Questionnaire

Summary of the main activities of a scientific Organisation of the Slovak Academy of Sciences

Period: January 1, 2007 - December 31, 2011

I. Formal information on the assessed Organisation:

1. **Legal name and address**
   Institute of Materials & Machine Mechanics, Slovak Academy of Sciences,
   Račianska 75, 831 02 BRATISLAVA 3

2. **Executive body of the Organisation and its composition**

Directoriat	name	age	years in the position
director	Dr. Ing. František Simančík	49	8
deputy director / head of 2nd division	Ing. Karol Iždinský, PhD.	52	6/11
head of 1st division	Dr. Ing. Juraj Koráb	49	8
head of 3rd division	Ing. Juraj Lapin, DrSc.	51	11
head of economic department	Ing. Mária Lazarová	39	10
scientific secretary	Dr. Ing. Jaroslav Jerz	46	10

3. **Head of the Scientific Board**
   Ing. Juraj Lapin, DrSc.

4. Basic information about the research personnel

i. Number of employees with a university degree (PhD students excluded) engaged in research and development and their full time equivalent work capacity (FTE) in 2007, 2008, 2009, 2010, 2011 and average number during the assessment period

ii. Organisation units/departments and their FTE employees with the university degree engaged in research and development

Research staff	2007		2008		2009		2010		2011		average	
	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE	No.	FTE
organisation in whole	40	34,69	38	32,54	43	34,65	41	32,17	44	34,00	41	33,61
Division 1 - New Materials & Technologies	11	9,80	10	8,20	12	9,27	14	11,05	18	14,13	13,00	10,49
Division 2 - Microstructure of Surfaces & Interfaces	14	12,30	14	12,30	16	13,62	15	12,25	13	10,56	14,40	12,21
Division 3 - Properties of Materials & Structures	15	12,59	14	12,04	15	11,76	12	8,87	13	9,31	13,80	10,91

5. Basic information on the funding

i. Total salary budget[1] of the Organisation allocated from the institutional resources of the Slovak Academy of Sciences (SAS) in 2007, 2008, 2009, 2010, 2011 and average amount for the assessment period

Salary budget	2007	2008	2009	2010	2011	average
total salary budget (milions of EUR)	0,636	0,683	0,715	0,697	0,699	0,686

6. URL of the Organisation's web site

http://www.umms.sav.sk

[1] Objem mzdových prostriedkov bez odvodov do poisťovní so započítaním sumy miezd pracovníkov THS, ktorú organizácii poskytne ETO Úradu SAV. Rozpočet v Sk prepočítajte na eurá podľa konverzného kurzu 1€ = 30,126. (Podobne aj v ďalších tabuľkách.)

II. General information on the research and development activity of the Organisation:

1. Mission Statement of the Organisation as presented in its Foundation Charter

The main objective of Institute of Materials and Machine Mechanics SAS (IMSAS) is to perform basic and applied research in the field of materials science and mechanical engineering:

Materials science is devoted to the development of advanced metallic materials, in particular metal matrix composites, metallic foams, nanostructured materials and intermetallic alloys, which are prepared by means of modern technologies, such as gas pressure infiltration, plasma spraying, directional solidification, vacuum diffusion bonding, powder metallurgy, etc. The development of complex metallic materials is accompanied with their structural characterisation and evaluation of their physical and mechanical properties.

Mechanical engineering is mainly devoted to applied mechanics of solid structures incl. the research on deformation of elasto-plastic continuum, the development of theoretical knowledge concerning noise and vibration insulation, acoustic elasticity, dynamical analysis of machine aggregates, non-destructive testing and in-service fatigue life of structures.

IMSAS also provides consultacy, expertise and other services concerning with the main objectives of the organisation; performs scientific education (PhD study) within generally valid legal regulations; publishes the research and scientific results in scientific journals or other non-periodical publications and issues own scientific journals according to regulations of Presidium of SAS.

In order to strengthen the transfer of research results into the praxis IMSAS built in a small bussines unit for:

- ✓ manufacturing and sale of prototypes and components made from new materials in range of small batch production,
- ✓ manufacturing and sale of technological equipment for production of new materials,
- ✓ manufacturing and sale of equipment for testing of new materials.

IMSAS business activities are carried out on strictly non profit basis within the frame of Presidium of SAS decision No. 638 from 1st February 2007 issued according to regulation concerning bussines activities of state organisations and Trade licence issued by Obvodný úrad Bratislava on 3rd September 2007 under No. OŽP-A/2007/37557-2/CR1, No. of trade register 110-171425.

2. Summary of R&D activity pursued by the Organisation during the assessed period, from both national and international aspects and its incorporation in the European Research Area (max. 10 pages)

In accordance with the Foundation Charter, IMSAS R&D activities during the assessed period were mainly devoted to:

- ✓ the design and development of advanced metallic materials, in particular metal matrix composites, metallic foams, intermetallics, bulk nanostructured materials and ultrahard coatings
- ✓ the development of unique technologies for manufacturing of these materials, including gas pressure infiltration, foaming of aluminium, vacuum metallurgy, plasma melting, directional solidification, physical vapour deposition and various advanced powder metallurgy techniques such as hot and cold isostatic pressing (CIP, HIP), equal channel angular pressing (ECAP) and extrusion or forging of powder mixtures, etc.
- ✓ the development of advanced techniques for rapid manufacturing of prototypes from the developed materials
- ✓ advanced characterisation of developed materials comprising systematic microstructural analysis (incl. X-Ray microtomography) and testing of mechanical and physical properties (incl. development of methods for non destructive testing (NDT))
- ✓ the development of the theoretical base for reliable estimation of fatigue endurance limits of materials and structures working under stochastic loading, for simulation and modelling of their structural and mechanical properties and for evaluation of their behaviour at high temperatures
- ✓ the vibroisolation and attenuation of vibration influence on human body

The selection of topics for systematic research was strongly affected by institute's research tradition, competence of leading researchers and availability of technological devices and equipment for characterisation and testing. The absence of modern characterisation equipment caused by insufficient investment resources in the past was mostly balanced with the extraordinary technological ability of IMSAS to prepare unique high-tech materials, which enabled to keep its competitiveness at European level. The lacking equipment necessary for reliable investigation was involved into the research through large international cooperation with better equipped institutions that on the other hand appreciated the possibility to test unique advanced materials.

Therefore most research activities were performed rather on international than national level. They were often initiated and driven by the interest of many industrial partners.

