

PROJECTS OF THE INSTITUTE OF MATERIALS SCIENCE

Project Title **Quantification of radiation damage in composite materials for thermonuclear fusion reactors**

Coordinator doc. Ing. Mária Dománková, PhD.

Start Date 01/01/2013

End Date 31/12/2016

Program VEGA

Annotation One of the most important criteria which have to be met by materials for construction of thermonuclear fusion reactors is resistance against irradiation. Collisions of high-energy particles with the reactor containment causes defects in substructure of the construction materials. To evaluate suitability of the construction materials it is essential to compare substructure of reactor wall before and after simulated radiation damage. Systematic analysis of defects will be performed by combination of macroscopic, microscopic, submicroscopic and spectroscopic methods, which will reveal changes in substructure and chemical composition of materials on the surface as well as inside of samples.

Project Title **Study of relaxation mechanism in composites with special carbon-based fillers**

Coordinator Mgr. Ondrej Bošák, PhD.

Start Date 01/01/2013

End Date 31/12/2015

Program 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 thermo-mechanical degradation. Correlations between the composition of the investigated system and the values of the rheological, electrical, dielectric quantities at non-isothermal heating of rubber mixtures are described. Important characteristics such as the resistance to thermo-mechanical exposure and the reproducibility of the properties defined by the values of the physical properties are discussed, too.

Project Title **Investigation of metallurgical principles of changes in microstructure and properties of Cr-V ledeburitic steel due to sub-zero treatment**

Coordinator prof. Ing. Peter Jurči, PhD.

Start Date 01/01/2014

End Date 31/12/2016

Program VEGA

Annotation The project is focused to the investigation of phenomena taking place in selected chromium-vanadium ledeburitic tool steel when it is sub-zero treated using various regimes of the treatment. The effects of important heat treatment variables such as the austenitizing temperature, tempering regimes and hold at the temperature of sub-zero treatment on the microstructure, the hardness, the three point bending strength, the fracture toughness and the wear resistance will be determined. In the project, variety of investigation techniques are planned to be utilized, which makes it possible to achieve the main goal of the project - to make a serious and comprehensive analysis what happens in the microstructure of selected Cr-V ledeburitic steel when sub-zero treated using various regimes and, what is an impact of microstructural changes on mechanical properties and tribological performance of the material.

Project Title **Corrosion stability of advanced zinc, aluminium and tin alloys**
Coordinator Mgr. Marián Palcút, PhD.
Start Date 01/01/2014
End Date 31/12/2017
Program VEGA
Annotation The goal of this project is to investigate the corrosion stability of phases in Zn, Al and Sn alloys. The studied materials can be used, for example, as light materials for automotive and aviation industries, steel protection coatings or lead-free solders for microelectronics. The alloys shall be prepared by a controlled melting of pure elements. The corrosion resistance will be studied in aqueous electrolytes. Moreover, the alloys stability shall be investigated in simulated off-shore conditions by a salt spray test. Selected samples will undergo a high temperature oxidation testing in corrosive atmospheres. Furthermore, mechanical properties will be investigated and a stress corrosion cracking behaviour shall be characterized. The oxidation products will be studied by a combination of methods, including X-ray diffraction, energy dispersive spectroscopy, transmission electron microscopy and infrared spectroscopy. The aim of the project is to identify corrosion resistant alloys for practical applications.

Project Title **Application of complex thermal analysis and computational thermodynamics at investigation of processes in advanced materials systems**
Coordinator doc. Ing. Roman Čička, PhD.
Start Date 01/01/2014
End Date 31/12/2017
Program VEGA
Annotation The project is focused on application of experimental and computational thermodynamics at the investigation of processes and phase equilibria in selected materials systems as complex metallic alloys, advanced tool steels, austenitic stainless steels, hardenable aluminium alloys and lead-free solders. In experimental part the complex thermal analysis of investigated systems will be performed, together with the measurement of some important thermophysical properties and analysis of structure. In computational part the phase equilibria and processes occurring in the investigated materials during controlled temperature programme will be modeled using Thermo-Calc, JMatPro, Dictra, ANSYS, SYSWELD, DEFORM and MATLAB software. The aim of the project is to improve the prediction of phase equilibria and processes in materials systems, using advanced techniques of computational thermodynamics.

Project Title **Multicomponent special glasses for optoelectronics, non-linear optics and fiber optics**
Coordinator doc. RNDr. Vladimír Labaš, PhD.
Start Date 01/01/2014
End Date 31/12/2016
Program VEGA
Annotation The project is oriented on special glasses and glasses doped by rare-earth elements for applications in optoelectronics, fiber optics and non-linear optics. In case of chalcogenide glasses and heavy metal oxide glasses, we will investigate relations between their composition and preparation technology, glasses structure and their physical properties, which determine the suitability of glasses for practical applications too. The modeling of studied processes, structural or electronic defects, and optical centers will be added. We will develop methods how to use our physical measurements for determination of basic characteristics of glasses (thermal, chemical stability, occurrence of crystalline phases, phase separation, bulk homogeneity etc.).

