



## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

### EMPLOYEE SELECTION

Dean of Faculty of Mechanical Engineering Brno University of Technology, hereby announce the employee selection process for positions:

#### **ACADEMIC STAFF – SCIENTISTS AND RESEARCHERS (DOCTORAL STUDY GRADUATE)**

**(for the ESF project OP VK CZ.1.07/2.3.00/30.0039)**

#### **Research areas of the team of expert:**

1. Thermal effects in elasto-hydrodynamically lubricated contacts - Tribology (1 position)
2. Computational modelling of mechanical properties of composites with elastomer matrix (1 position)
3. Materials science and engineering (1 position)
4. Preparation of nanostructures using advanced nanotechnology methods (1 position)
5. Micro and nano optic waveguide structures design and simulation (1 position)
6. Manufacturing technology for production and insertion of implants. (1 position)

#### **Job position description:**

The selected graduates of doctoral studies main task shall be participation in science and research activities of the expert team under the supervision of a mentor as well as implementation of science and research activities plan. He/she shall also participate in educational activities in the range of a full-time job, i.e. 3-5 hours on average per week. The research work shall be performed by means of scientific results publication in prestigious foreign magazines, industrial results, integration into national and international research projects. The lecturer shall also undergo 3-6 months internship and participate in Czech and foreign conferences as well. Subsequently, he/she will be required to transfer the acquired pieces of knowledge to other scientific workers and students by means of workshops.

#### **Qualification requirements:**

- Graduation of a Ph.D. study programme at a Czech university or an adequate study programme abroad, accepted by the Czech tertiary education law (n. 111/1998 Sb.), the earliest study completion date being 28<sup>th</sup> March 2008,
- adequate knowledge of Czech or English (CAE certificate or alternative),
- research experience in the area of the specific research area of the expert team.

**Each of the positions shall be occupied by one applicant only. The announced position is a full-time job for a 32-month period (from 15<sup>th</sup> October 2012 to 30<sup>th</sup> June 2015).**

**Proposed salary: 50.000 – 60.000 CZK (gross pay/salary monthly – 40 hours per week)**



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**Expected start date: 15<sup>th</sup> October 2012 or later**

**The application form must include:**

- structured CV,
- copies of university degree documents (diploma),
- copies of English level certificate (CAE or alternative),
- overview of published articles in prestigious magazines and other publications,
- overview of quotations in international scientific literature,
- overview of implemented research results,
- overview of research teams the applicant has cooperated with, including a list of projects the applicant participated in

**Application form deadline: 1.10. 2012**

**Written applications to be handed over to:**

Personnel Department, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2896/2, 616 69 Brno, Czech Republic

JUDr. Pavla Konečná, e-mail: [konecna@fme.vutbr.cz](mailto:konecna@fme.vutbr.cz), tel.: +420 541 142 143



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

**Plan of research and development activities of post-doctorate in field of **THERMAL EFFECTS IN ELASTOHYDRODYNAMICALLY LUBRICATED CONTACTS - TRIBOLOGY****

**Plan of post - doctoral activities** (the actual project proposal will be supplied with recruitment procedure materials):

- Temperature field mapping in contact of non-conformal surfaces by capturing infrared radiation.
- Coefficient of friction measurement generated by fluid film in contact of non-conformal surfaces.
- Lubricants flow properties examining by employing high-pressure rheometers, or by interpretation of the traction curves.
- Study of lubricants properties at low shear strain rate in static concentrated contact during impact load change.
- Study of lubricants properties at high shear strain rate in the concentrated contact under particular slide to roll ratio.
- Study of fluid flow and thermal phenomena role on lubrication and friction effects in the highly loaded areas of elastohydrodynamically lubricated contacts.
- Numerical simulations and theoretical predictions of lubrication, friction and damaging processes, taking into account thermal phenomena.

**Responsibilities:**

- Individual conduction and development of own research subject that reads:
  - Literature review of the particular subject.
  - Hypothesis formulation and methodology design.
  - Experiment conduction and data analysis.
  - Data interpretation, conclusions formulation and results publication.
- Addressing the specific issues as required by the industrial sector.
- Cooperation on preparation of research and development projects
- Leading of small research team - diploma and dissertation projects.

**Expected outcomes:**

- Publication of results in prestigious international journals with impact factor; 4 times for the entire project,
- presentation of results at important international conferences; 6 times for the entire project.

**Mentor and the contact person: prof. Motohiro Kaneta, M.Eng., Ph.D. – [kaneta@fme.vutbr.cz](mailto:kaneta@fme.vutbr.cz)**



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

**Plan of research and development activities of post-doctorate in field of COMPUTATIONAL MODELLING OF MECHANICAL PROPERTIES OF COMPOSITES WITH ELASTOMER MATRIX**

**Plan of post - doctoral activities (the actual project proposal will be supplied with recruitment procedure materials):**

- Proposal of a constitutive model of composite with elastomer matrix reinforced by metal fibres with significant bending stiffness on the basis of Cosserat theory of elasticity and homogenization methods including.
- Proposal of experiments and a theoretical basis for an experimental identification of parameters of the model.
- Realization and evaluation of mechanical tests of composites with elastomer matrix and various types of reinforcing fibres, differing significantly in their bending stiffness.
- Simulation of selected mechanical tests with the composites using the model created on the basis of a detailed topology, geometry and properties of both components of the composite.
- Creation of a specific finite element program for a stress-strain analysis of the above composites on the basis of the proposed constitutive model.
- Debugging and testing of the created computer program.
- Evaluation of accuracy of the proposed model with the identified parameters using a computational simulation of selected mechanical tests and comparison of the results with experiments and with the more detailed model comprehending geometry and properties of both components of the composite.