The most important results of IMSAS research activities in assessed period were achieved in following fields:

- ✓ A. Lightweight structural materials
- ✓ B. Materials for thermal management
- ✓ C. Structural materials for high temperature applications
- ✓ D. Fatigue of materials and structures
- ✓ E. Vibroisolation and attenuation of vibration influence on human body
- ✓ F. Advanced characterisation of microstructure of materials and non destructive testing

A. Lightweight structural materials

The research activities in this field were mainly devoted to the design, development and optimisation of:

- ✓ complex aluminium alloys with extraordinary mechanical properties prepared via consolidation of rapidly solidified highly alloyed Al powders and melt-spun ribbons (project Hightemal - 6th FW EU, MNT ERANET, project APVV)
- ✓ aluminium matrix composites reinforced with ceramic particles with increased ratio of elastic modulus to density, controlled thermal expansion and improved wear resistance (project APVV, ERDF and bilateral cooperation with SAPA Profily a.s. Žiar nad Hronom)
- ✓ ultra-fine grained Al+Al_2O_3 composites in situ formed during PM consolidation of fine atomised commercial purity (CP) Al powders with enhanced structural stability and properties at elevated temperatures (project Hightemal - 6th FW EU, MNT ERANET, and bilateral cooperation with NMD GmbH Austria)
- ✓ Al+AlN composites containing nanoscale AlN crystallites prepared via partial in situ nitridation of Al powder green compacts in gaseous nitrogen followed with full densification (collaboration with University of Queensland, Australia)
- ✓ Al+TiC composites prepared using pellets manufactured via self propagating synthesis of Al+Ti+C powdered mixture which were diluted in aluminium melt cast and extruded into structural lightweight profiles with enhanced E modulus (bilateral cooperation with NMD GmbH Austria)
- ✓ novel powder compaction techniques, in particular those based on severe plastic deformation such as equal channel angular pressing (ECAP) (project Hightemal - 6th FW EU, MNT ERANET)
- ✓ novel techniques for foaming of aluminium at significantly reduced processing costs (project APVV Lowcostfoam)
- ✓ components made from aluminium foams in particular various crash boxes for the protection from sudden impact (bilateral cooperation with Gleich GmbH Kaltenkirchen, Germany)

The investigated materials were mostly prepared using advanced techniques of powder metallurgy (PM). Aluminium powders or rapidly solidified flakes made from highly alloyed aluminium alloys were used as starting material. Most of the research activities were initiated and driven by industrial interest (SAPA Profily a.s. Žiar nad Hronom, SHW GmbH Wasseralfingen, Alulight GmbH Ranshofen, Gleich GmbH Kaltenkirchen, NMD GmbH St.Pantaleon, etc.). Reflecting the background of the related industrial partners, the powder compaction was realized predominantly using hot working approaches. The developed materials underwent systematic characterisation of their structure and properties. The optimised materials were used for manufacturing of various structural components at laboratory and also industrial scale, where related problems attributed to upscaling process (e.g. heat generation due to exothermic reaction during stabilisation of surface powder oxides) needed to be solved.

The most significant results achieved in assessed period include:

- ✓ The development of new type of heat resistant thermally stabile ultrafine grained Al-Al_2O_3 “composite” with exceptional high temperature mechanical properties, thermal stability and creep performance. The composite is produced via cost effective hot working PM processes from atomised ultrafine Al powders. Material properties stemmed from the extraordinary grain boundary strengthening effect in the ultrafine-grained microstructure of the compacts. The efficiency of grain boundary strengthening is significantly enhanced by the presence of nano-metric Al_2O_3 dispersoids introduced in situ. The decisive effect of powder compaction technique to the final microstructures, the properties and the thermal stability has been described and explained. The developed materials exhibit long term structural stability and extraordinary mechanical properties at elevated temperatures up to 450°C, which qualified them for the use in lightweight highly thermally loaded structural components. Their performance has been successfully tested in novel engine pistons in F1 racing cars and in the use of protection boxes for the safe storage of exhausted nuclear fuel. The gained knowledge was internationally patented and the results were published as international success stories 2011 of MNT ERANET

(project Hightemal - 6th FW EU, MNT ERANET, and bilateral cooperation with NMD GmbH Austria)

- ✓ The development of unique AlCr4.7Fe1.1Si0.3 (at.%) alloy produced by direct extrusion of rapidly solidified particles. This material shows exceptionally high mechanical properties at elevated temperatures (above 300°C), high specific modulus, decreased coefficient of thermal expansion and exhibits excellent long-term microstructural thermal stability over a broad temperature range. The material was successfully fabricated at large industrial scale without detrimental effect of the scaled-up consolidation to expected properties and costs. (project Hightemal - 6th FW EU, MNT ERANET)
- ✓ The industrial technology for extrusion of aluminium powders has been developed and established in SAPA Profily Žiar nad Hronom. This technology enables extrusion of hardly-formable aluminium alloys incl. composite mixtures into complex profiles with extraordinary properties, in particular enhanced structural stability at elevated temperatures, increased wear resistance, elastic modulus and dimensional stability. These properties allow replacement of many steel components with lightweight aluminium parts. New technology line was built including new continuous 4-zone furnace for controlled heating of powdered billets prior to extrusion, cutting and thermal treatment stations and quality control unit. Optimised thermal treatment led to reduction of residual stresses and improvement of structural and dimensional stability of the parts, especially at elevated temperatures. The developed - high added value - technology is unique in Europe from the point of view of complexity as well as production volume of produced components. The technology has been successfully used for mass production (ca 900 thousands per year) of stator rings for camshaft phaser for automotive BMW engine. This application represented (to our knowledge) the worldwide largest production of structural components made of aluminium powders.
- ✓ The new low cost technology for manufacturing of complex shape components from aluminium foam has been developed. Costs of powdered precursor material were significantly reduced using equal channel angular pressing, which enables compaction of powdered mixture into foamable precursor at lower temperature and pressing forces than conventional technology. Beside this, considerable cost reduction was achieved via replacement of powdered precursor with suitable aluminium melt, whereas it appeared possible to replace up to 50% of expensive precursor material. The new technology for low pressure injection of aluminium foam into complex permanent or temporary ceramic moulds has been developed for manufacturing of complex shape foam parts. The semiautomatic pilot setup was designed and constructed for injection of aluminium foam into 3D shape parts. Its beneficial performance was shown on several prototype parts, whereas significant (more than 30%) reduction of material costs and shortening of foaming time below one minute was demonstrated. Considerable reduction of the development time from design to final prototype part was achieved by using novel precise moulds manufactured by developed lost wax model rapid prototyping techniques. The new technology has been successfully applied in manufacturing of various structural and design components from aluminium foams incl. car suspension part, crash boxes for long vehicles and railway carriages, where it resulted in the scrap reduction to almost zero level.
- ✓ Novel aluminium foam crash boxes have been developed for enhancement of passive safety in railway carriages. The part is able to reduce high crash forces in case the absorbing capability of existing (conventional) damping elements is exhausted. It is expected from the crash box to protect chassis of 22 ton heavy carriage in a case of frontal crash at the velocity of 8 km/h. The kinetic energy must be dissipated within about 30 mm deformation length. The special 3D shaped component of aluminium foam was developed, whereas the shape of its natural “foam skin” and preferred orientation of pores were carefully designed to meet these requirements. The cell walls are made of heat treatable AlMgSi aluminium alloy and the porosity is gradiently changing along the thickness of the part in order to guarantee gas release from the foam structure during dynamic compaction. The production of this part started in 2008 and still continues with the amount of about 800 pieces per year. This development was awarded with „Best Application Award“ at International Conference CELLMET 2008, Dresden, Germany and “Inovation product 2007” awarded by Minister of economy SR (bilateral cooperation with Gleich GmbH, Kaltenkirchen)

B. Materials for thermal management

The research activities in this field were mainly devoted to the design, development and optimisation of:

