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

B. Decontamination of acid mining water

(2 postdoc positions; contact: Professor Andras, peter.andras@vsb.cz)

D. Measurement-taking, transmission and data processing in distributed industrial and biomedical applications

(1 postdoc position; contact: Assoc. Professor Koziorek, jiri.koziorek@vsb.cz)

E. Bio-inspired computations, artificial intelligence and logic

(3 postdoc positions; contact: Professor Snasel, vaclav.snasel@vsb.cz)

F. Problems with reliability and power supply of electric traction

(1 postdoc position; 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

(1 postdoc position; contact: Professor Strnadel, bohumir.strnadel@vsb.cz)

H. Advanced materials, preparation and technology of their processing

(7 postdoc positions; contact: Professor Drapala, jaromir.drapala@vsb.cz)

I. Nanomaterials and nanostructures for progressive applications

(2 postdoc positions; contact: Professor Pistora, jaromir.pistora@vsb.cz)

K. Mechatronic systems - Control of mechatronic systems, Lifetime prediction of advanced metallic materials for mechatronic systems

(3 postdoc positions; contact: Professor Noskievic, petr.noskievic@vsb.cz)

L. Managing, decision-making and modelling of economic and financial processes

(2 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 2 ½ 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 one more project module as an alternative. If not selected for their main project module, the candidate will be evaluated for their alternative project module.

Interested candidates should send the following documents in the Czech or English language to daniela.vedrova@vsb.cz by no later than August 20, 2012:

1. An application containing the candidate´s contact information incl. e-mail address, chosen project module (or alternative module) 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, in the marking and structure as below:
   - A.1 an article in an impact journal (stated on the Web of Science)
   - A.2 an article in a reviewed magazine (stated on the Scopus)
   - B. a professional book
   - D. an article in a collection of proceedings
   - P. patents
   - Z. pilot plants, verified technology, variety, breed

F. utility model, industrial patterns

G. prototypes, functional samples

H. results realized by the provider

N. certified methodology and procedures, specialized maps with expert contents

R. software

V. 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 is **2**.
5. The minimum number of other outputs defined in the RIV[1] 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 September 2012 (a specific date and location will be provided). Interviews will be held in Czech and English.

[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.

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:

$$\frac{\text{The value of partial evaluation criterion}}{\text{The highest value of partial evaluation criterion}} \times 100 \text{ points}$$

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	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

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 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 the 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),
- testing of acid mining water in "batch" and "feed and bleed" modes using an electrodialysis 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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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.

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.

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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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

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.

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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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 (ECHC) 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 ECHC 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

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 (2 - 3 times), Jneimp (3 times), article (WoS – 4 - 5 times), the methodology and utility models (S-3 times). Internships in foreign institutions – one or two times short/medium traineeships, internships in the application sphere – 1 or 2 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, active knowledge of software platforms ANSYS, LabView, COMSOL, FlexPRO etc., professional experience and experience in solving problems in the electricity power system is beneficial. Short or medium term foreign internships, knowledge of English, German or other languages is welcomed. Required are communication skills in both Czech and foreign language, teamwork, responsibility, ability to hard-working, organizational and pedagogical skills for regularly presenting the outputs of the project module's activity.

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

An 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 technology special non-ferrous metals and steelmaking in accordance with the specified objectives.

H.1 A basic description of the project module

Specialization 1-4

The development, preparation and evaluation of special alloys and intermetallic 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 microstructural analyses of experimental materials and products. The preparation of ultrafine grained and nanostructural metallic materials by severe plastic deformation; the study of their structure and properties.

Specialization 5

Development of the 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).

Contributing to the 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

Development of the 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.

Contributing to the 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 iron-making 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

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 intermetallic 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

The scope of work and planned outputs: the development, preparation, modelling and optimisation of alloys alloyed by other metals modifying the service properties of biocompatible 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 biomedical applications; structural and microstructural analyses of experimental samples, including phase analyses; determining the porosity of alloys, evaluating mechanical properties; corrosion tests of products identified for biomedical 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 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 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

Research activities will be focused on investigating processes for creating ultra-fine grained microstructures (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

Development of physico-chemical and manufacturing fundamentals of the preparation of new-generation hard magnetic materials intended for of high-coercivity permanent magnets with the high temperature-time stability and preset combination of physical properties, in particular, adequate corrosion resistance, for the modern technology. The finding of principal parameters controlling the design of high-coercivity hard magnetic materials based on R2Fe14B intermetallic with the tetragonal structure (with R = rare-earth metals) with possible additions other elements which will exhibit the high magnetization and high temperature-time stability for modern engineering. Among such parameters are the residual inductance, the time-temperature stability. This is characterized by the temperature coefficient of induction over the operation temperature range (this parameter determines the constancy of useful signal at various temperatures), the coercive force determining the maximum operating temperature of material and its insensitivity to external electrical and magnetic fields, and physical and mechanical properties so that a magnets of any geometry can be prepared by powder metallurgy and withstand the mechanical treatment and pulsed magnetization without failure. The research will be focused on the effect of alloying method, the alloying composition, temperature-time treatment conditions on the structure (grain size) and magnetic properties of R2Fe14B-based magnetic materials, which will allow to develop processes and substantially to steadily realize the preparation of high-quality magnets, and, depending on application purposes to modify additions and heat-treatment conditions to manufacture magnets with different properties.

Another aim is research and development of friction materials for automotive industry (powder metallurgy technology).

Specialization 5

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), 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

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

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 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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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 magnetooptics 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 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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PROJECT MODULE K: MECHATRONIC SYSTEMS - CONTROL OF MECHATRONIC SYSTEMS, LIFETIME PREDICTION OF ADVANCED METALLIC MATERIALS FOR MECHATRONIC SYSTEMS

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.
- High efficient hydraulic systems, hydraulic components, modeling of complex systems, the interaction of different physical subsystems, dynamics of hydraulic components and systems, applications for mobile machines and automotive industry.
- 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 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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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

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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