

PROJECTS OF THE INSTITUTE OF MATERIALS SCIENCE

- Project Title** **A study into the metallurgy nature of the structure and property changes of Cr-V ledeburitic steel by sub-zero treatment**
- Coordinator** Prof. Ing. Peter Jurči, PhD.
- Start Date** 01/ 01/ 2014
- End Date** 31/12/2016
- Programme** VEGA
- Annotation** The project is focused on the study of the phenomena taking place in the selected chromium-vanadium ledeburitic tool steel during sub-zero treatment and various regimes of such treatment. The research will determine the effect of the key process variables such as tempering and holding on the temperature of sub-zero treatment on the microstructure, hardness, toughness in 3-point bending, fracture toughness and wearresistance. The project will use a wide range of experimental techniques, which will enable attainment of the main goal of the project: a detailed and complex analysis of the phenomena in the microstructure of selected Cr-V ledeburitic steel in the conditions of sub-zero treatment under various regimes, and determination of the effect of microstructure changes taking place during sub-zero treatment on the mechanical and tribological properties of the material.
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- Project Title** **Using complex thermoanalysis and computer thermodynamics in the study of processes in advanced material systems.**
- Coordinator** doc. Ing. Roman Čička, PhD.
- Start Date** 01/01/2014
- End Date** 31/12/2017
- Programme** VEGA
- Annotation** The project is focused on utilising the experimental and computer thermodynamics in the study of processes and phase equilibria in perspective material systems such as complex metal alloys, advanced tool steels, corrosion-resistant austenitic steel, Al-based hardenable alloys and leadfree solders. In the experimental part, a complex thermoanalysis of the examined systems along with the measurements of some important thermo-physical quantities and a structure analysis will be carried out. Thermo-Calc, JMatPro, Dictra, ANSYS, SYSWELD, DEFORM and MATLAB programmes will be used to calculate the model phase equilibria and processes taking place in the examined materials during the controlled temperature regime. The project objective is to improve the prediction ability of phase equilibria and the processes in material systems by using advanced methods of computer thermodynamics.
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- Project Title** **Corrosion resistance of advanced metal alloys on the basis of zinc, aluminium and tin**
- Coordinator** Mgr. Marián Palcut, PhD.
- Start Date** 01/01/2014
- End Date** 31/12/2017
- Programme** VEGA
- Annotation** The aim of the project is the study of the corrosion resistance of phases in the Zn, Al and Sn-based alloys. The studied materials can be used as light construction materials for the automobile and aviation industries, protective coatings of steels and lead-free solders for microelectronics. The alloys will be prepared by melting pure metals in the protective atmosphere or under the layer of flux. Corrosion resistance will be studied in water solutions of electrolytes. Simultaneously, corrosion resistance will be examined by an accelerated test in a fog chamber. Selected samples will be subjected to mechanical tests for their susceptibility to corrosion cracking under stress. Corrosion products will be examined by a combination of methods of X-ray diffraction, energy-

disperse spectroscopy, transmission electron microscopy and reflective infrared spectroscopy. High-temperature corrosion resistance of selected samples will be also investigated. The contribution of the project will be the identification of corrosion-resistant alloys for practical applications.

Project Title **A Centre of Excellence for functionalised multiphase materials (FUNMAT)**
Coordinator prof. Ing. Jozef Janovec, DrSc.
Start Date 04/08/2011
End Date 31/12/2014
Programme Other domestic
Annotation The aim of the project is to gain new physics knowledge in the field of multiphase complex alloys, ceramics, composites and catalytically active surfaces of metals, plasmonic effects, photovoltaic and thermoelastic polymer structures, as well as from the field of biosensors. The acquired knowledge enables targeted functionalisation of materials with the goal to achieve the required specific properties such as mechanical toughness, chemical selectivity, increased quantum efficiency of light conversion and others. The final aim is a marked added value in research, the development and the implementation of unique high-tech solutions based on a multidisciplinary approach and the connection of research subjects with expertise in the field of physics of solids, quantum optics, materials engineering, inorganic chemistry, chemistry of polymers and biology.

Project Title **Interactions in bio and nanosystems**
Coordinator prof. RNDr. Miroslav Urban, DrSc.
Start Date 01/05/2011
End Date 31/10/2014
Programme APVV, General Call
Annotation The bonding characteristics, including chemical and hydrogen bonds to weak intermolecular interactions are essential in apparently remote areas like biophysics and material sciences. Recently, benchmarking data was obtained for properties of molecules and their interactions, using the Coupled Cluster CCSD (T) method capable of recovering a substantial part of the electron correlation. It provides reliable predictions of molecular properties. Innovations developed within the project remit allow CC molecular calculations with more than 80 correlated electrons and basis sets with up to 1500 functions. Real applications require properties of large molecules and clusters, inaccessible to rigorous methods. As a result, computationally less demanding DFT and semi-empirical methods will be used. The accuracy control of appropriate methods using relativistic CC data for smaller model systems is essential in this project. Intermolecular interactions will be exploited "in silico" drug design, "docking and scoring" analysis and the description of the ligandactive site of the protein. The activity of "Aurora" kinase inhibitions in tumour cells, molecules with angiostatic activity, blocking the vascular endothelial growth factor receptor2 will be investigated. Reference data for metal ligand interactions related to the SAMS formation and catalysis on surfaces and cavities will be obtained. A model will be proposed as part of the research findings in order to summarise the application of Nanoparticles in relation to material sciences and drug design. Polymer interactions based on HCNB clusters will also be studied.

Project Title **Solidification and properties of novel peritectic TiAlbased alloys**
Coordinator Ing. Svetozár Demian
Start Date 01/05/2011
End Date 31/10/2014
Programme APVV, General Call

Annotation Peritectic alloys based on TiAl are excellent candidates for near net shape casting of lightweight structural components for aircraft and automotive engines, industrial gas turbines and new generation of nuclear reactors. To advance the knowledge in the emerging casting technology sector of TiAlbased alloys, the SOPERIT project aims to investigate microstructure formation and segregation during solidification and solid phase transformations of novel peritectic TiAlbased alloys. The attention is directed to understand the effect of solidification parameters and alloying on the primary solidification phase, solidification path, phase equilibria, the columnar to equiaxed transition (CET), texture formation and nucleation activity of peritectic phase which will open up new opportunities for alloy and process design. The novel peritectic alloys with a fine grain structure will be designed and their microstructure and properties (chemical, physical and mechanical) will be characterised. Fine grain structure will be achieved through appropriate alloying affecting nucleation of peritectic phase and solid phase transformations. Unique CET experiments will provide advanced knowledge about the mechanisms of nucleation of equiaxed grains, associated segregation and the necessary input data for CET modelling. Parallel to these research activities, laboratory near net shape casting techniques based on plasma melting in a water-cooled crystalliser and gravity casting into ceramic moulds will be developed.