- ✓ Metal matrix composites with maximised thermal conductivity (TC) and controlled thermal expansion aimed for applications in electronic components (CTE) (project ExtreMat 6th FP EU – high conductivity heat sinks)
- ✓ Copper matrix composites with improved mechanical properties at elevated temperatures (above 500°C) and controlled CTE aimed for applications in HT reactors (project ExtreMat 6th FP EU– high temperature heat sinks)
- ✓ copper matrix composites reinforced with (gradient) microcrystalline alumina preform with increased wear resistance for applications in brake discs (project MATRANS 7th FP EU)
- ✓ Graphite components infiltrated with copper for sliding contacts of locomotives and electrodes, including optimisation and supply of technology equipment for industrial infiltration (bilateral cooperation with Elektrokarbon a.s. Topoľčany)
- ✓ Lead alloy infiltrated ceramics plates for electrodes of novel bipolar batteries, including optimisation of infiltration technology and design of infiltration equipment for mass production (bilateral cooperation with Effpower Hising, Backa, Sweden)
- ✓ Heating/cooling panels based on aluminium foams (project APVV - Wallfoam)

The investigated materials with the exception of foamed panels were mostly prepared by gas pressure infiltration of molten metallic alloy into porous preform made from graphite, sintered ceramics, loose ceramic powders or arranged tungsten wires or high conductivity (pitch based) carbon fibers. Most of the research activities were initiated and driven by industrial interest (Elektrokarbon a.s. Topoľčany, Effpower Sweden, Plansee AG Austria, Siemens AG Germany, Ansaldo Richerche Italy). Development of industrial technology feasible for manufacturing of composite components in large volume was therefore inevitable part of the research. In some cases the unique equipment suitable for pilot production has been designed, constructed and supplied to industrial partner.

The most significant results achieved in assessed period include:

- ✓ Unique metal matrix composite materials reinforced with long or short high modulus and high thermal conductivity carbon fibres were developed. In case of Cu matrix and unidirectionally oriented long fibres TC of 700 W/m.K and CTE close to 1.0×10^{-6} K^{-1} have been achieved in the direction parallel to fibre alignment. The infiltration technology has been optimized up to an industrially viable procedure. The composite exhibits good machinability, structural stability, and well repeatability of the properties. With long fibres, one needs to take its anisotropy into account and use it as an advantage in future designs. Such composite is the best candidate for highly conductive wires or tubes aiming to remove heat from critical parts of electronic components. For those areas where the density and isotropy are the major issues, Al and Mg alloy matrix variants with short fibre reinforcements have also been developed (project ExtreMat 6th FW EU).
- ✓ Copper matrix composite material reinforced with tungsten wires that as a mock-up for monoblock of the divertor of ITER fusion reactor survived the most severe testing conditions 100 thermal cycles at 20 MW/m^2. The developed Cu-W composite monoblock mock-up prepared by gas pressure infiltration with proprietary arrangement of reinforcing W wires that significantly reduces internal stresses arising from large temperature changes proved fully its potential for the current divertor applications. It has been demonstrated that copper matrix reinforced with W wires represent a very suitable material for various heat sink applications where high thermal conductivity and high structural stability at temperatures above 450°C up to 1000°C are required (project ExtreMat 6th FP EC).
- ✓ The pressure infiltration technology was transferred from laboratory level to successful industrial utilisation. The world unique equipment (automatic infiltration autoclave) has been designed, constructed and in 2010 put into pilot production in Elektrokarbon a.s., Topoľčany (Slovakia). The machine is able to produce copper infiltrated graphite sliding contacts for locomotives in lengths up to 1350 mm. The GPI autoclave comprises several functions from pre-heating of graphite material, melting and infiltration of copper, cooling of manufactured components up to

recycling of used gas. It is able to work continuously in fully automated mode at exceptionally low production costs. The technology enabled to increase the lifetime of sliding contacts by 40% and thus significantly improved the competitiveness of the Slovak company, that was able to increase yearly production volume of this segment already in 2011 by nearly 0,5 mil euro. The successful technology transfer helped the company to overcome the negative consequences of economic crisis in 2009, saved the employment and make it profitable again, which undoubtedly qualified this result to the highlights of SAS research outcome (bilateral cooperation with Elektrokarbon a.s. Topoľčany).

- ✓ The long term research in the field of lead-infiltrated-ceramic electrodes for new type of bipolar batteries has been successfully accomplished by technology transfer to industrial partner. In comparison to typical lead batteries with monopolar arrangement the bipolar ones offer high discharge and recharge power – 800 W/kg discharge and 400 W/kg recharge and also very high cycling ability – more than 500 000 shallow cycles and are thus very suitable for usage in heavy loaded electric or hybrid vehicles. Technology of lead-infiltrated-ceramic plates is based on infiltration of porous ceramic material with molten lead alloy. (bilateral cooperation with industrial partner Effpower AB, Sweden)
- ✓ The novel heating / cooling panels made from aluminium foam have been developed and successfully tested in pilot application in 260 m^2 open space office room. The low heat capacity of aluminum foam allows changing the temperature very quickly, whereas the temperature of the entire foam volume is always very uniform due to excellent thermal conductance of aluminium cell walls. The heat is transferred into or from the foam using foamed-in tubes, which are completely embedded in the foam, keeping excellent contact to cell wall aluminium. Good thermal conductance of the foam resulted in short length of embedded tubes, what is beneficial for low flow resistance and necessary pumping systems. The foamed panels can be partially impregnated at facing side by appropriate plaster, which improves the appearance and also serves as an absorber of potentially condensed air humidity. The developed panels provide an excellent alternative for large built-in ceiling radiators for efficient heating or cooling of rooms using low potential energy resources (project APVV Walfoam – patent pending)

C. Structural materials for high temperature applications

The research activities in this field were mainly devoted to the design, development and optimisation of:

- ✓ TiAl based intermetallics for automotive, power engineering and space related applications (project APVV, project IMPRESS 6th FP EU))
- ✓ Silicide matrix composites reinforced with refractory metals for applications working at temperature above 1200 °C (project SILTRANS 7th FP EU)
- ✓ NiAl matrix composites for applications in engine valves (project MATRANS 7th FP EU

The research of ***multiphase nickel, titanium and iron based intermetallic alloys*** started at the Institute in 1994. During the last six years the main research activities in this field have been redirected to TiAl-based alloys, which showed to be of the largest interests for automotive, power engineering and aircraft industry. The research of TiAl alloys is based on complex approach including alloy design, ingot metallurgy, fundamental studies of solidification behaviour, solid phase transformations, heat treatments, numerical simulation and characterisation of microstructure and mechanical properties. The research was performed within several national (SRDA, SGA SAS) and in the frame of 6th FP EU IMPRESS where Institute's role was to coordinate the research on fundamentals of solidification of TiAl based alloys. IMSAS with several member states of ESA also participates on the project with European Space Agency focused on solidification behaviour of TiAl-based alloys in microgravity and hyper gravity conditions using parabolic flight of TEXUS rocket and large centrifuge of ESA. The contribution of IMSAS to the particular knowledge in the field of intermetallics includes:

- ✓ development and optimisation of metallurgical processing routes based on room temperature consolidation of pure elements, induction melting of master alloys and plasma melting and casting of Ti-Al-Nb-Ta ingots with defined chemical composition