Project Title **Regularities of formation and thermodynamic stability of structurally complex phases in aluminium - or zinc-base alloys**
Coordinator prof. Ing. Jozef Janovec, DrSc.
Start Date 01/01/2015
End Date 31/12/2018
Program VEGA
Annotation Both experimental and theoretical studies of phase diagrams related to aluminium- or zinc-base alloys containing one or two transition elements and studies of thin films done of these alloys are attributed to the submitted project. The radiofrequency sputtering deposition combined partially with the plasma immersion ion implantation will be used to prepare thin films.

Project Title **Preparation and characterization of the properties of new types of hard coatings for tool materials**
Coordinator prof. Ing. Ľubomír Čaplovič, PhD.
Start Date 01/01/2015
End Date 31/12/2018
Program VEGA
Annotation The submitted project is aimed on development of new type superhard coatings for tool materials with enhanced useful properties. The project is based on gathered knowledge about correlation of structural and stress relations in hard and superhard nitride coatings of transition metals in monolayer or multilayer system on in advanced prepared surface of substrate which is basically tool steel or cemented carbide. By application of two technological processes of creating functional coatings (cathodic arc evaporation and magnetron sputtering), deposition process and its effects of doping of additional interstitial elements (boron, carbon) will be analyzed as well as substitutional elements such as aluminium and silicon in order to achieve a nanocomposite morphology of these coatings.

Project Title **Preparation and characterization TiC nanocomposite coatings by HiPIMS method for automotive applications**
Coordinator prof. Ing. Ján Lokaj, CSc.
Start Date 01/01/2015
End Date 31/12/2017
Program VEGA
Annotation This project focuses on the investigation of plasma parameters and the deposition behaviour of HiPIMS process with pre-ionization. Thus, the aim of this project is to perform diagnostics of the plasma generated by powerful pulses with pre-ionization in order to understand the relationship between the process parameters and local parameters of deposition plasma, which actually govern plasma processes and plasma-surface interaction. The aim of this project is also to prepare and characterize nanocomposite TiC wear-resistant coatings targeted for automotive applications where high load-bearing capacity and thermal stability, low friction, and wear resistance are the primary requirements.

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 thermo-mechanical degradation. Correlations between the composition of the investigated system and the values of the rheological, electrical, dielectric quantities at non-isothermal heating of rubber mixtures are described. Important characteristics such as the resistance to thermo-mechanical exposure and the reproducibility of the properties defined by the values of the physical properties are discussed, too.

Project Title **Implementation of non-destructive methods for the description of the physical characteristics of advanced thin-layered materials**

Coordinator Mgr. Ondrej Bošák, PhD.
Start Date 01/01/2014
End Date 31/12/2016
Program KEGA
Annotation The project is oriented on the improvement of possibilities of the on-destructive diagnostics of materials based on thin layers. Content of the project supports the development of educational and scientific research activities in the field of ion and plasma technology in Faculty of Material Science and Technology in Trnava. The aim of the project is to prepare and implement another experimental methods of materials investigation, which will increase the competence of graduates of all levels in the field of materials and at the same time to extend the current capabilities of the scientific research activities aimed at the study of selected physical parameters by non-destructive methods.

Project Title **Centre of excellence for functionalized multi-phase materials**

Coordinator prof. Ing. Jozef Janovec, DrSc.
Start Date 04/08/2011
End Date 02/08/2015
Program FUN-MAT
Annotation Researchers from four institutes of the Slovak Academy of Sciences (SAS) cooperate with colleagues from the Comenius University in Bratislava and the Slovak University of Technology in Bratislava in the frame of the Centre of Excellence (CEX) FUN-MAT established at SAS for the period of project duration. All the involved partners are aimed at the investigation of advanced materials (e.g. nanomaterials, complex metallic alloys, functional ceramics and polymers), promising to be functionalized in various physical, chemical, biological, and/or industrial processes. The partners are expected to improve their scientific outputs due to the synergy effect resulting from the collaboration in the frame of CEX.