Project Title **Research and development of advanced materials, processing and automation technologies for direct manufacturing and application**

Coordinator doc. Ing. Martin Kusý, PhD.

Start Date 01/09/2011

End Date 31/08/2014

Programme Other international

Annotation The subject of the research is focused on advanced materials, processing and automation technologies for direct manufacturing and its application.

Project Title **The structure, properties and processes at surfaces and interfaces of materials from first principles calculations**

Coordinator RNDr. Andrej Antušek, PhD.

Start Date 01/01/2012

End Date 31/12/2015

Programme VEGA

Annotation The project is focused on density functional calculations of surface and interface structures relevant for materials science and chemistry. Through the application of methods of theoretical and computational chemistry, the research will address the growth of a thin layer and the subsequent thermodynamic properties of such structures with possible applications in brazing and joining technology. Using our previous experience with intermolecular interactions, the research will model interactions of molecules with surfaces, with a focus on increasing the understanding of the bonding mechanism. For smaller model systems accurate relativistic CCSD (T) calculations will be used as benchmarks to verify DFT results. Wave function calculations may also be useful for the selection of a proper DFT functional.

Project Title **A study of crystal structure and thermodynamic properties of aluminiumbase and zincbase complex metallic alloys**

Coordinator prof. Ing. Jozef Janovec, DrSc.

Start Date 01/07/2012

End Date 31/12/2015

Programme APVV, General Call

Annotation The project is focused on the study of phases, their equilibria, and transformations due to changes in temperature and chemical composition in aluminiumbase and zincbase complex metallic alloys, as well as on the determination of their crystal structure, This study will be carried out using experimental (Xray diffraction, DTA, DSC, TEM, electron diffraction, SEM, EDX, WDX, and EBSD) and theoretical (CALPHAD, DFT and empirical potentials) tools. Selection of alloys will be focused on systems where one component is either aluminium or zinc, and the remaining components are formed by transition metals. The project may significantly contribute to complementation and clarification of phase diagrams in areas that are less well-known and poorly studied. The emphasis will be placed on areas where structurally complex and quasicrystalline phases could be supposed. The contribution to finding of new quasicrystalline and structurally complex phases is anticipated. Theoretical study of these phases will lead to a more detailed description of their crystal structure, as well as to a deeper understanding of the relationship between the structure and physical properties.

Project Title **A study into the structural and mechanical stability of a new extremely hard coating for the construction and tool materials**

Coordinator Prof. Ing. Ľubomír Čaplovič, PhD.

Start Date 01/01/2012

End Date 31/12/2014

Programme VEGA

Annotation The project is aimed at analysing the effect of structural, material and technological parameters of the current advanced coatings applied on the construction and tool materials in specific conditions of their application. The latest analytical techniques (HRSEM, HRTEM, EBSD, RTG diffraction) will be used to examine the mechanism of forming wear-resistant types of PVD coatings on selected types of materials. The following evaluation of mechanical and tribological characteristics will be used to describe the influence of dynamic and static load of the layers on their operational reliability. The goal is to find a correlation between the internal construction of coatings, their interphase interfaces with substrate, structural tension relations in the layers, way of heat treatment prior to and post the PVD application and their tribological properties.

Project Title **The effects of inhomogeneities on the functional properties of hightemperature superconducting wires**

Coordinator Mgr. Michal Skarba, PhD.

Start Date 01/01/2011

End Date 31/12/2014

Programme VEGA

Annotation Nonmetallic superconductors based on a mixture of Y, Ba and Cu oxides (YBCO) are well known materials showing superconductive properties at relatively high temperatures. Structural analysis of micrometer superconducting layers on metallic substrate enables an understanding of the relationship between the parameters of preparation of layer and its properties. During deposition of layer on metallic substrate and during further processing, defects in the structure of thin layers of YBCO develop. These defects significantly affect the electromagnetic properties of superconductors, especially critical current and ac losses. Information about defects in layers of YBCO, inferred from structural analysis, is useful to decrease imperfections during the production of superconducting layers. It is also necessary for the development of superconducting devices, because they can have a significant influence on their working characteristics. Evaluations of structure of thin superconductive layers will be performed mainly with (highresolution) TEM.

Project Title	Study of relaxation mechanisms in composites with special carbon-based filling
Coordinator	doc. Ing. Marian Kubliha, PhD.
Start Date	01/01/2013
End Date	31/12/2015
Programme	VEGA
Annotation	The project is aimed at the implementation of measurements of selected physical parameters in the study of composites with polymeric matrix with an emphasis on the investigation of relaxation mechanisms in the structure. In the case of the matrix formed from reactoplast, the project is oriented on the evaluation of the impact of nanoparticles and carbon fibres (content and the arrangement of the individual phases) on mechanisms of dielectric behaviour. In the case of the matrix based on elastomers, the critical processes are examined in the formation of rubber mixture vulcanisers, as well as in their thermomechanical degradation. Correlations between the composition of the investigated system and the values of the rheological, electrical, dielectric quantities at nonisothermal heating of rubber mixtures are described. Important characteristics such as the resistance to thermomechanical exposure and the reproducibility of the properties defined by the values of the physical properties are discussed, too.
Project Title	Study of the turbulent accretion process in accreting binary systems through flickering activity
Coordinator	Mgr. Andrej Dobrotka, PhD.
Start Date	01/01/2013
End Date	01/01/2015
Programme	VEGA
Annotation	The main purpose of the project is to study turbulent flow in the high Reynolds number (Re) regime, not accessible in today's laboratories. Accretion systems are unique cosmic experiments to do so. The turbulence minimum dimension scales in the fluid are described by the Re. The largest scales of fluid motion are set by the overall geometry of the flow and are dissipating into smaller eddies up to the minimal dimension scale. From the basic fluid mechanics it is well known that higher Re numbers yield a smaller minimal dimension scale. From Re about 10^6 the dissipation toward smaller scales of turbulent elements is so strong that the fluid becomes quasilaminar. The bigger eddies should dissipate and hence disappear. Today Re estimates from Earth point towards a value of about 10^8 . What is happening then? The typical Re in an accretion disc of cataclysmic variables is of about 10^{12} and one of the possibilities to explain flickering is turbulence in the disc.
Project Title	The Influence of exposure conditions on the evolution of binary and ternary phases in aluminiumbased complex metallic alloys
Coordinator	prof. Ing. Jozef Janovec, DrSc.
Start Date	01/01/2012
End Date	31/12/2014
Programme	VEGA
Annotation	The evolution of binary and ternary phases under thermal activation in Albased CMAs will be studied with the intention to make the concerned phase diagrams more precise. The AlTM (TM=transition metal) alloys will be annealed for longterms at various temperatures and then quenched to fix the microstructure at annealing temperature. To analyse the phases, XRD, TEM, SEM, DTA, EDX, WDX, and EBSD, thermodynamic simulations will be used. Attention will be paid to the systems investigated insufficiently until now. Based on the experimental results and the available theoretical knowledge, precise thermodynamic parameters will be determined for the identified phases and the related databases will be modified. The use of advanced experimental methods gives rise