- ✓ elucidation of the effect of ceramic moulds on contamination of directionally solidified intermetallic Ti-Al-Nb alloy and experimental determination of parameters of kinetic equations for increase of oxygen content and volume fraction of ceramic particles during melting and solidification in Y_2O_3 moulds
- ✓ development of experimental procedure based on directional solidification for fast determination of primary solidification phase, solidification path and solid phase transformations during cooling, and estimation of temperatures for phase transformations and temperature interval for stability of coexisting phases in new TiAl-based alloys with unknown phase diagrams
- ✓ characterization of long-term creep properties, determination of kinetics of creep deformation, analysis of creep deformation structures, microstructure stability during creep and identification of creep controlling mechanisms of new "air-hardenable" TiAl-based alloy
- ✓ development of new generation of "air-hardenable" TiAl-based alloys, characterization of microstructure, microstructure stability, mechanical properties and thermodynamic calculations of phase equilibria in Ti-Al-Ta system
- ✓ identification and characterisation of a new intermetallic Ti-Al-Ta phase with B82 crystal structure formed during long-term ageing of "air-hardenable" Ti-46Al-8Ta (at.%) alloy, assessment of existing phase diagrams and incorporation of this new phase into new calculated phase diagram

The internationally recognized reputation of IMSAS in the field of ***composite materials*** resulted in the attendance of two FP7 EU projects (priority NMP):

- ✓ SILTRANS (coordinated by IMSAS), where a new class of HT composites consisting of a continuous refractory metal framework (Nb, Mo, W) embedded in a silicide matrix is under development, whereas percolating porous skeletons of refractory metal are infiltrated with molten silicon using gas pressure infiltration following with partial reactions between melt and refractory metal forming refractory silicides. In such composites the silicide matrix provides excellent oxidation resistance at HT (forming silica), while refractory metal reinforcements bring the HT strength, ductility and creep resistance. The continuous metallic skeleton provides efficient tool against crack propagation, thus improving toughness of material at both high and low temperatures. The material is aimed for applications required operation in temperature ranges beyond currently used Ni based superalloys
- ✓ MATRANS, where new FGM material based on NiAl matrix reinforced with gradiently changing content of ceramic phase (alumina) is under development for the use in novel lightweight engine valves with improved resistance to high temperatures. IMSAS role in the project is to develop the demonstrator valves according to proprietary design of FGM composite. In the assessment period the first valves exhibiting more than 30% weight reduction have been prepared and now they are subjected to engine test at Centro Richerche Fiat for further optimisation.

D. Fatigue life and reliability assessment

Assessment of operational safety and reliability of mechanical structures is long-developed topic in IMSAS. In the assessed period the research has been focused on the creation of flexible system enabling to solve various tasks from the field of fatigue-reliability of the constructions. Practically it means to assess the resistance of the construction against fatigue failure at design stage (fatigue endurance check), at stage of the service (after the change of the load conditions to check ability to guarantee the originally designed fatigue properties), or in the case of modification of the requirements on operational endurance of the structure (to assess ability of the construction to operate after expiration of the designed endurance, etc). In the frame of the APVV project FATIQUEMENTH:

- ✓ the probabilistic model of computation of the behavioural characteristics of the material under cyclic loading has been developed. Such a model enables to include inhomogeneity in cyclic material's properties into the fatigue-damage calculation.
- ✓ the model of fatigue-life estimation under random operational loading has been developed. The output of the model is fatigue-life distribution function respecting the random character of the operational loading and material's properties.

- ✓ the model of fatigue reliability evaluation was proposed based on the fatigue-life calculation in the form of distribution function and its comparison with the requirements on operation of the construction. The model enables to determine probability of premature fatigue failure occurrence in respect of the requirement put on operational endurance of the construction.

F. Vibration analysis and active suspension systems

The aim of the research, within the framework of VEGA projects No. 2/6161/27 and No. 2/0075/10, was to obtain fundamental knowledge on human body-driver's seat vibration interaction in two perpendicular axes accounting for the cross influences. Modelling of the vertical and horizontal seat suspension optimised to the random and impulse excitations was performed. Further, the properties of broad range of measured and simulated random and combined road longitudinal profiles and their influence on the road unevenness indices and vehicle vibration were analysed. A new topic, dealing with electromagnetic damping of vibration was started. The physical background of this topic is highly non-linear and parameters dependent, so a lot of theoretical and simulation work was devoted to this issue. The most important contributions of IMSAS related to vibration analysis and suspension systems modelling include:

- ✓ Analysis of a non-linear model of fore-and-aft seat suspension system was performed, using excitation signals acquired in real operating conditions.
- ✓ Planar model of the seat - human body suspension system was developed and its parameters were identified.
- ✓ The methodology of the local road distresses (obstacles) separation from the longitudinal road profile by median filtering was designed.
- ✓ A new road unevenness classification based on the road spectrum properties and vibration response of the vehicle model was designed.
- ✓ A new simulation algorithm for generation of the random longitudinal road profiles combined with the local obstacles was created.
- ✓ A unique result was the identification of dimensions and shapes of 17,000 obstacles for real road profiles.
- ✓ The road waviness influence on the road indicators and the vehicle vibration response was quantified.
- ✓ The statistics of current used road indicators was quantified for the real road sections.
- ✓ In collaboration with the Institute of Measurement of SAS a field measuring system based on three-axial MEMS accelerometers was designed and constructed.
- ✓ The analysis of transversal vibrations of a beam and their damping by an electro-magnetic actuator was started. The static operating conditions of such a system (described by a third order algebraic equation) were derived. The dynamic operation conditions of an ideal system were thoroughly analysed by simulation means.

G. Advanced characterisation of microstructure of materials and non destructive testing

IMSAS has gained a recognized position in the ERA mostly due to its ability to prepare various unique material samples. This is particularly true for those areas where new technological equipment was not available and had to be built. Here the experience and skill have brought the desired results. However, the analytical part of the work was behind the times due to lack of sources for purchasing last analytical equipment. This has somehow hindered the progress as it was necessary to wait for results obtained from foreign institutes.

Therefore in assessed period a lot of attention was paid to the improvement of methods for advanced characterisation and testing of developed materials. For this purpose IMSAS actively participated in 10 ERDF projects (list is given in chapter 4) that are significantly helping to acquire modern equipment and also to develop the methods for their proper use for characterisation of advanced materials.

This has resulted in dramatic change in IMSAS analytical infrastructure in last two years:

- ✓ new JEOL 7600F scanning electron microscope with the 1 nm resolution, equipped with latest EDX, WDX and EBSD detectors and analyzers launches a completely new era where the

analytical information necessary for better understanding and further development is already available in house. This is particularly true for objects with dimensions larger than roughly 1 µm scale (X-ray generation volume),

- ✓ new Phoenix X-ray microtomograph (Nanotom 180) has been acquired enabling the non destructive study of internal structure of materials at submicron resolution level,
- ✓ new laser induced breakdown spectroscope LIBS LEA 500 enables to focus laser pulses with precisely specified energy on specific area of the specimens and is thus extremely efficient in characterisation of material composition also in small induced areas of the characterised specimen.