Project title: **Study of crystal structure and thermodynamic properties of aluminium-base and zinc-base complex metallic alloys**

Coordinator: prof. Ing. Jozef Janovec, DrSc.
Start date: 01/07/2012
End date: 31/12/2015
Programme: APVV
Annotation: The project is focused on the study of phases, their equilibria, and transformations due to changes in temperature and chemical composition in aluminium-base and zinc-base complex metallic alloys, as well as on the determination of their crystal structure, This study will be carried out using experimental (X-ray 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 the areas that are less known and poorly studied. 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 expected. Theoretical study of these phases will lead to 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: **Characterization of selected special glasses**
Coordinator: doc. RNDr. Vladimír Labaš, PhD.
Start date: 26/05/2015
End date: 31/12/2015
Programme: APVV
Annotation: The proposed project is oriented to support co-operation between Slovak and French partners in the area of preparation and testing of the chosen physical properties of special glasses suitable to photonic applications. From the scientific point of view the project deals with study reasons of permanent (irreversible) changes in glasses structure. Structure changes usually manifest by the creation of new phases. It can be observed by various techniques. In case of mentioned noncrystalline materials structure changes can be reflected in observable changes of physical properties (optical and electrical). The project will provide the possibility to continue the cooperation at investigation of the special characters of processes in non-crystalline structures by means of several experimental techniques based on IR and UV VIS spectroscopy, dielectric spectroscopy and thermo-kinetic analyses.

Project title: **Special glasses for optoelectronics, non-linear optics and fiber optics**
Coordinator: doc. RNDr. Vladimír Labaš, PhD.
Start date: 18/06/2015
End date: 31/12/2015
Programme: APVV
Annotation: The project is oriented on special glasses and glasses doped by rare-earth elements determined for applications in optoelectronics, fiber optics and non-linear optics. In case of chalcogenide glasses and heavy metal oxide glasses, we will investigate relations between their composition and preparation technology, glasses structure and their physical properties using measurement electrical and dielectric properties and next transport parameters, which determine the suitability of glasses for practical applications too. The modeling of studied processes, structural or electronic defects, and optical centers will be added.

Project title: **Chemical sputtering: Computational modelling of interactions in the carbon-containing films exposed to molecular ions and hydrogen EURATOM CU**
Coordinator: prof. RNDr. Miroslav Urban, DrSc., prof. Ing. Jozef Janovec, DrSc.
Start date: 2010
End date: 2016
Programme: EURATOM
Annotation: 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 model for interactions with hydrogenated carbon films. Calculations of ionization potentials of small hydrocarbons, C_xH_y (C_xH_yD_z) and their ions, their properties and thermodynamic stability.

Project title: **Advanced materials, processing and automation technologies**
Coordinator: doc. Ing. Martin Kusý, PhD.
Start date: 2011
End date: 2018

Programme: NV Bekaert SA
Annotation: The subject of the research will be Research of advanced materials, processing and automation technologies for direct manufacturing and application. The aim of the project is to bridge basic and applied research in the field of advanced materials with application and manufacturing leading to competitiveness and sustainable growth of both partners. A valuable and unique aspect of the research project is broad involvement of students of master and doctoral degree in up-to-date research activities.

Project title: Investigation of fine structures in metallic materials using TEM
Coordinator: prof. Ing. Jozef Janovec, DrSc.
Start date: 2008
End date: 2015
Programme: IFW MTF STU
Annotation: With the intention to improve the investigation of fine metallic structures at the Faculty of Materials Science and Technology of STU, the IFW provided financial resources for purchase ancillary units for TEM (Delta Abrasiment).

PROJECTS OF THE INSTITUTE OF PRODUCTION TECHNOLOGIES

Project Title Research of modified solders for fluxless soldering of metallic and ceramic materials
Coordinator prof. Ing. Roman Koleňák, PhD.
Start Date 01/01/2014
End Date 31/12/2016
Program VEGA
Annotation Project is aimed at research of modified soldering alloys. This concerns mainly the research of soldering alloys type Sn-Ag-Ti, Sn-Ag-Cu and Zn-Ag-Al. New soldering alloys, alloyed with a small amount of active elements (In, Ga, Y and several components from the group of lanthanides) will be prepared for experiments. The solders will be designed with the aim to apply in fluxless soldering by use of laser and power ultrasound technologies. The tests of technological solderability of ceramic and metallic materials will be performed with use of modified soldering alloys. The character of solder structure and quality of soldered joints will be studied at different soldering conditions. Also interactions on the boundary of soldered material and solder will be investigated.

Project Title Utilization of modern optical 3D scanning methods for weldment deformation analysis
Coordinator prof. Ing. Milan Marônek, CSc.
Start Date 01/01/2014
End Date 31/12/2016
Program VEGA
Annotation Today's methods of weldment deformation measurement utilize, particularly from economical reasons, simple measurements instruments for distance and angle measuring, whereas they are provided by a human operator. If the weldment construction is complicated and requires a large number of measurements, the whole process is also time consuming. It is obvious, the results are also influenced by a human factor. The modern 3D scanning methods being applied apart from architecture, civil and reverse engineering, are more and more often used in the field of production technologies, e. g. in an automotive industry. The goal of the submitted project is to evaluate the applicability of 3D scanning methods in measurement of deformations originated from welding. The influence of scanning method and scanning parameters

on final measurement accuracy, scanning methods suitability with regard to weldment size, used welding technology and its process parameters will be investigated in the project research.