**Mentors and the contact person: prof. Ing. Jiří Burša, PhD. – [bursa@fme.vutbr.cz](mailto:bursa@fme.vutbr.cz); prof. RNDr. Michal Kotoul, DrSc. – [kotoul@fme.vutbr.cz](mailto:kotoul@fme.vutbr.cz)**



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

## **Plan of research and development activities of post-doctorate in field of **MATERIALS SCIENCE AND ENGINEERING****

**Plan of post - doctoral activities** (the actual project proposal will be supplied with recruitment procedure materials):

Modeling of phase transformations in metallic materials:

- Share on modernize parts and profiling of the courses Complex phase transformations, theory, Modeling of phase transformations and Degradation of materials and prediction of their lifetime that are taught in the Master's program "Materials Engineering",
- preparing documents for tenders,
- modeling of sequences production - structure - properties of metallic materials with an emphasis on modern methods of welding,
- calculation of equilibrium states of selected metallic materials, including nanomaterials (software Thermo-Calc),
- modeling sequences of precipitation processes (software like DICTRA),
- modeling of redistribution of alloying elements in dissimilar welded joints of heat resistant materials under real conditions (PWHT, exploitation).

**Expected outputs of postdoctoral work:**

- Publications in IF journals,
- presentation of results at international conference – 2 per year,
- seminars on research for target groups – 2 per year,
- supervising bachelor and master thesis – min. 2 per year.

**Mentor and the contact person: prof. Ing. Rudolf Foret, CSc. – [foret@fme.vutbr.cz](mailto:foret@fme.vutbr.cz)**



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

## Plan of research and development activities of post-doctorate in field of **PREPARATION OF NANOSTRUCTURES USING ADVANCED NANOTECHNOLOGY METHODS**

**Plan of post - doctoral activities** (the actual project proposal will be supplied with recruitment procedure materials):

- The work is focused on research in the field of fabrication, characterization, and measurements of functional properties of surfaces, thin films, and nanostructures. Assistance in supervising PhD and diploma-degree students is an integral part of the work commitments, as well as coordination of scientific work in the frame of the CEITEC project.
- Fabrication of 2D – 0D semiconductor- and metallic nanostructures by using “bottom up” methods
- Fabrication of nanostructures (nanowires, nanodisks) by electron beam lithography, focused ion beam, etc.
- Development of hybrid methods of the selective growth of nanostructures
- Characterization of nanostructures by scanning probe microscopy
- Characterization of nanostructures by optical methods and other related methods
- Design, preparation, and testing of functional nanostructures, nanodevices, and nanosensors based on different working principles and covering a wide range of possible applications (nanophotonics, spintronics, etc.)

### **Expected outputs of postdoctoral research:**

- At least three publications in well established impact international scientific journals,
- presentation of the results achieved during the postdoctoral stay at profile international conferences (for example IVC 19th- September 9 -13, 2013, Paris, or ECOSS 2014 and 2015),
- patents or functional samples,
- participation in fabrication of R&D projects (EU 7th FP, etc.).

**Mentor and the contact person: prof. RNDr. Tomáš Šíkola, CSc. – [sikola@fme.vutbr.cz](mailto:sikola@fme.vutbr.cz)**



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EVROPSKÁ UNIE



MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání  
pro konkurenceschopnost

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

## **Plan of research and development activities of post-doctorate in field of MICRO AND NANO OPTIC WAVEGUIDE STRUCTURES - DESIGN AND SIMULATION**

**Plan of post - doctoral activities** (the actual project proposal will be supplied with recruitment procedure materials):

The activities of the research team are focused on the theoretical description and simulation of micro- and nanooptic waveguide structures. The PostDoc will deal with the following topics:

- Theory and modeling of photonic waveguides and photonic crystals.
- Application of nonlinear optical effects in the design of new functional elements.
- Simulation of advanced nanophotonic structures.

### **Responsibilities:**

1. Development of rigorous numerical methods for efficient simulation of three-dimensional photonic structures. Research on eigenmode expansion techniques.
2. Application of the developed techniques in the design, simulation and optimization of promising photonic nanostructures
  - photonic nanoresonators with high-quality factor
  - plasmonic structures

### **Expected outputs of postdoctoral work:**

- Publication of the results in prestigious international journals – 3,
- presentation of the results at major international conferences – 6,
- participation in the preparation of R&D projects – 3.

**Mentor and contact person: prof. RNDr. Jiří Petráček, Dr. – [petracek@fme.vutbr.cz](mailto:petracek@fme.vutbr.cz)**



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

## **Plan of research and development activities of post-doctorate in field of **MANUFACTURING TECHNOLOGY FOR PRODUCTION AND INSERTION OF IMPLANTS****

**Plan of post - doctoral activities** (the actual project proposal will be supplied with recruitment procedure materials):

- 3D analyses and modelling of special bone substitutions with T-spline use.
- 5-axis parametric CNC machining of special alloys (the bio-tolerant mainly).
- 3D measurement of real machined shapes and parts 5-axis parametric CNC machining of fitting surfaces, optimization of machining strategies.
- 3D measurement of real machined shapes and fitting parts.
- A matching assessment.
- Finishing technology for high compliance of fitting parts and surfaces.
- Tribological testing of bone-implant interfaces and counter-parts.

### **Expected outputs of postdoctoral work:**

- The Czech patent – 1,
- new technology – 1,
- papers in IF journals – 1,
- papers in international conferences – 3,
- papers in specialized journals – 3.

**Mentor and contact person - prof. Ing. Miroslav Píška, CSc. - [piska@fme.vutbr.cz](mailto:piska@fme.vutbr.cz)**