to methodological innovations. The project is expected to contribute to the basic knowledge and perhaps to the discovery of new phases exhibiting original properties.

Project Title **Chemical sputtering: Computational modelling of interactions in the carboncontaining films exposed to molecular ions and hydrogen EURATOM CU**

Coordinator prof. RNDr. Miroslav Urban, DrSc

Start Date 01/01/2010

End Date 01/09/2014

Programme Euromat

Annotation The formation of small hydrocarbons, their chemistry and cracking pattern upon the electron (e) impact and/or the thermodynamics of the formation of saturated lower hydrocarbons. Interaction energies of the hydrogen, nitrogen and molecular ions with compounds representing and modelling interactions with hydrogenated carbon films. Calculations of ionisation potentials of small hydrocarbons, C_xH_y (C_xH_yD_z) and their ions, their properties and thermodynamic stability.

PROJECTS OF THE INSTITUTE OF PRODUCTION TECHNOLOGIES

Project Title Technological heritability of the laser micromachining process and its influence on technological and exploitation properties of material.

Coordinator Prof. Ing. Peter Šugár, CSc.

Start Date 01/01/2011

End Date 31/12/2014

Programme VEGA

Annotation The goal of the project is to research the laser micromachining process (laser micromilling and so called laser microstructuring) during machining of metals by solidstate Nd: YAG and ytterbium fiber laser. Two fields of interest are solved in this project. The first is the assignment of laserinduced surface degradation relevancy on changes in corrosion resistance of stainless steels and commercially pure titanium with the different degree of deformation strengthening (thin sheet plates made by technology of drawing and metal spinning). The second area of interest is to define optimal technological conditions of forming tools laser structuring with the goal to optimise the tribology conditions in the tool – workpiece interface.

Project Title Research of weld joints properties of duplex and superduplex steels

Coordinator Prof. Ing. Koloman Ulrich, PhD.

Start Date 01/10/2013

End Date 31/12/2016

Programme APVV

Annotation The project is focused on the basic research conditions and procedures for creating the weld joints by laser and electron beam in selected types of duplex stainless steels with a ferriticaustenitic structure. Concentrated energy sources, due to their flexibility, allow for the immediate application of preheating before the welding process and postheating after the welding process using a defocused or rasterised beam, which provides great research potential. The weldability of duplex and superduplex steels, the structural analysis and the tests of mechanical properties, as well as corrosion properties will be investigated at particular stages of the project. All processes of the technological network participate in creating the final properties of the product. For this reason, the experimental research programme will also cover the analysis of weld joints created from materials influenced by different types and levels of deformation, as well as the sheet forming of weld joints. A special focus will be devoted to finding the correlation between the crucial technological parameters of the process and the properties of the weld joint. The project has the aim to push the knowledge boundaries of the welding process of selected duplex stainless steels through the application of concentrated energy sources, such as laser and electron beam.

Project Title Research of new soldering alloys for fluxless soldering with the application of beam technologies and ultrasound

Coordinator doc. Ing. Roman Koleňák, PhD.

Start Date 01/10/2013

End Date 31/05/2017

Programme APVV

Annotation The project is oriented towards the research of environmentally friendly solder alloys and conditions of soldering with progressive technologies. The designed and experimentally manufactured solders will be used for the soldering of metallic and

ceramic materials at higher application temperatures. To ensure the wettability of ceramic and hardtosolder materials, the solders will be alloyed with active elements and metals from the group of lanthanides. The tests of technological solderability of ceramic and metallic materials will be performed through the use of new soldering alloys for fluxfree soldering, with the application of laser technologies, power ultrasound and electron beam. The structural characteristics of solders and soldered joints will be studied under different soldering conditions. Interactions in the boundary of joined material and the solder will be investigated. Qualitative criteria of solderability such as wettability, spreadability, diffusion and erosion will be determined at standard and extreme soldering conditions for research to investigate the application conditions of soldering. The shear strength of soldered joints fabricated in metallic and ceramic materials will be determined.

Project Title **The implementation of blended learning principles into teaching the programming of CNC machine tools and devices with a progressive kinematic structure**

Coordinator Prof. Ing. Peter Šugár, CSc.

Start Date 01/01/2014

End Date 31/12/2016

Programme KEGA

Annotation The project is oriented on the unification of teaching procedures within the subject of Programming CNC machine tools and devices for various technology purposes, while focusing on the machine tools and devices with progressive kinematic structure and using the blended learning principles. The target group involves the students of all degrees levels, including postgraduate students and partially also the students of secondary technical schools. Besides defining a unified content structure of synchronous and asynchronous on-line education and preparing the conditions for face-to-face laboratory education of programming a wide scale of CNC production and measurement technology, the project also has the ambition to build a system for cooperation between education and production entities, with the aim to intensify information transfer in shaping the graduate profile in the field in accordance with the current demands of practice.

Project Title **An investigation of selected machining process characteristics by using HI-technologies of machining and their effect on the resulting quality of machined surfaces and trouble-free loading**

Coordinator doc. Ing. Peter Pokorný, PhD.