Project Title **Research of influence of selected characteristics of machining process on achieved quality of machined surface and problem free assembly using high Technologies.**

Coordinator doc. Ing. Peter Pokorný, PhD.
Start Date 01/01/2014
End Date 31/12/2017
Program VEGA
Annotation The project is focused on research of selected characteristics of machining process (cutting forces, thin walled parts machining, tool wear and tool renewing, cutting fluids and machining strategies). Characteristics of machining process affect the quality of achieved surface. The project uses high Technologies, which are situated in centre of excellence of 5 axis machining (high speed milling machine tools, ultrasonic milling tool, laser milling tool, tool grinder). On the geometric and dimensional accuracy depends the condition of assembly or more precise, the result of assembly process. Therefore the methodology will be designed in order to adjust machining technology with demands of geometric specification of parts.

Project Title **Research of defect diagnostic of welded joint by using of modern NDT methods**

Coordinator prof. Ing. Koloman Ulrich, PhD.
Start Date 01/01/2014
End Date 31/12/2016
Program VEGA
Annotation The project aim is the research of defect diagnostic of welded joints using modern ultrasonic methods TOFD and Phased Array (PA) compared with radiation methods and impact of defects detected on the lifetime of welded structures. Samples of welded joints shall be prepared with artificially created defects, to be used to verify the sensitivity of UT techniques and results of detected defects will be compared with classical and modern radiation methods. Methods TOFD and PA will be further applied to measurements in industrial practice for testing of welded joints of concrete.

Project Title **Establishing the patterns of the structure and properties formation in high-speed steels during melting and casting in vacuum**

Coordinator prof. Ing. Alexander Čaus, DrSc.
Start Date 01/01/2015
End Date 31/12/2018
Program VEGA
Annotation With proper choice of an appropriate nomenclature the durability of cast cutting tools (CCT) can be better than that of conventional tools. However, for successful application of CCT it is necessary to provide adequate impact toughness of cast high speed steel (HSS). From this point of view casting into metal moulds is more attractive because due to high rate of solidification this technology provides enhanced alloy density, fine-grained cast structure, consequently enhanced mechanical properties, primarily impact toughness. Disadvantage is the low life of moulds when casting HSS.

Project Title **Research of laser surface texturing and its application in the sheet metal forming processes tribological conditions optimization**

Coordinator prof. Ing. Peter Šugár, PhD.
Start Date 01/01/2015

End Date 31/12/2018
Program VEGA
Annotation The project is aimed at the research of the laser texturing of metal spinning tools. Two fields of interest are solved in this project. The goal is optimization of rolling friction conditions in the contact area spinning tool -- formed part with minimal quantity of lubricants and creation of assumptions for improvement of the spun part surface quality while reducing the intensity of tool wear and unwanted adhesion sticks formation.

Project Title **Development of a virtual laboratory for Robotics and Manipulation techniques**
Coordinator prof.h.c. prof. Ing. Karol Velíšek, CSc.
Start Date 01/01/2014
End Date 31/12/2016
Program KEGA
Annotation The main aim of the project is the establishment of laboratory with the group of training modules from the area of automation and industrial robotics, which will serve the several purposes. Namely training of automatic control of handling equipment and programming of industrial robots, which are nowadays increasingly implemented into manufacturing practice. This laboratory will enable to develop students' knowledge and practical skills in the area of automated and robotic systems applying the inovative educational program and methodology which use modern IT technologies, e-learning including. The aim is also an elaboration of study materials with widely applicable exercises, that can make the laboratory study more effective and can serve the further knowledge and skills.

Project Title **Blended Learning principles implementation into teaching of programming of CNC machine tools with advanced kinematic structure**
Coordinator prof. Ing. Peter Šugár, CSc.
Start Date 01/01/2014
End Date 31/12/2016
Program KEGA
Annotation The project is focused into unification of teaching methods of programing CNC machine tools and machinery with different structures and technological purposes, with emphasis on machine tools and machinery with advanced kinematic structure, using Blended Learning principles. Students of all levels of university education, postgraduate education and also partially students of secondary technical schools are the education recipients.

Project Title **Research of electron beam complex generation designed to vacuum welding of aluminum and magnesium alloys**
Coordinator prof. Ing. Koloman Ulrich, PhD.
Start Date 01/07/2015
End Date 30/06/2018
Program STIMULY Req-00048-0005
Annotation The strategic objective of the industrial (applied) research and experimental development project is an overall increase of technical parameters the critical modules of electron beam welding technology complexes comparable to world level.

Project Title **Education in practice: Virtual Commissioning as a technological tool of the future for virtual commissioning of production systems in the automotive industry within the concept of "Digital Factory"**
Coordinator Ing. Roman Ružarovský, PhD.