Some unique and expensive equipment needs is shared among several SAS institutes – IMSAS belongs to the initiators of this idea which resulted in the founding of Technology Institute of SAS that is coordinating the mentioned cooperation. In this way IMSAS gained the free access to other advanced analytic equipment such as FIB SEM, nanoindentor, DMA, BET, nanoporosimeter, etc. It is expected, that after finishing the ERDF project, almost all necessary equipment for IMSAS characterisation needs will be available.

Additional R&D activities

Besides the mainstream research also additional R&D activities were performed in assessed period. These included small scientifically oriented projects funded mostly by SGA SAS, education activities and expertise for industrial partners (more than 50 particular projects). More details concerning these activities are given in next chapters or at the internet web site of IMSAS.

The most important results from these projects include:

- ✓ Development of plasma sprayed ceramic coatings for renovation of the structural components for textile and for improvement of their wear resistance
- ✓ Deposition of superhard nanostructural composite coatings with nanocrystalline TiB2 crystallites embedded in amorphous matrix, which exhibit the hardness of up to 73 GPa and modulus of elasticity up to 600 GPa. They retain their structural stability up to the temperature of 800 °C. High level of internal stresses could have been decreased by the addition of nitrogen during deposition, although the hardness and modulus of elasticity decreased as well. TiB_2 coatings were further modified by the addition of Si with the aim to form SiO_2 coating protecting the outstanding mechanical properties at high temperatures. Depending on the amount of Si (5 to 15 at. %) the hardness of the coating varies between 16-38 GPa.
- ✓ Development of unique method for recycling of Mg scrap based on sublimation of Mg in special reactor and condensation of the vapours into high purity Mg crystals. This method enables recycling also of highly contaminated Mg scrap, which cannot be recycled efficiently by any other technique. Large sublimator for charges up to 500 kg Mg scrap was designed and built for industrial partner and now it is subjected to optimisation tests before final delivery to the partner (bilateral cooperation with LMT GmbH, Austria)
- ✓ Interactions of advanced high temperature lead free solders with metallic and non-metallic substrates have been studied, in particular the effect of Sb and Cu on wetting of Cu substrate with Sb-Sn-Cu solder. It appeared that the wetting angle increases with the Sb concentration in air whereas in deoxidizing atmosphere remains basically the same. The bonding strength decreases with increasing Sb content; on the other hand positive effect of Cu was recognized if soldering was accomplished in deoxidizing atmosphere. Structural analysis revealed that Cu3Sn inermetallic phase is adjacent to copper substrate in soldered joints, whereas Cu6Sn5 phase is formed also inside the joint structure (project COST).

Highlights of the IMSAS research output in assessed period:

developed knowledge *(see chapter III. 1. i. for references):*

- ✓ explanation of the reinforcing effect of oxide nanodispersoids in materials prepared from ultrafine aluminium powders and the role of compaction technology on their shape and dispersion [38]
- ✓ explanation of the effect of strong and weak interfaces on the thermal expansion of metal matrix composites and suggestion of possibilities for beter control of interfacial reactions [23]

- ✓ elucidation of the effect of ceramic moulds on contamination of directionally solidified intermetallic Ti-Al-Nb alloy and experimental determination of parameters of kinetic equations for increase of oxygen content and volume fraction of ceramic particles during melting and solidification in Y_2O_3 moulds [33]
- ✓ identification of a new intermetallic Ti-Al-Ta phase with B82 crystal structure formed during long-term ageing of "air-hardenable" Ti-46Al-8Ta (at.%) alloy and incorporation of this new phase into new calculated phase diagram [34]
- ✓ a new road unevenness classification based on the road spectrum properties and vibration response of the vehicle model [19]
- ✓ the new model of fatigue reliability evaluation [35]
- ✓ new FTIR spectrometry based method for evaluation of interfacial reactions in metallic composites [9]
- ✓ explanation of fracture behaviour of MgLi matrix composites based on in situ microstructural observations during deformation [21]
- ✓ novel method for evaluation of microstructure of superconducting wires using X-ray microtomography[2]

new materials:

- ✓ ultrafine grained aluminium with extraordinary structural stability and mechanical properties at temperartures up to 450°C [41]
- ✓ CuW composite with proprietary arrangement of W wires for reduced thermal stresses in high heat flux applications
- ✓ machinable CuC composite with extremely high thermal conductivity ~ 700 W/mK and controlled thermal expansion for heat sinks in advanced electronic application [23]
- ✓ a new generation of "air-hardenable" TiAl-based alloys [32]
- ✓ nanostructured ultrahard TiB_2 coating with enhanced structural stability up to 800°C [5, 37]

new technologies:

- ✓ gas pressure infiltration of long graphite sliding contacts with molten copper (transferred to Elektrokarbon Topoľčany)
- ✓ gas pressure infiltration of ceramic plates with lead alloy for novel bipolar batteries (transferred to Effpower AB, Sweden)
- ✓ industrial extrusion of composites made from powdered precursors (transferred to SAPA Profily a.s. Žiar nad Hronom)
- ✓ novel technology for recycling of Mg scrap (developed for LMT GmbH Austria)
- ✓ novel low cost technology for manufacturing of complex aluminium foam parts
- ✓ novel plasma melting technology for synthesis of HT intermetalic materials

new products & most important applications:

- ✓ stator ring for camshaft phaser of BMW engine made of extruded aluminium powder composite (producer SAPA Profily)
- ✓ crash box for railway carriages made of aluminium foam (producer IMSAS)
- ✓ infiltrated grafphite sliding contact for locomotives (producer Elektrokarbon Topoľčany
- ✓ heating / cooling panel made of aluminium foam (producer IMSAS)
- ✓ piston for engine of F1 racing car with enhanced structural stability during long term exposure at HT (producer NMD Austria)
- ✓ novel composite electrode for bipolar battery (producer Effpower Sweden)

[2] KOVÁČ, P. - HUŠEK, I. - PACHLA, W. - KULCZYK, M. - MELIŠEK, T. - DVORÁK, T. As-deformed filament's density and transport currents of MgB_2/Ti/Glidcop wire. In *Journal of Alloys and Compounds*, 2011, vol. 509, p. 8783-8787. (2.134 - IF2010). (2011 - Current Contents). ISSN 0925-8388.

3. Concept of R&D activity of the Organisation for the next four years (max. 5 pages)

i. Present state of knowledge and status of ongoing research related to the subject of the Concept, from both international and national perspective

It is obvious, that for further development of the society new high performance materials are inevitable. Therefore the research oriented towards applications of new engineering materials and advanced technologies will still play a very important role. This is true for both international and also national perspective. To keep a sustainable growth, Institute must be definitely competitive at international level. This will allow necessary financing from large EU projects and/or from stronger (better developed) industry, which is inevitable for Institute's existence (currently institute has to gain about 50% of finances from external sources, whereas research projects driven by industry cover substantial portion of this part). The growing interest of both international and national industry in the Institute's research results (documented by increasing bilateral cooperation) gives an indication that the research strategy is correct and that there is no strong need to change it significantly.
Therefore R&D on advanced metallic materials will be the main part of IMSAS future activities in following four years. The topics for further systematic research will comply with institute's research tradition, competence of leading researchers and availability of technological devices and equipment for characterisation and testing. The extraordinary technological ability of IMSAS to prepare unique high-tech materials, which enabled to keep the competitiveness at European level, will be further strengthened.