Start Date 01/01/ 2014

End Date 31/12/2017

Programme VEGA

Annotation The project is aimed at the investigation of selected characteristics of machining process (cutting forces, machining of thin-wall components, wear and restoration of the tool's cutting properties, cutting media and strategies of machining). The above-mentioned characteristics of machining affect the quality of parts. The project therefore investigates their effect on the resulting characteristics of components. In the process of investigation, the researchers will use Hi-technologies in the Centre of Excellence for 5-axis machining (high-speed machine tools, millingultrasound machine, laser machine, tool grinder). The required geometric and dimension precision of the fabricated component determine the conditions for assembly and thus also the result of the assembly process. The project will therefore elaborate a method of harmonising

production technology with the requirements defined in the geometric specifications of products.

Project Title	Research into the defect diagnostic of welded joint through the use of modern NDT methods
Coordinator	Prof. Ing. Koloman Ulrich, PhD.
Start Date	01/01/ 2014
End Date	31/12/2016
Programme	VEGA
Annotation	The project aim is to research defect diagnostics of weld joints using modern ultrasonic methods TOFD and Phased Array (PA), compared with radiation methods and the impact of defects detected over the lifetime of welded structures. Samples of weld joints will be prepared with artificially created defects, in order to verify the sensitivity of UT techniques and the results of detected defects will be compared with classical and modern radiation methods. The methods TOFD and PA will be further applied to measurements in industrial practice for testing the welded joints of concrete. Control of the weld samples will be measured by the size of present defects on the calculated critical size defect and residual life of welded structures. Calculations will be transferred by shape coefficients for the presence of peripheral and internal defects. Comparing the results of the analysis and evaluation of measurement methods will be determined by inspection and accurate method of determining the size of immediate defects.
Project Title	Utilising advanced methods of optical 3D scanning for the analysis of weldments
Coordinator	Prof. Ing. Milan Marônek, CSc.
Start Date	01/01/ 2014
End Date	31/12/2016
Programme	VEGA
Annotation	To measure lengths and angles, current methods of measuring the weld joints deformations use simple manual gauges, mainly for financial reasons. When measuring free-form structures and a higher number of measurements, the process is time-consuming. Furthermore, results of the measurements are influenced by human factors. Besides architecture and reverse engineering, modern methods of 3D scanning are finding wider application in the field of technologies of machine production, e.g. in the automobile industry. The project will verify the suitability of the 3D scanning methods for determining the deformations occurring in welding. The project will also examine the effects of the scanning parameters on the resulting precision of measurement, suitability of individual scanning methods, depending on individual types of deformation and regarding geometric dimensions of the parts welded, welding technology used and its process parameters.
Project Title	Research and Development Centre in the field of electron-beam and progressive arc welding technologies, cladding and surface finishing
Coordinator	Prof. Ing. Milan Marônek, CSc.
Start Date	01/10/2012
End Date	30/09/2015
Programme	OP VaV
Annotation	The specific objectives of the project comprise modernisation and improvement of the technical infrastructure of research and development.

The goal is to build a high-tech workplace for research of progressive welding technologies, surface hardening, remelting and depositing special layers by electron beam. Another goal is to build a top-class workplace for the complex research of technology of welding and cladding processes by using the methods of electric and plasma arcs welding in all welding positions and in any weld/clad trajectory.

Project Title **The technical infrastructure of research and development for the field of temperature gauging by the contact and non-contact methods of measurement**

Coordinator doc. Ing. Augustín Görög, PhD.

Start Date 01/10/2012

End Date 30/09/ 2014

Programme OP VaV

Annotation The strategic objective of the project is to build research and development workplaces oriented on the research of progressive welding technologies and on the increase of research potential in the field of engineering metrology by using advanced methods of measuring the precision of machine parts, and its integration into research and developments networks. The project output will have a positive impact on the development of the education process and the preparation of a new generation of researchers and qualified staff for high-tech industrial sectors. New machines and devices will provide favourable conditions for direct cooperation with practice, thus enabling effective transfer of research results into practice.

Project Title **The effect of 5-axis grinding parameters on the geometric precision of cutting tools with a shank**

Coordinator doc. Ing. Štefan Václav, PhD.

Start Date 01/01/2012

End Date 31/12/2014

Programme VEGA

Annotation The project will investigate the precision of grinding and the geometry of cutting tools with a shank by using a new method developed by the project authors. The theory of cutting forces in grinding is not sufficiently developed so far. The project output will be the application of the above-mentioned theory of highly parametric 3-axis grinding to 5-axis grinding. The project goal is also the verification of the tools produced by the researchers involved in the project on 5-axis milling machines, and subsequent measurement of their geometry prior to and after machining on both the Zoller 5-axis measuring machine and optical scanner.

Project Title **Building an on-line classroom for the dynamic education of secondary school and university students in the field of design and production of free-form parts**

Coordinator Prof. Dr. Ing. Jozef Peterka

Start Date 01/01/2012

End Date 31/12/2014

Programme KEGA

Annotation The project is focused on building an on-line classroom for the dynamic education of secondary school and university students, and the subsequent piloting of the on-line classroom for education of the wider public in the field of programming CNC machines and CAD/CAM systems, primarily for the accredited study programmes of Computer-aided Production Technologies (Bc.) and Computer-aided Design and Production (Master's degree) in STU MTF. The on-line classroom will provide dynamic education in two forms: 1/ on-line practical lectures and

exercises in real time, 2/ on-line testing in real time. The on-line classroom with software and hardware support will help the full-time and part-time university students as well as allowing secondary technical school students to acquire the knowledge without physical contact and attendance to classes at STU MTF in Trnava. The contents of the pilot project will involve the fundamentals of programming CNC machines and CAD/CAM systems (design and production of parts). Complex materials (texts, presentations, multimedia videos, model examples) developed for the online classroom will be available on the Internet website for all potential target groups, including the students of all forms of study at STU MTF in Trnava, the training centre in Dubnica, as well as the students of other universities and secondary schools and the general public. The results will be applicable in the Slovak Republic and abroad.

Project Title **Industrial research of silenblocks for excessive loading at extreme temperatures in the field of industrial application**

Coordinator doc. Ing. Jozef Bilik, PhD.

Start Date 01/11/2011

End Date 01/10/2015

Programme OP VaV

Annotation The project is focused on building an on-line classroom for the dynamic education of secondary school and university students, and the subsequent piloting of the on-line classroom for education of the wider public in the field of programming CNC machines and CAD/CAM systems, primarily for the accredited study programmes of Computer-aided Production Technologies (Bc.) and Computer-aided Design and Production (Master's degree) in STU MTF. The on-line classroom will provide dynamic education in two forms: 1/ on-line practical lectures and exercises in real time, 2/ on-line testing in real time. The on-line classroom with software and hardware support will help the full-time and part-time university students as well as allowing secondary technical school students to acquire the knowledge without physical contact and attendance to classes at STU MTF in Trnava. The contents of the pilot project will involve the fundamentals of programming CNC machines and CAD/CAM systems (design and production of parts). Complex materials (texts, presentations, multimedia videos, model examples) developed for the online classroom will be available on the Internet website for all potential target groups, including the students of all forms of study at STU MTF in Trnava, the training centre in Dubnica, as well as the students of other universities and secondary schools and the general public. The results will be applicable in the Slovak Republic and abroad.