Start Date 01/11/2014
End Date 31/07/2015
Program Nadácia Volkswagen Slovakia
Annotation The project is focused on primary education for young teachers and students IPSM FMS STU in order to enhance the educational, technical and practical level with impact on the design and virtual commissioning of robotic, production and assembly systems in the automotive industry.

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: Project is focused on basic research of conditions and procedures of creating the weld joints by laser and electron beam on selected types of duplex stainless steels with ferritic-austenitic structure. Concentrated energy sources, due to their flexibility allow immediate application of preheating before the welding process and post-heating after the welding process using a defocused or rasterized beam, what provides a 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 in particular stages of the project. All processes of technological network participate on final properties of the product. That is why the experimental research program will also cover analysis of weld joints created from materials influenced by different type and level of deformation as well as the sheet forming of weld joints. Special focus will be devoted to finding the correlation between the crucial technological parameters of the process and properties of performed weld joint. The project has the ambition to push the knowledge boundaries of the welding process of selected duplex stainless steels by the concentrated energy sources, such as laser and electron beam.

Project title: **Research of new soldering alloys for fluxless soldering with application of beam technologies and ultrasound**
Coordinator: prof. Ing. Roman Koleňák, PhD.
Start date: 01/10/2013
End date: 31/05/2017
Programme: APVV
Annotation: The project is oriented toward the research of environmentally friendly solder alloys and conditions of soldering with progressive technologies. The designed and experimentally manufactured solders will be used for soldering of metallic and ceramic materials at higher application temperatures. For assuring the wettability of ceramic and hard-to-solder materials, the solders will be alloyed with active elements and the metals from the group of lanthanides. The tests of technological solderability of ceramic and metallic materials will be performed by use of new soldering alloys at flux-free soldering, with application of laser technologies, power ultrasound and electron beam. The structural characteristics of solders and soldered joints will be studied at different soldering conditions.

Project title: **Innovative methods of sheet metal forming tools surfaces improvement - R&D**
Coordinator: prof. Ing. Peter Šugár, PhD.
Start date: 2015
End date: 2017
Programme: FormTool MANUNET-2014-11283
Annotation: The project is focused on development and verifying a new advanced technology of sheet-metal forming tools surfaces improvement in order to obtain better performances, lower costs and lower environmental impacts of sheet-metal parts

production processes. The attention is paid to issue of stamping and metal spinning tools and its application in metal forming processes of different challenging materials, such as Al-alloy, Mg-alloy, Ni-alloy, duplex and super-duplex stainless steels. It aims to demonstrate the technical, economical and environmental feasibility of advanced forming tool surfaces treatment by laser micro-structuring (texturing) and hydrostatic ball-burnishing applied to improve the stability of forming processes.

PROJECTS OF THE INSTITUTE OF INDUSTRIAL ENGINEERING AND MANAGEMENT

Project Title	Transformation of ergonomics program into the company management structure through integration and utilization QMS, EMS, HSMS
Coordinator	prof. Ing. Jozef Sablik, CSc.
Start Date	01/01/2013
End Date	31/12/2015
Program	VEGA
Annotation	The present project is aimed to confirm the need, definition of the possibilities and proposal of the process using an integrated QMS/EMS/HSMS to transformation the content of ergonomic program into structure activities of management of the company. Application of the outputs project envisages the creation of conditions for that improvement course of the work process, which guarantee for the long term a high level of work performance with minimal risk to safety and health of employees in accordance with the philosophy of sustainable development.
Project Title	The research of Games Learning applications impact into the educational process effectiveness in newly accredited stud course: Fundamentals of Industrial Engineering
Coordinator	Ing. Vanessa Prajová, PhD.
Start Date	08/07/2015
End Date	30/04/2016
Program	Nadácia Volkswagen Slovakia
Annotation	Project is focoused on the application of new, creative methods an forms of university level education within the selected study course: Fundamentals of Industrial Engineering and multiduplicative transfer of this knowledge to following study courses.
Project title:	Social Innovation for Youth Social Entrepreneurship (INNOVAT)
Coordinator:	doc. Mgr. Dagmar Cagáňová, PhD.
Start date:	2015
End date:	2017
Programme:	ERASMUS+
Annotation:	InnovaT wants to strengthen the capabilities of 7 social organisations that work in the field of youth: 4 from Europe (Spain, Portugal, Greece and Romania) and three from Latinamerica (Nicaragua, Colombia and El Salvador) in order to improve their work in the YOUTH PARTICIPATION SECTOR and specifically working in 3 KNOWLEDGE AREAS: Methodologies for social innovation ICTs tools Social entrepreneurship and communitarian development This project wants to contribute in the implementation of "Europe 2020" strategy, working specifically in the fights against poverty and social exclusion of youth.
Project title:	Festival of Science as a platform for intensifying cooperation between V4 region universities
Coordinator:	doc. Mgr. Dagmar Cagáňová, PhD.
Start date:	2013
End date:	2015
Programme:	V4, Grant No. 21310155
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.