The attention in material research will be paid to:

A. Lightweight metallic materials aimed mostly for structural application in machine construction with the main interest in automotive industry. The main objective will be to develop materials enhancing stiffness- and strength-to-weight ratio of the structures. Several ways will be followed:

- development of ***composite materials based on aluminium matrix*** reinforced with ceramic particles with enhanced modulus of elasticity (~100 GPa). The main manufacturing techniques will comprise extrusion of powder mixtures into stiff profiles and infiltration of ceramic powders with liquid metal followed by pressure assisted casting or semisolid forging into complex parts. The main work will be focused to the improvement of particle distribution and interface quality.
- development of ***nanostructured aluminium alloys*** prepared via powder metallurgy (PM) with enhanced structural stability above 300°C. Here the profound understanding of structure development from rapidly quenched state will be crucial. The stability of nanostructure will be controlled by proper thermal treatment via in situ formation of hardly soluble quasicrystalline phases, intermetallics or oxide dispersoids. The main attention will be also paid to the development of high modulus aluminium alloys, whereas increase of Young`s modulus is expected from the high level of complex alloying (Al + Mo, Mn, Cr, Fe, Ti, B, Li). The properties will be also optimised from the fatigue life and creep resistance point of views. The development of rapidly solidified alloys will be accompanied by the study of their deformation behaviour during hot working consolidation techniques with an aim to suggest suitable – industrially relevant – production method. In this way very promising ECAP compaction will be further optimised.
- development of ***complex lightweight structures based on aluminium foams***. Here the future research will mostly comprise the development of the industrially viable method for production of complex hybrid castings in which aluminium foam will create a stiff lightweight core in injection moulded polymer castings. The attention will be given to further optimisation of the newly developed unique method for low cost foaming using combination of PM precursor and aluminium melt. The research will be focused on deeper understanding of the way of melt flow into just foaming PM precursor as well as to comprehensive study of structure-to-property relationship. As the stochastic structure of complex shaped foam part does not allow reliable calculation of the properties, manufacturing of prototypes and their testing will be still necessary. The development of suitable rapid prototyping methods will be further supported.

- development of magnesium alloys and composites for complex shape castings or forgings. The gas pressure infiltration of reinforcing elements (graphite flakes, C fibres or ceramic particles) with molten Mg alloy will be further optimised in order to create optimum interface between matrix and reinforcing phase and thus improve the materials properties. The attention will be given also to the further optimisation and industrialisation of newly developed sublimation method for Mg recycling.

B. **Structural materials for high temperature applications** with the main aim to **enhance the temperature limits for current structural components.** For such components long term high-temperature strength, room-temperature fracture toughness and reliability in operation are crucial issues. The research work will be focused on the design, development and optimisation of:

- ***silicide matrix composites*** reinforced with percolation refractory phase (Mo, Nb, W), whereas the silicides will be made in situ during infiltration of refractory skeleton with liquid silicon. The continuous metallic skeleton will provide efficient tool against crack propagation, thus improving toughness of material at both high and low temperatures and silicide matrix will increase the creep resistance and help also against HT oxidation. The main attention in further research will be given to the deep understanding of interfacial reactions and structural stability at HT. The material is aimed for applications operating in temperature ranges beyond currently used Ni based superalloys.
- advanced ***intermetallic TiAl-based and NiAl-based alloys*** and ***nickel based superalloys*** for functional and structural applications in power engineering, and aircraft or automotive industry. Main attention will be paid to understanding of fundamental phenomena controlling microstructure formation during solidification in microgravity, normal gravity and hyper gravity conditions, solid phase transformations, phase equilibria, microstructure degradation, to development of analytical models describing relationships between microstructure and mechanical properties and numerical simulations of heat transfer during solidification and heat treatments. The research will also focus to the development of ingot metallurgy and to the design of novel TiAl-based alloys forming fine grain structure during appropriate heat treatments or during solidification and cooling. The research will include development of precise casting technology for processing of complex shaped thin walled components including induction or plasma melting and casting into ceramic moulds.

C. Materials and components for thermal management. Two main ways will be followed:

- development of various ***copper matrix composites*** for heat sink applications in automotive components, power electronic, HT reactors, sliding current contacts or special electrodes. The optimisation of composite architecture and tailoring of interfaces will be the main objectives, with an aim to improve thermal conductivity, control CTE and stabilise the structure under thermocyclic loading. The main target will be to increase structural stability of components at constantly changing temperatures and parallel high heat and/or current flux. The composites will be prepared by well established gas pressure infiltration
- further optimisation of aluminium foam panels with embedded tubes for heating/cooling purposes. This unique development will continue with the main aim to transfer the research result to successful components and to bring them to the market. Therefore the main attention will be given to the design and optimisation of industrially feasible manufacturing technique and to the deep characterisation of panel properties, including necessary certification for their expected use.

In the field of **machine mechanics** the research will cover:

- identification, simulation and modelling of interactions of structural part with surrounding environment (loading, vibrations, etc.) with main attention paid to ***interactions between road and vehicle***. The research effort in this field will be focused on the following themes:
  - ✓ assessing and reducing of vehicle vibration caused by longitudinal road profiles and auxiliary machinery;
  - ✓ the relation between road unevenness, its description and vehicle model vibration response with regard to roll of wheel on track;

- ✓ the limits of the most commonly used unevenness indicator, IRI, to reflect the changes in the quality of real and simulated random and combined profiles;
- ✓ the influence of slabs joints of the cement concrete pavements on the vibration response

- estimation and/or ***calculation of operational fatigue endurance*** of structural part under stochastic loading, with an aim to develop credible methodology of evaluation of fatigue life, reliability and safety of structure operation for the complicated load conditions and new advanced materials. The research effort will be focused on the following themes:
  - ✓ accumulation of fatigue damage based on the operational loading process in the form of time dependent total or plastic deformation only;
  - ✓ modelling of the stress-strain behaviour at critical spot of the structure with respect of the loading history;
  - ✓ influence of non-standard load occurrence during operation on the parameters of fatigue reliability – methodology of assessment;
  - ✓ incorporation of the findings into the system of continuous monitoring of fatigue damage.

- ***vibration control of structural part*** with an aim to improve human body protection against whole body vibration, including simulation and modelling, whereas an technically and economically viable vibration control means for vibration mitigation in non-vertical directions will be optimised. The possibility of reducing the vibration of auxiliary machinery by the semiactive actuators will be analysed.

ii. Organisation's role or significance in the overall research effort within the field of the Concept on both the national and international scales

The excellent reputation of IMSAS ***on international level*** is documented e.g. with more than 30 issued international patents, regular participation in European framework programmes, incl. coordination of some projects, 6 worldwide unique serial applications running in last 5 years, among them e.g. aluminium foam stiffener in Ferrari cars, crash absorbing components in Audi Q7, bumpers of railway wagons, Al composite component for camshaft phaser in BMW engine, graphite/copper composite for electric sliding contacts for trolley vehicles or composite electrodes for the new generation bipolar batteries.
IMSAS belongs to the leading institution giving the way in the technological development of advanced materials in particular:

- ***aluminium foams*** (long term international cooperation, more than 20 issued patents, 3 worldwide unique serial applications in automotive and railway, many invited lectures, organizator of 6th Metfoam 2009 world congress in Bratislava)
- ***aluminium powder based bulk nanostructured materials*** (coordination of 6th FP EU MNT ERANET Hightemal-6 partners); strong industrial cooperation (serial application in BMW engine, testing of pistons for F1)
- ***high temperature materials***: 6th FP IMPRESS (large project 40 partners, coordination of WP); 7th FP EU SILTRANS (8 partners IMSAS is coordinator); coordination of the research for ESA in Slovakia
- ***materials for thermal management***: 6th FP Extremat (large project 38 partners, IMSAS was coordinator of SP2 "heat sinks"); 7th FP EU MATRANS (18 partners); 7th FP EU ULTRARODES (project after successful evaluation in 1st stage); successful delivery of world unique technology for production of MMCs - Effpower AB, Sweden, Elektrokarbon a.s., Topolcany,

On the national level IMSAS is coordinating activities in the development of structural composites for engineering, construction and medical applications (coordinator of ***Centre of excellence CEKOMAT*** - ERDF), development of light metals and composites (coordinator of ***Centre of Competency INOVAL*** – ERDF, 10 partners among them 8 from Slovak industry).

iii. Objectives of the Concept

The motivation for proposed research on **advanced materials** is derived from societal needs and requirements. The main fields of institute's interest are:

- **lightweight structural materials**
  Weight reduction of structural components is long term motivation of all designers. Lower weight of especially moving parts can significantly increase their performance with simultaneous decrease of energy consumption and environmental loading. In lightweight design the increased specific stiffness and strength of the components can bring the best benefits. Here two approaches are possible; increase specific properties of particular structural materials (e.g. making composites, improving (nano)microstructure) or optimise a structural design of components (making lightweight structure e.g. foams, sandwiches, etc.)
- **structural materials for high temperature performance**
  Increase of the efficiency and decrease of fuel consumption and green house gas emissions of engines, gas turbines for power engineering and aircraft industry require continuous increase of operating temperatures of materials used for their production. For such components specific high-temperature strength, room-temperature fracture toughness and reliability in operation are crucial issues. Nowadays, there is no alternative material, which might fully compete with single crystalline nickel based superalloys currently used for applications in the high pressure first stage of gas turbines. In the case of low pressure stage of gas turbine as well as for some high-temperature applications in automotive industry cast titanium and iron based multiphase intermetallic alloys were identified to be promising systems to replace nickel and iron based superalloys currently in use.
- **materials for thermal management**
  Further development in many technical fields is strongly crimped with raising problem of thermal management of high-tech components. At present overheating causes more than 50 % failures of electronic devices and the high temperature becomes a limiting factor also in construction of heat exchangers, fusion reactors, thruster chambers, brake systems, aircraft engine parts, etc.
  The introduction of new high performance electronic components or high temperature plasma reactors will in short term require novel thermal management approaches able to dissipate almost 20 MW per square m. This will be possible only with heat spreaders or heat sinks possessing extremely high thermal conductivity, ability to withstand large temperature changes without disintegration and deterioration of properties and capability to reduce complex thermo-mechanical stresses after bonding to supporting or protecting structures by tailoring of CTE. The use of metal matrix composites is probably inevitable also in this case.

- **Fatigue of material** still belongs to the most frequent cause of breakdown of engineering structures. This is mostly due to the complexity of the fatigue process. Therefore development of a new effective procedures and methods, enabling to evaluate reliability of a structure in view of fatigue-fracture occurrence, is still a topical problem. An optimum structure design calls for use of advanced materials (composites, ceramics, polymers); however the interaction between material performance and dynamical loading of those materials is still not completely understood. This is the motivation for furthering research into this problem.
- The Directive EC/2002/44 commands the minimal requirements on health and work safety in respect to prolonged influence of mechanical vibration and mechanical shocks on industrial workers. For assessment of vibration exposure limit values are stated. If exceeded mandatory measures on the employer's part are necessary to decrease the influence of vibration below the allowable limit. Improvements of driver's seats vibration control properties, using passive, semi-active and active vibration control means are one of the technical means for reaching this goals, nowadays especially in the non-vertical directions.

iv. Proposed strategies and methods to be applied, and time schedule

The significance of the IMSAS role in the development of abovementioned materials is based on the number of unique technologies such as foaming of metals, gas pressure infiltration of porous structures by melt, directional solidification, plasma melting, advanced powder-metallurgical methods or rapid prototyping. These technologies acquire strong attention, not only from international research consortia, but also from industry. Such interest may provide large additional financial support for the research, which is, in the recent situation of research funding from public resources, inevitable. Therefore the further research on the proposed topics will be again based on technology driven innovation.
However, thanks to large running infrastructure projects in the frame of ERDF, the unique competency of IMSAS in the field of technology can nowadays be strongly supported with state-of-the-art methods for characterisation of material structure and testing of their properties. New JEOL 7600F FEG scanning electron microscope with the 1 nm resolution, equipped with latest EDX, WDX and EBSD detectors and analyzers launches a completely new era where the desired analytical information is already available in house. The other unique analytical and testing equipment include X-ray microtomography (Nanotom 180), laser induced spectrometry (LIBS LEA 500), ultrahigh speed camera, or equipment for advanced characterisation of hot deformation processes. The technological competency will be further supported by a new atomizer with the capacity of producing unique powders in kilogram quantities (expected end of 2012) and the complete line for investment casting.
An interdisciplinary approach comprising metallurgy, physics, chemistry, mathematics and informatics will be implemented wherever possible to guarantee high-quality and efficiency of the research level:

- advanced process engineering (CAD, FEM check, rapid prototyping)
- multiscale modelling of structure-behaviour relations (on nano-micro-macro scale)
- understanding of phase transformations and structural changes
- Interface science and microstructure design

The attention must also be paid to the further **development of suitable technologies**, which are inevitable for industrial application of developed materials. In case of MMC the main effort will be given to optimisation of gas pressure infiltration, including alloys optimisation with respect to wetting and reaction with reinforcements, development of the methods for manufacturing of performs, preparation of powders with controlled structure at nanometric level, development of new powder compaction techniques as well as the techniques for plasma melting and vacuum casting of HT materials.

The most important task in the proposed research is to find sufficient financial resources. However, the situation is not really optimistic, due to low national public funding for research. Nevertheless, the necessary financial resources are available at least for next two years thanks to two 7^{th} FP EU projects running until 2013. One new 7^{th} FP project was successfully evaluated in stage 1 and submitted for final evaluation. Beside 2 running contracts with industrial partners, three new proposals are under negotiation. IMSAS submits yearly about 3-4 proposals also to Agency for Research and Development (APVV) and these initiatives will continue also in next years. 3 currently running main APVV projects will continue until 2014. The improvement of infrastructure, technology transfer and the development of new characterisation and testing methods will be covered from 9 still running ERDF projects with IMSAS participation. The largest ones will continue until end 2014. The other necessary financial resources will be gained through IMSAS business unit, from the sales of own products made of advanced materials. It is expected to cover about 15-20% of IMSAS budget in this way.