Project Title **Research into modified soldering alloys for the fluxless soldering of the metal and ceramic materials.**

Coordinator doc. Ing. Roman Koleňák, PhD.

Start Date 01/01/2014

End Date 31/12/2016

Programme VEGA

Annotation The project is focused on the research into modified soldering alloys, particularly those of the Sn-Ag-Ti, Sn-Ag-Cu and Zn-Ag-Al type. New soldering alloys with a small amount of active metals (In, Ga, Y and some elements of the group of lanthanoids) will be experimentally prepared. Solders will be designed for fluxless soldering by using the technologies of laser and high-power ultrasound. The modified soldering alloys will be tested for technological solderability of ceramic

and metallic materials, in order to determine the structure of the solders and solder joints under various conditions of soldering. Interactions between the soldered material and solder will be studied along with the mechanical properties of the soldered joints.

Project Title	Research into the metallurgical joining and other technological processes of processing magnesium and other light alloys by progressive and suitable environment-friendly technologies
Coordinator	Ing. Miroslav Sahul, PhD.
Start Date	01/01/2012
End Date	31/12/2014
Programme	VEGA
Annotation	The project is focus on: the design, experimental verification and scientific justification of technological processing of Mg alloys; the selection of progressive and environment-friendly technologies of metallurgical joining and forming; the welding and soldering/brazing of Mg alloys with other metals (Al, Ti, Steels); and the design and quality control of joints by using advanced non-destructive and destructive methods. A detailed study will be conducted of the interface of combined joints with the AZ91 and AZ31 alloys, thus contributing to the research into the mechanisms and their origin and participation into the development of a new Mg alloy of the ML5 type. The heat distribution will be investigated by concentrated energy sources and comparison with AWJC. Verification for the possible use of microplasma polishing of surfaces of the Mg and Al alloys will be made. The study will focus on the strain/stress- deformation states of materials in the processing of Mg and Al alloys (ISF, MS, Thixoforming) in order to optimise the parameters of forming processes and to predict the utility properties of products. The justification of the economic and environmental priorities of the individual technologies will also be provided.

PROJECTS OF THE INSTITUTE OF PRODUCTION SYSTEMS AND APPLIED MECHANICS

Project Title	The analysis of nonequilibrium thermal, metallurgical and stress-strain processes in production technologies involving rapid cooling and solidification of metallic materials
Coordinator	doc. RNDr. Mária Behúlová, CSc.
Start Date	01/01/2011
End Date	31/12/2014
Programme	VEGA
Annotation	Rapid cooling and solidification of materials in nonequilibrium conditions is used in several advanced technologies of production and the processing of metallic materials. The research in the framework of the submitted project will be focused on experimental investigation, numerical simulation and analysis of nonequilibrium thermal, metallurgical and stress-strain processes in technologies for the preparation of rapidly solidified powders using inert gas atomisation of melt, material forming in semisolid state and also the laser welding and surface heat treatment. The main aim of the project is the identification of common characteristics, phenomena and nonequilibrium processes leading to the development of refined microstructures in the conditions of rapid cooling and solidification of materials. In the theoretical field, the project should contribute to the explanation of physical and metallurgical reasons and mechanisms of metastable structures development in the high-alloyed materials on the base of iron and aluminium.
Project Title	Research into the possibilities of "intelligence" implementation in the assembly process
Coordinator	doc. Ing. Peter Košťál, PhD.
Start Date	01/01/2012
End Date	31/12/2014
Programme	VEGA
Annotation	The intelligent assembly paradigm includes a new approach to assembly system structure design. For manipulation and assembly the industrial robot is used and equipped with the industrial vision system. Intelligent behaviours are based on the monitoring of important parameters of the system and its environment and the flexible reaction to changes. Realisation and utilisation of this design paradigm as an "intelligent assembly system" enables the flexible system to react to the production requirements as soon as the environment changes. Results of these flexible reactions are a smaller layout space through decreasing the production and investment costs and by increasing productivity.
Project Title	Education for practice: Virtual Commissioning as a future technology tool for virtual implementation of production systems into automobile production within the "Digital Company" concept
Coordinator	Ing. Roman Ružarovský, PhD.
Start Date	-- other domestic --
End Date	in progress
Programme	01/11/2014
Annotation	31/07/2015 The project is focused on the primary education of the young STU MTF UVSM teachers and students with the aim of increasing their knowledge, technology and practical levels, with the emphasis on devising and virtual implementation of the robotic, production and assembly systems in

the automobile industry.

Project Title	Building a virtual laboratory of robotics and manipulation technology
Coordinator	Prof.h.c. Prof. Ing. Karol Velíšek, CSc.
Start Date	KEGA
End Date	in progress
Programme	01/01/2014
Annotation	31/12/2016 027STU-4/2014

The aim of the project is to build a laboratory with a set of training modules in the field of automation and industrial robotics, for the purposes of teaching the principles of automatic control of manipulation technology and programming of industrial robots, which are currently introduced in industrial practice. The laboratory will enable the building of student knowledge in the field of automated and robotised systems by using the innovative educational programme and methods along with modern CA technologies including e-learning. The laboratory will enable various application tasks to be dealt with, using various automation means and several control levels, including simulation and subsequent verification on real industrial components.

PROJECTS OF THE INSTITUTE OF INDUSTRIAL ENGINEERING AND MANAGEMENT

INTERNATIONAL PROJECTS

Project Title **Festival of Science as a Platform for Intensifying Cooperation between V4 Region Universities**

Coordinator doc. Mgr. Dagmar Cagáňová, PhD.

Start Date 01/03/2013

End Date 31/08/2014

Programme International Visegrad Fund

Annotation The main project feature is to establish a basis for active V4 scientific cooperation using best practice exchange and knowledge transfer. It is an opportunity for linking academic and business institutions from V4 countries that will ensure collaboration in research, education and increased international mobility of university teachers and students. It will also contribute to the popularisation of science for professionals and public and ensure continuation of activities to the future.