PROJECTS OF THE INSTITUTE OF INTEGRATED SAFETY

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	01/01/2014
End Date	31/12/2017
Program	VEGA
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>
Project Title	The readiness of industrial enterprises to implement the requirements of standards for quality management systems ISO 9001:2015 and environmental management systems ISO 14001:2014
Coordinator	doc. RNDr. Miroslav Rusko, PhD.
Start Date	01/01/2015
End Date	31/12/2017
Program	VEGA
Annotation	<p>The project is focused on the research and analysis of current approaches to quality management system and environment with respect to readiness to implement the changes induced by formation of SL Annexes to Regulation ISO / EIC "Consolidated Supplement - Procedures specific to ISO", and in particular the requirements into a single structure standards for management systems. Based on the analysis methodology will be created for successful transformation of new approaches to quality management and environmental management as defined in forthcoming revisions of the standards. Besides, the methodology for effective implementation of defined standards requirements will be developed.</p>
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
Program	KEGA
Annotation	<p>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 nad</p>

miscarriages of justice. A key tool for determination, respectively. verification of the fire cause is its reconstruction in the laboratory scale. Reconstruction of fire in a laboratory scale is divided into reconstruction of initiation and reconstruction of progress(development) of fire. Reconstruction of initiation gives an answer to the question whether a specific ignition sources could be the cause of the fire. Reconstruction of fire development provides valuable data about the behaviour of materials and products in the fire section under conditions similar to fire. To basic assumption 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 specialized facility for the reconstruction of fire in a laboratory scale, and no training centre to prepare specialists for the execution of the tests in the Slovak Republic.

Project Title **E-learning as a Handbook of Health and Safety in Welding**
Coordinator Ing. Zuzana Szabová, PhD.
Start Date 01/01/2013
End Date 31/12/2015
Program KEGA
Annotation The project aims to create a comprehensive handbook on safety and health (OSH) and fire protection in the classic, special, modified and hybrid technologies, welding, brazing and thermal cutting of materials. Guide to health and safety in welding will be available on the Internet for students of all forms of study within the e-learning and for the 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 to bring a new perspective for solving practical problems of safety and health in welding.

Project Title **An innovative approach to legislative coordination of environmental protection through the visualization on the basis of the phenomenon Small World Networks**
Coordinator doc. Ing. Alena Pauliková, PhD.
Start Date 01/01/2015
End Date 31/12/2017
Program KEGA
Annotation The purpose of this project is to develop a comprehensive review and subsequent coordination of environmental legislation as part of a system of ambient protection. Selected set of laws which form part of the environmental legislation will include laws, regulations, decrees, international treaties and agreements and other relevant provisions of the national character. Coordination will be done using hierarchical organizational charts and finally visualized using Small World Networks

Project title: **Progressive methods of material fire-technical 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 in accordance with world trends by utilisation of the progressive methods for determination of important fire-technical characteristics for calculation and modelling of compartment fires. The characterisation and verification of the laboratory testing methods with modern equipment utilisation for obtaining of the unique material characteristics and their alterations due heat and fire. The behaviour prediction of solid and liquid materials in

the process of initiation and propagation of combustion on the ground of the determined characteristics. The application of new methods for determination of critical boundary conditions of testing of representative materials in the progressive material structures for the improving of outputs from used fire scenarios.

PROJECTS OF THE INSTITUTE OF APPLIED INFORMATICS, AUTOMATION AND MECHATRONICS

Project Title Knowledge discovery for hierarchical control of technological and production processes

Coordinator prof. Ing. Pavol Tanuška, PhD.

Start Date 01/01/2015

End Date 31/12/2017

Program VEGA

Annotation The project is aimed at the area of knowledge discovery on databases and the application of such knowledge in hierarchical process control. It will include conceptual design of a knowledge discovery process in hierarchical control systems. The formulation of the proposal design will constitute comprehensive approach to solving problems related to processing of extreme amount of data for the purposes of complex system control. Selected methods of data mining , e.g., based on statistical and inductive learning techniques and chosen on the basis of defined criteria, will be compared in terms of several measurable criteria.

Project Title Research and development of a new autonomous system for checking a trajectory of a robot

Coordinator doc. Ing. Pavol Božek, CSc.

Start Date 01/01/2015

End Date 31/12/2017

Program VEGA

Annotation The research project deals with implementation of hybrid sensors - an Inertial Navigation System which will be utilized for the calibration of a robotic workplace. The calibration is necessary for adapting the simulation of a production device model to real geometric conditions. Constructing the model of the production device, as well as creating the corresponding programmes of robots by means of a simulation system represents an exact picture of reality. The deflections of reality from the simulation arise from different reasons (position of work piece, geometric accuracy of a tool, etc.). The proposed INS will be utilized for their calibration without using the calibration agents. It will lead towards great simplification of calibration in practice.

