes

The research and development of measurement methods, analysis and characterization of ultra-fine particles and nanoparticles in the processes of the energy conversion of fuels, including alternative fuels based on waste; the study of particle behaviour in energy processes with respect to their potential environmental, health and safety impacts; completing one foreign and one domestic fellowship similar to the project and the program. Output: publications, functional samples. It is a full-time position lasting 3 years.

Specialization: The physicochemical risks of flammable substances

The application of physicochemical methods for studying material dangerous properties of alternative fuels and modern energy processes; building an experimental laboratory for studying explosions in a large volume (1000 l) chamber; developing test methods and their application on specific industrial flammable materials; completing one foreign and one domestic fellowship similar to the project and program. Output: publications, functional samples. It is a full-time position lasting 3 years.

J.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

Specialization: Ultrafine particles and nanoparticles in industry and combustion processes

A postgraduate education in energy, chemical or physical sciences; experience with measuring emissions from combustion devices or the physics of aerosols.

Specialization: The physicochemical risks of flammable substances

A university or postgraduate education, completed at a foreign university in safety or involving dangerous properties of substances; experience with the physico-chemical methods of study of the properties of substances; knowledge of two languages.

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K PROJECT MODULE K: CONTROLLING MECHATRONIC SYSTEMS AND THE LIFETIME PREDICTION OF ADVANCED METALLIC MATERIALS

K.1 Basic description of the project module

The project module focused on Mechatronic systems and the lifetime prediction of advanced metallic materials is engaged in research in four areas:

- The theory of automatic control of non-linear and non-stationary systems, synthesis of controllers.
- Controllers, electro-hydraulic and piezoelectric actuators, mobile service robots and their actuators, sensors for spatial orientation, ultrasonic sensors and inertial systems with GPS.
- Hydraulic components, particularly research on cavitation phenomena. Topic research is focused on the modelling of flows in hydraulic machines and components, the interaction of bodies of different physical systems, including changes (cavitation), and dynamics of hydraulic components and systems. The goal is basic research and its application in practice.
- Stress deformation behaviour of materials under cyclic and temperature loading, both experimentally and in terms of phenomenological modelling, including development and validation of multi-axial fatigue criteria for advanced materials.

K.2 The contents of the postdoc's work

The length of full-time employment is generally three years, but for foreign postdocs, it can be reduced to two years or one year. The research plan will be based on the research projects of the Faculty of Mechanical Engineering and industrial research. Laboratories for researching the control of hydraulic systems and dynamic phenomena in hydraulic elements, test rigs with piezoactuators, equipment for dynamic measurements with signal analyzers, robotic laboratories and laboratories for cyclic and thermal loading of materials, specially equipped for multi-axial and combined loading will be fully available to the interested postdoc. We will help postdocs to arrange scientific stays at foreign universities.

K.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

The candidate should hold a master's and PhD degrees in mechanical engineering, electrical engineering or material sciences. A degree in natural sciences is also acceptable. It is expected that the candidates are able to understand theory and have an aptitude towards experimental work and to analyze experiment results. Work with a computer, namely the use of Matlab-Simulink software, multibody systems and FEM is considered a required skill.

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L PROJECT MODULE L: MANAGING, DECISION-MAKING AND MODELLING OF ECONOMIC AND FINANCIAL PROCESSES

L.1 A basic description of the project module

The project module is focused on all relevant applications of quantitative methods within economics and finance, but primarily in econometrics, financial modelling, and operational research – these are topics that receive permanent priority in research activities at the Faculty of Economics and are the basis of this research programme. As such, they should be publicised in top journals (with respect to IF factor) in applied mathematics, such as the European Journal of Operational Research, Fuzzy Sets and Systems, Information Sciences, Management Sciences or Cell Transplantation as well as journals focusing on local problems of economics (Eastern European Economics, International Finance, Czech Journal of Economics and Finance).

L.2 The contents of the postdoc's work

It is full-time employment lasting up to 3 years. Initially, it is assumed that postdocs will work with senior researchers on their research tasks. Later, ie. after the first year and according to achieved results, they might form their own groups by selecting PhD students and promising Master's students and choose their own research topics to work on that would result in publications for top journals. The postdocs should also be able to deliver seminars for PhD or Master's students related to their research topics. The positions include standard benefits, such as laptop usage, access to research books, conference trips and mid-term research visits abroad.

L.3 Specific project module requirements for the candidate (expected education, knowledge, experience and skills)

The candidates should have a PhD in economics, finance, applied mathematics or other related disciplines. Candidates with a strong background in programming and computational software skills will be preferred.

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