Project Title **Knowledge exchange in the framework of alternative economic systems for the promotion of sustainable regional development**

Coordinator doc. Mgr. Dagmar Cagáňová, PhD.

Start Date 01/09/2013

End Date 31/12/2014

Programme European Territorial Co-operation (ETC) Slovak Republic – Austria

Annotation The project ALTECS is implemented by the Vienna University of Economics and Business, the Slovak University of Technology in Bratislava, the Ministry of Life, the Vienna Chamber of Commerce and Industry, and the Slovak Chamber of Commerce and Industry Trnava in the framework of the funding programme European Territorial Co-operation (ETC) Slovak Republic – Austria. The objective of the ALTECS project is to set the first steps for a sustainable regional development based on knowledge exchange between companies and students and using knowledge to pursue and implement a responsible and resource conserving economic way. In order to advance ecological, economic, and social sustainability, regional know-how founded on the important pillars science and economy and generated among the involved target groups in the context of a summer university is made available. The realisation of the summer university will be designed together with the “OeAD-WohnraumverwaltungsGmbH” as the initiator and implementing body of this educational method. In this regard, those companies shall be supported that wish to follow a socially, ecologically, and economically exemplary pattern or already represent best practice and can thus give valuable advice. Economy students from Austria and the Slovak Republic will be involved from the sector of science. They will enlarge and also share their knowledge in the field of sustainability in order to elaborate new perspectives for sustainable regional development in the framework of peer group projects together with small and medium-sized enterprises (SMEs). Long-term orientation as an essential indicator of sustainability is achieved in the establishment of a regular platform and network events that will simultaneously accelerate knowledge exchange. The shared set-up and the realisation of the educational programme also fosters relations with the

neighbouring country (cultural, economic, ecological, and social) as well as solidarity in the border region and promotes a common responsibility for the cross-border economic area.

Project Title	EAI SK European Alliance for Innovation Slovakia
Coordinator	doc. Mgr. Dagmar Cagáňová, PhD.
Start Date	01/03/2014
End Date	30/09/2015
Programme	International Collaboration
Annotation	The main goals of the project are as follows: Goal 1 Improvement of the automatic web tools to support the convergence of EAI online tools and services supporting the organization of events and publications release. Goal 2 Utilisation of the web tools to promote entrepreneurs, start-ups and small and medium enterprises through the EAI services Promotion and presentation of the best innovative products/prototypes and start-ups through the EAI tools and communities Increase of the productivity through the transfer of technology and research results Goal 3 Motivation of the users through the building of the thematic groups and forums with the emphasis on the selected innovation themes Project beneficiaries - Access to the EAI communities activities - Connection to influential innovation stakeholders - Participation in EAI international projects and activities including Horizon 2020 projects - Fostering of the technology transfer and research results - Access to the EAI know-how in the area of the ICT tools for the community building, event organization, innovation evaluation and promotion - Access to funding opportunities for start-ups and spinoffs - Access to the EAI expertise in development and submission of international projects - Promotion and international visibility of the Slovak University of Technologies

NATIONAL PROJECTS

Project Title	Identification of key parameters of sustainable performance of industrial companies under the conditions of a multicultural environment
Coordinator	Prof. Ing. Miloš Čambál, CSc.
Start Date	01/01/2012
End Date	31/12/2014
Programme	VEGA
Annotation	This project investigates the approaches to organisation performance management in terms of performance sustainability. The emphasis is on “sustainability”, since currently used models of performance management have a detrimental impact on the decisive groups of employees (longtime over-loading, burnout syndrome, health troubles of various character), decreased their performance and thus also performance of the whole

organisation and its competitiveness. The project is aimed at solving the subject under the specific conditions of multicultural organisations (with orientation on industrial companies), requiring the approaches different from those applied in monocultural organisations.

Project Title **Information Quality Management in Project Management of Industrial Companies in SR**

Coordinator doc. Ing. Jana Šujanová, CSc.

Start Date 01/01/2012

End Date 31/12/2014

Programme VEGA

Annotation The project focuses on the results of the projects worked on in the Institute of Industrial Engineering, Management and Quality of STU MTF in Trnava:
VEGA 1/2578/05: Analysis of current world-wide trends of project management, research of current state of the subject in Slovakia and a proposal of its implementation in the conditions of Slovakia;
ESF 11230220391: Modular system of distant education in project management with elearning and information technologies support;
VEGA 1/0491/09: Maturity inspection of project management processes as a tool of increasing competitiveness of industrial companies. Partial outcome of the above-mentioned projects was the identification of shortcomings in the field of information and information management quality, negatively influencing the projects' impact. The project aim is to design a methodology of information quality management in project management of industrial companies in SR.

Project Title **Implementation of the subject "Corporate Social Responsibility Entrepreneurship" into the Master's study programme Industrial Management at MTF STU Trnava**

Coordinator Prof. Ing. Peter Sakál, CSc.

Start Date 01.01.2012

End Date 31.12.2014

Programme KEGA

Annotation The content of the project concerns the implementation of the subject "Corporate Social Responsibility Entrepreneurship" into the study programme Industrial Management in context of the strategy of corporate social sustainable development of the EU. Firstly accepted in Gothenburg in 2001 and consequently revised in 2006 and 2009. The strategies include, Europe 2020 for Employment and Growth, Enterprise 2020, key findings from the council meeting on 19th November, 2010 about education for sustainable development (2010/C 327/05), and also from the Organisation of United Nations (OSN) summit from 20th-22nd September, 2010 regarding the millennium development aims and the present accepted norms. The project also considers ISO 26000 relating to corporate social responsible entrepreneurship

Project Title **Transformation of the ergonomics programme into the company management structure through integration and utilisation of QMS, EMS, HSMS**

Coordinator Prof. Ing. Jozef Sablik, CSc.

Start Date 01/01/2013

End Date 31/12/2015

Programme VEGA

Annotation	The project is aimed to confirm the need, definition of the possibilities and proposal of the process using an integrated QMS/EMS/HSMS for transformation of the content of the ergonomic programme into structured activities of management for the company. Application of the project outputs envisages the creation of conditions that improve the work process, which guarantee a long term high level of work performance with minimal risk to safety and health of employees in accordance with the philosophy of sustainable development.
Project Title	Centre for Competence Development in Industrial Engineering and Management
Coordinator	doc. Ing. Jana Šujanová, CSc.
Start Date	01/10/2013
End Date	30/09/2015
Programme	The European Social Fund
Annotation	The Centre for competence development in the field of Industrial Engineering and Management, will focus on supporting the development of human potential in research and innovation in industrial engineering and management, in particular through post-graduate studies and training of researchers and experts from industrial practice, which will also contribute to linking the activities of universities, research centres and companies to the networks.