Project Title University textbook "The means of automated production" by interactive multimedia format for STU Bratislava and Kosice

Coordinator doc. Ing. Pavol Božek, PhD.

Start Date 01/01/2015

End Date 31/12/2017

Program KEGA

Annotation The submitted project proposal is oriented on creating and integration of the content and design of multimedia applications to support the teaching of the newly accredited subject Means of automated production via written and interactive multimedia form to continuously complement and improve the level of technical subjects related to automation and their control systems at universities. The support of a better, stronger, more efficient perception of information from the textbooks in the subject "Means of automated production" (texts, images, graphics, speech, animations, video sequences) is enabled by multimedia and are presented in several formats.

Project Title	Development of Autonomous Measuring and Archiving System (AMAS) for measuring manufacturing and assembly line productivity
Coordinator	prof. Ing. Pavol Tanuška, PhD.
Start Date	15/10/2014
End Date	15/02/2015
Program	AMAS (Projekt Slovenskej inováčnej a energetickej agentúry pri MH SR)
Annotation	The project is to be solved for the Slovak Innovation and Energy Agency of the Ministry of Economy of the Slovak Republic in cooperation with the company Innov8, s.r.o. The objectives of the project are development and programming activities with the purpose of creating an autonomous hardware-software solution providing general-purpose applicability in manufacturing, assembly and packaging lines. In the first phase, components of AMAS, mutual hardware component communication and the resulting solution architecture are to be proposed. In the second phase, the form of visualizing the obtained data and evaluation statistics are to be outlined. In the third phase, archiving application including the conversion algorithms is to be implemented and the individual hardware components are to be integrated with the archiving application. The benefits of the proposed solution stem mainly from the innovative approach of the technical design and from the flexibility of the deployment possibilities. AMAS will be utilised for collecting input data from the real environment. The obtained data is to be further used in virtual simulation of the material, packaging and product flow on a line. AMAS concept will contribute to increasing employment of the Innov8, s.r.o. company.

Project Title	Development of software solution for innovative measuring system - EMAS
Coordinator	prof. Ing. Pavol Tanuška, PhD.
Start Date	01/06/2015
End Date	31/10/2015
Program	EMAS (Projekt Slovenskej inováčnej a energetickej agentúry pri MH SR)
Annotation	The project is to be solved for the Slovak Innovation and Energy Agency of the Ministry of Economy of the Slovak Republic in cooperation with the company Innov8, s.r.o. The aim of the project is to propose concept for automated collecting, processing and visualising the ergonomics and endurance attributes. This data will serve to creating a catalogue of endurance statistics for manufacturing and assembly operations. The objectives of the project are development and programming activities with the purpose of creating a hardware-software solution providing general-purpose applicability on measuring ergonomic palm and fingers endurance in production, assembly and logistics processes carried out manually. In the first phase, components of the mutual hardware component communication and the resulting solution architecture are to be defined. In the second phase, the form of visualizing the obtained data and evaluation statistics are to be outlined. In the third phase, evaluation application including the conversion algorithms is to be programmed. In the fourth phase, the individual hardware components are to be integrated with the evaluation application.

PROJECTS OF THE ADVANCED TECHNOLOGIES RESEARCH INSTITUTE

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
Program	VEGA
Annotation	Within the context of using of new flexible materials and derated mechanism constructions in the mechatronics systems in the present is dedicated large focus to

elimination of spurious frequencies in drives and motional mechanisms in research. Because of extensity of this issue this project dealt with elected type of mechatronics system only. The basic aim of adaptive control in this type of system is ineligious influences elimination. Proponed project is focused on: - Physical and mathematical analysis of parameters that influencing control; - Design and verification of chosen advanced control methods; - Investigation of sensitivity and robustness of solution. The basic objective of the project is design of appropriate manner of flexible mechatronics system adaptive control.

Project Title **Study of turbulent accretion process in accreting binary systems through flickering activity**

Coordinator Mgr. Andrej Dobrotka, PhD.

Start Date 01/01/2013

End Date 31/12/2015

Program VEGA

Annotation The main purpose of the project is the study of the turbulent flow in 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 smaller minimal dimension scale. From Reabout 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 goes toward a value of about 10^8 . What is happening then? The typical Re in an accretion disk of cataclysmic variables is of about 10^{12} and one of the possibility to explain flickering are turbulence in the disc.

Project Title **Structure, properties and processes at surfaces and interfaces of materials: computational modeling**

Coordinator RNDr. Andrej Antušek, PhD.