PROJECTS OF THE INSTITUTE OF APPLIED INFORMATICS, AUTOMATION AND MATHEMATICS

Name of the project	Project IPID
Duration of project	01/2011 - 12/2014
Programme	DAAAD - The German Academic Exchange Service
Annotation	<p>Within the IPID programme, doctoral students of both universities (TU Ilmenau, Germany and STU MTF) have the chance to participate in mobility at the partner university. The programme aim is to enable both domestic and foreign doctoral students to acquire a multi-national dissertation, thus educating high-quality young researchers for both Slovakia and Germany, and establishing scientific co-operation between the two countries.</p> <p>The programme involves two activities:</p> <ol style="list-style-type: none">1. Fulfilling the partial objective of the “Autonomy microsystems for biosensorics” project. <p>The project aim is to examine and design modern technologies for microtechnologically constructed biosensors which are independent in terms of power and able to communicate with each other in local networks, transferrable and implantable into a human organism. The intention is strongly interdisciplinary, and therefore structured to various branches and faculties.</p> <ol style="list-style-type: none">2. Multi-national network of PhD students. <p>The programme simultaneously supports the establishment of a multi-national network for PhD students’ education which would enable the exchange and mobility of PhD students and support the perspective of multi-national study programmes and double doctoral degrees.</p>

Name of the project	Workplace: Automation and ICT Implementation of Production Processes and Systems – University Scientific Park
ITMS of project	26220220179
Duration of project	03/2013 - 06/2015
Operational programme	Research and development
Annotation	<p>The aim of the project is to build a modern and unique university integrated scientific park and to prepare highly-qualified operative staff for it, to train management for the needs of the regional and the whole country as well as central-European large industrial enterprises in the transfer of the application science results directly into practice. After the project implementation, CAMPUS STU MTF University Scientific Park will possess a research workplace of Automation and ICT Implementation of Production Processes and Systems with several specialised research laboratories forming the core of the related part of the University Scientific Park, oriented on the development of the control and information technologies. The specified part of the University Scientific Park, i.e. Automation and ICT Implementation of Production Processes and Systems, is in compliance with the intention of the governmental research and technology policy and the Strategy for Europe 2020.</p>

The Park and its laboratories will form a fundamental pillar of the research and development infrastructure in accordance with the University system priority to support the transfer of research and development results into practice, currently preferably in the region and the following geographical expansion.

Project Title **Identification and evaluation of shapes and surfaces of materials scanned by laser confocal microscope**

Coordinator Ing. Tomáš Bezák, PhD.

Start date 01/01/2012

End Date 01/01/2015

Programme KEGA

Annotation The aim of this project was to develop a suitable software environment dedicated to the evaluation of basic metrological and topographical parameters of the scanned 3D surfaces. Application of the software is focused on the Master of Science degree in the following branches of study: Material science and Engineering technologies. The created software package is an alternative to the currently used software for processing the data obtained by the contactless surface scanning. It allows users to process the data remotely without direct access to the microscope or bundled software. The developed software package also extends the ability of processing and evaluation of the surface topography. This package extends the possibilities of processing and surface topography evaluation. Due to the open software concept, it allows the development of additional user requested modules.

Project Title **Study of flexible mechatronics system variable parameters influence on its control**

Coordinator Dr.h.c. Prof. Dr. Ing. Oliver Moravčík

Start date 01.01.2013

End Date 31.12.2015

Programme VEGA

Annotation Within the context of using new flexible materials and derated mechanism constructions in the mechatronics systems, presently a large focus is dedicated to the elimination of spurious frequencies in drives and motional mechanisms in research. Because of the extensity of this issue this project deals with the elected type of mechatronics system only. The basic aim of adaptive control in this type of system is to eliminate inelible influences. The proposed project is focused on: Physical and mathematical analysis of parameters influencing control; Design and verification of chosen advanced control methods; Investigation of sensitivity and robustness of the solution. The basic objective of the project is to design in an appropriate manner the flexible mechatronics system adaptive control.

Project title **Reseach into monitoring and assessing non-standard states in the vicinity of a nuclear power plant**

Coordinator Prof. Ing. Pavol Tanuška, PhD.

Type OP VaV

Start date 01/04/2012
End date 30/06/2015
Annotation Industrial research is focused on the options to improve the quality and effectiveness of monitoring and assessing non-standard states in the vicinity of a nuclear power plant. Its objective is to implement theoretical knowledge of a research organisation and the know-how and experience of a private company into practice by utilising the technology for collection, processing, measurement, distribution, assessment and presentation of the data from the mobile and stationary units and related risks in the vicinity of a nuclear power plant, in order to improve its operation and increase its quality. Advanced sophisticated information and communication technologies along with the elements of the existing telemetric system will be used within the project implementation. The project output will provide a system of utilising the project results in practice, resulting in significant improvement of the existing technologies and procedures. The improvement will assure a higher quality of the collection, scope of data processing, measurement, distribution, assessment and presentation of data and related risks in the vicinity of the nuclear power plant in real time.

Project title **Writing an interactive multimedia textbook of "Mechatronics" for secondary technical schools**
Coordinator Ing. Igor Halenár, PhD.
Type KEGA
Start date 01/01/2012
End date 31/12/2014
Annotation Various forms of multimedia can be used to support better, more effective and intensive perception of information (texts, pictures, photographs, speech, music, animations, video etc.) in technical subjects. In pedagogy practice, students are not able to absorb all the information delivered to them. It is therefore important to focus the flow of information, select the most important ideas and search for the key message within the subject studied. Multimedia and hypertext provide a tool to support study information, easy information retrieval and orientation within it. The project was focused on the preparation and development of a modern interactive multimedia teaching application for secondary schools in the Slovak Republic with the aim to increase the level of teaching/learning the subject of "Mechatronics)" via video-sequences, programmable interactive animations, pictures and others.

Project title **Implementation of the internal quality assurance system**
Coordinator doc. RNDr. Mária Mišútová, PhD.
Type SOP Human resources
Start date 01/01/2012
End date 30/06/2014
Annotation The aim of the project was to design and verify a system of objective quality assessment, effectiveness and suitability of education in compliance with sustainable adaptability of universities to the current and future needs of the knowledge society. The project will enable

implementation of the system of direct quality measurement of university education, thus providing the space for improving the university output and approximation of the educational system to societal needs. The project objectives were to: design and verify a system of direct quality measurement of university education in the Bachelor degree study programmes in STU MTF; to design and verify the measures for eliminating information deficiencies in the Bachelor degree study programmes in STU MTF, to design and verify the measures for improving the quality of university education in the Bachelor degree study programmes in STU MTF; to design and verify the impact of the abovementioned measures in the Bachelor degree study programmes at STU MTF.

PROJECTS OF THE INSTITUTE OF SAFETY, ENVIRONMENT AND QUALITY

Project Title **Elearning as a Handbook of Health and Safety in Welding**
Coordinator Ing. Zuzana Szabová, PhD.
Start Date 01/01/2013
End Date 31/12/2015
Programme KEGA
Annotation The project aims to create a comprehensive handbook on safety and health (OSN) and fire protection in the classic, special, modified and hybrid technologies, welding, brazing and thermal cutting of materials. The guide to health and safety in welding will be available on the Internet for students of all forms of study within elearning and for use by experts. The guide will be an important tool and source of information in assessing risks for a wide range of subjects using the technology of metallurgical bonding and cutting of materials. There will also be taken into account the effective application in existing social practice. The guide will simplify access to the information and bring a new perspective for solving practical problems of safety and health in welding.

Project Title **Progressive methods of material firetechnical characteristics determination in fire engineering**
Coordinator Prof. Ing. Karol Balog, PhD.
Start Date 24/10/2013
End Date 30/09/2017
Programme APVV
Annotation The contribution to research in the area of fire engineering is in accordance with world trends through the utilisation of the progressive methods for the determination of important firetechnical characteristics for the calculation and modelling of compartment fires. The characterisation and verification of the laboratory testing methods will utilise modern equipment for obtaining the unique material characteristics and their alterations due heat and fire. The behaviour of the solid and liquid materials will be predicted in the process of initiation and propagation of combustion on the ground. New methods will be applied for the determination of critical boundary conditions of testing for representative materials in the progressive material structures for the improving of outputs from the fire scenarios used.

Project Title **Construction of an educational laboratory for fire reconstruction on a laboratory scale**
Coordinator Ing. Jozef Martinka, PhD.
Start Date 01/01/2013
End Date 31/12/2015
Programme KEGA
Annotation Investigation of fires causes is one of the most difficult tasks for fire protection. Correctly determined the cause of the fire can be a thin line between justice and miscarriages of justice, and a key tool for the determination respectively. Verification of the fire cause is its reconstruction on a laboratory scale. Reconstruction of a fire on a laboratory scale is divided into the reconstruction of initiation and the reconstruction of progress (development) of the fire. Reconstruction of initiation gives an answer to the question whether a specific ignition sources could be the cause of

the fire. Reconstruction of the fire development provides valuable data about the behaviour of materials and products in the fire under conditions similar to the fire. The basic assumptions for the applicability of laboratory tests for the reconstruction of fire are the proper selection, design and implementation of laboratory tests. Currently there is no specialised facility for the reconstruction of fire on a laboratory scale, and no training centre to prepare specialists for the execution of the tests in the Slovak Republic.

Project Title	Studying the use of advance oxidative processes for metalworking fluids lifetime extension and for their following acceleration of biological disposal at the end of the life cycle
Coordinator	prof. Ing. Maroš Soldán, PhD.
Start Date	VEGA
End Date	01/01/2014
Programme	31/12/2017
Annotation	<p>The project follows the possibility of using low concentrations of O₃ as a progressive method of hygienisation of MWFs during the period of their use in machining. It is for the purpose of extending the lifetime of MWFs, protection of the human operator of the machine by reducing the amount of biocide used and reduction of the used sources for their longer utilisation (economic, environmental and safety aspects).</p> <p>On the other hand, after the useful life of process fluids in the machine, the effects of the high concentration of O₃ will be monitored (with the combination of other advanced oxidative processes mostly sonolysis and photocatalytical oxidative processes) to accelerate the biodegradation of MWFs (economic and environmental aspects). The decrease of organic substances content as well as the primary elimination of biocides will help the biological degradation of this type of waste. Both aims reflect the world trend of sustainability, decreasing substances toxicity and the increasing use of biological treatment of wastes.</p>

PROJECTS OF THE CENTRE OF PROGRESSIVE TECHNOLOGIES

Name of project	Human Resources Development in the field of research and development for the UVP-CAMBO
ITMS of project	26110230116
Duration of project	10/2013-06/2015
Operational programme	OPV-2013/1.2./07-SORO
Annotation	<p>In October 2013, 14 researchers and operators were sent to Helmholtz-Zentrum Dresden Rossendorf to attend a 2-year educational programme within the working groups oriented on materials research and projects on the utilisation of ion beams. Their knowledge is being theoretically enhanced by attending specialised lectures and on-site training to use the unique equipment. The intention is that they will continue their scientific work in the Workplace of Materials Research after the construction of Slovakion is accomplished.</p>
Name of project	University Scientific Park „CAMPUS STU MTF“ - CAMBO
ITMS of project	26220220179
Duration of project	03/2013-06/2015
Operational programme	OPVaV - 2012/2.2/08-RO
Annotation	<p>The aim is to build a university research workplace of excellence of international importance in the field of Materials research and ion technologies as well as information science, automation, modelling and chemistry. Specific objectives of the project:</p> <p>Applied research within the research workplaces</p> <ol style="list-style-type: none">1. Research workplace of Materials research. Building a workplace of European importance specialised in advanced ion and plasma technologies.2. Research workplace of automation and ICT implementation in production processes and systems with laboratories. <p>Support for modern technologies transfer into practice in the form of academic know-how, innovations and knowledge transfer into practice, start-ups, and spin-offs.</p>
Name of project	Implementation of an internal quality assurance system in education
ITMS of project	26110230042
Duration of project	01/2012-07/2014
Operational programme	Operational programme of education
Annotation	<p>The aim of the project is to design and verify the system of objective quality assessment, effectiveness and purpose of education in order to achieve sustainable adaptation of universities to the topical and perspective needs of the knowledge society. The project will enable the implementation of the system of direct quality measurement of university education with the aim of providing a space for improving the quality of the university institution output and approximation of the education system to the societal needs.</p>