Start Date 01/01/2013

End Date 31/12/2015

Program VEGA

Annotation Joining is an important technological process. Frequently, there is defined an upper limit for the joining temperature due to, e.g. undesirable phase transition in the joined materials and the technological need for decreasing of the joining temperature arises. This goal can be achieved by the melting point depression -- its reduction in nanostructured material in comparison to the bulk material. Nano-multilayer foils of brazing filler alloy and diffusion barrier layer (DBL) was shown to be working concept in joining. In the proposed project we address by atomic scale modeling methods structural and thermodynamical properties of the nano-multilayer systems potentially applicable in joining technology. We will apply DFT methods to model structure of the brazing alloy and DBL material interfaces and fit effective potentials for subsequent classical molecular dynamics modeling of large scale structure of interfaces and simulation of melting point depression. Benchmark interaction energies will also be provided.

Project Title **Design of Al-TM alloys for on-board hydrogen production**

Coordinator RNDr. Martin Šulka, PhD.

Start Date 01/01/2015

End Date 31/12/2018

Program VEGA

Annotation The project is aimed on design of Al-TM metal aluminum alloys for on-board hydrogen production by hydrolysis, TM being Co, Ni, Pd, Rh. The goal of the theoretical part is to study the impact of chemical composition on electrochemical stability of aluminum alloys. By periodic DFT we will investigate the influence of chemical composition on electrode potential shift in alloys relative to pure aluminum. We will also examine the segregation of the given element, composition influence on adsorption energies of water and trends in electrochemical stability of alloy surface after the adsorption of water. Within the experimental part we will investigate the correlation between the chemical composition and microstructure of alloys, the influence of preparation conditions and cooling speed on phase composition. Further, we will study the corrosion activity of alloys with emphasis on rapid hydrogen production. Influence of electrolyte type will be evaluated and mechanisms of corrosion will be described.

Project title: **Slovak Centre of Excellence in Ion Beam and Plasma Technologies for Materials Engineering and Nanotechnology - SlovakiON**

Coordinator: doc. Ing. Maximilián Strémy, PhD.

Start date: 2015

End date: 2016

Programme: H2020

Annotation: The Center of Excellence SlovakiON aims to become Eastern Europe's leading research centre for ion beam and plasma technologies in materials engineering and nanotechnology. Based on cutting-edge research and closely integrated in an international network of research facilities. SlovakiON's holistic approach to innovation transfer and its close interaction with the regional industry will contribute to the economic development of Slovakia. The main focus lies with the automotive and electronics industry as pointed out in Slovakia's Research and Innovation Strategy for Smart Specialisation.

PROJECTS OF THE DEPARTMENT OF LANGUAGES AND HUMANITIES

Project Title **The implementation of critical thinking standards within invation of the subject Introduction to Scientific Work at STU**

Coordinator Mgr. Mária Bednáriková, PhD.

Start Date 01/01/2013

End Date 31/12/2015

Program KEGA

Annotation The project is aimed at the innovation of the subject Introduction to the scientific work with emphasis on creating the methodology for s systematic approach to developing critical thinking and scientific skills within the frame of the second stage of the university studies including preparation of selected university teachers focusing on the development of critical thinking skills in relation to education and learning. The part of the project includes the design of technical univestiy students as well as the cration of framework for their evaluation in accord with the European qualification framework and The National qualification framework.

Project title: **Student online conferences of STU MTF (Slovakia) and University of Niš, Faculty of Electronic Engineering (Serbia) for the purposes of specific English language and other skills development**

Coordinator: Mgr. Gabriela Chmelíková, PhD.

Start date: 01/01/2015

End date: 31/12/2016

Programme: APVV

Annotation: English has become a language of the international scientific communication, making its use a prerequisite for process in any field of science and technology. Since opportunities for young scientists or experts in the Slovak and Serbian universities to

participate in prestigious conferences are quite limited by funding, on-line conferences offer an ideal platform for the exchange of professional information using technical English. The project will investigate similarities and differences in existing related study programmes, assess their mutual compatibility and compatibility with the EU standards via the on-line conferences it will determine common interests and possible goals of the groups of prospective project partners (IT teachers, young researchers).

Project title: **Transnational exchange of good CLIL practice among European Educational Institutions**

Coordinator: Mgr. Ludmila Hurajová, PhD.

Start date: 2015

End date: 2017

Programme: ERASMUS+

Annotation: The document Education and Training in Europe 2020 describes diverse policy initiatives targeting young people under the age of 34 and highlights that "Foreign languages skills can enhance the employability of young people". This initiative totally fits the target groups of our project which are primary and secondary students. The proposed project is built on international collaboration which will result in increase flow of knowledge and good CLIL practice among education institutions, represented by Spanish and Latvian partners, research organizations, represented by both Slovak partners and finally representatives of schools in Lithuania and Sweden. Lithuanian and Swedish partners will aim at learning ways to implement good practices of CLIL in the classroom, while Spanish and Latvian partners will contribute by sharing a good CLIL practice. Slovak partners will focus on research part of the project.