III. Partial indicators of the main activities:

1. Research output

i. List of the selected publications documenting the most important results of basic research. Total number of publications in the whole assessed period should not exceed the average number of the research employees

[1] LAPIN, J. – PELACHOVÁ, T. – DOMÁNKOVÁ, M. – DALOZ, D. – NAZMY, M. Influence of long-term creep exposure on the microstructure stability of cast Ti-46Al-2W-0.5Si alloy forturbine blades. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2007, vol. 45, no. 3, p. 121-128. (1.345 – IF2007)

[2] GABALCOVÁ, Z. – LAPIN, J. Estimation of high temperature phase equilibria in directionally solidified intermetallic Ti-45.9Al-8Nb alloy. In *Kovove materialy-Metallic Materials*. ISSN 0023-432X, 2007, vol. 45, no. 5, p. 231-240. (1.345 – IF2007)

[3] STEIN, G.J. – MÚČKA, P. – CHMÚRNY, R. – HINZ, B. – BLŰTHNER, R. Measurement and modelling of x-direction apparent mass of the seated human body-cushioned seat system. In *Journal of Biomechanics*. ISSN 0021-9290, 2007, vol. 40, no. 7, p. 1493-1503. (2.897 – IF2007)

[4] ŠEBO, P. – ŠVEC, P. – JANIČKOVIČ, D. – ŠTEFÁNIK, P. Influence of thermal cycling on shear strength of Cu-Sn3.5AgIn-Cu joints with various content of indium. In *Journal of Alloys and Compounds.* ISSN 0925-8388, 2008, vol. 463, nos. 1-2, p. 168-172. (1.510 – IF2008)

[5] MIKULA, M. – GRANČIČ, B. – BURŠÍKOVÁ, V. – CSUBA, A. – DRŽÍK, M. – KAVECKÝ, Š. – PLECENÍK, A. – KÚŠ, P., Mechanical properties of superhard TiB_2 coatings prepared by DC magnetron sputtering. In *Vacuum*. ISSN 0042-207X, 2008, vol. 82, no. 2, p. 278-281. (1.114 – IF2008)

[6] STEIN, G.J. – ZAHORANSKÝ, R. – MÚČKA, P. On dry friction modelling and simulation in kinematically excited oscillatory systems. In *Journal of Sound and Vibration*. ISSN: 0022-460X, 2008, vol. 311, nos. 1-2, p. 74-96. (1.364 – IF2008)

[7] KOVÁČIK, J. Correlation between elastic modulus, Poisson's ratio and porosity in porous materials. In *Advanced Engineering Materials*. ISSN 1438-1656, 2008, vol. 10, no. 3, p. 250-252. (1.506 – IF2008)

[8] KOVÁČIK, J. – EMMER, Š. – BIELEK, J. – KELEŠI, Ľ. Effect of composition on friction coefficient of Cu-graphite composites. In *Wear*. ISSN 0043-1648, 2008, vol. 265, nos. 3-4, p. 417-421. (1.509 – IF2008)

[9] KÚDELA, S., Jr. – OSWALD, S. – KÚDELA, S. – WETZIG, K. Applications of FTIR spectra for evaluating interfacial reactions in metal matrix composites. In *Analytical and Bioanalytical Chemistry*. ISSN 1618-2642, 2008, vol. 391, no. 6, p. 1477-1486. (3.328 – IF2008)

[10] STEIN, G.J. – MÚČKA, P. – GUNSTON, T.P. – BADURA, S. Modelling and simulation of locomotive driver's seat vertical suspension vibration isolation system. In *International Journal of Industrial Ergonomics*. ISSN 0169-8141, 2008, vol. 38, nos. 5-6, p. 384-395. (0.760 – IF2008)

[11] STEIN, G. J. – ZAHORANSKÝ, R. – GUNSTON, T.P. – BURSTRÖM, L. – MEYER, L. Modelling and simulation of a fore-and-aft driver's seat suspension system with road excitation. In *International Journal of Industrial Ergonomics*. ISSN 0169-8141, 2008, vol. 38, nos. 5-6, p. 396-409. (0.760 – IF2008)

[12] ŠEBO, P. – ŠVEC, P. – JANIČKOVIČ, D. – MOSER, Z. Identification of phases on Sn-Ag-Cu-In solder on Cu substrate interface. (Letter to the editor.) In *Kovove materialy-Metallic Materials*. ISSN 0023-432X, 2008, vol. 46, no. 4, p. 235-238. (0.367 – IF2008)

[13] LAPIN, J. – GABALCOVÁ, Z. Effect of oxygen content and cooling rate on phase transformations in directionally solidified intermetallic Ti-46Al-8Nb alloy. In *Kovove materialy-Metallic Materials*. ISSN 0023-432X, 2008, vol. 46, no. 4, p. 185-195. (1.345 – IF2007)

[14] LAPIN, J. – GEBURA, M. – PELACHOVÁ, T. – NAZMY, M. Coarsening kinetics of cuboidal γ precipitates in single crystal nickel base superalloy CMSX-4. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2008, vol. 46, no. 6, p. 313-322. (1.345 – IF2007)

[15] BALOG, M. – NAGY, J. – SIMANČÍK, F. – IŽDINSKÝ, K. – REQUENA, G. Heat resistant ultra-fine grained Al profiles. In *Reviews on Advanced Materials Science*. ISSN 1606-5131, 2008, vol. 18, no. 4, p. 415-421. (0.891 – IF2008)

[16] NAGY, J. – BALOG, M. – SIMANČÍK, F. – IŽDINSKÝ, K. – JANIČKOVIČ, D. - ŠVEC, P. Consolidation of rapidly solidified Al-based particles using equal channel angular pressing (ECAP). In *Reviews on Advanced Materials Science*. ISSN 1606-5131, 2008, vol. 18, no.7, p. 608-615. (0.891 – IF2008)

[17] BALOG, M. – SIMANČÍK, F. – BAJANA, O. – REQUENA, G. ECAP vs. direct extrusion – Techniques for consolidation of ultra-fine Al particles. In *Materials Science and Engineering A.* ISSN 0921-5093, 2009, vol. 504, nos. 1-2, p. 1-7. (1.901 – IF2009)

[18] ŠEBO, P. – MOSER, Z. – ŠVEC, P. – JANIČKOVIČ, D. – DOBROČKA, E. – GĄSIOR, W. – PSTRUŚ, J. Effect of indium on the microstructure of the interface between Sn3.13AgO.74CuIn solder and Cu substrate. In *Journal of Alloys and Compounds.* ISSN 0925-8388, 2009, vol. 480, no. 2, p. 409-415. (2.135 – IF2009)

[19] MÚČKA, P. – KROPÁČ, O. Sensitivity of road unevenness indicators to road waviness. In *Journal of Testing and Evaluation.* ISSN 0090-3973, 2009, vol. 37, no. 21, p. 139-149. (0.366 – IF2009)

[20] STEIN, G. J. – MÚČKA, P. – HINZ, B. – BLÜTHNER, R. Measurement and modelling of the y-direction apparent mass of sitting human body-cushioned seat system. In *Journal of Sound and Vibration.* ISSN 0022-460X, 2009, vol. 322, nos. 1-2, p. 454-474. (1.414 – IF2009)

[21] KÚDELA, S., Jr. – WENDROCK, H. – KÚDELA, S. – PAWEŁEK, A.j – PIĄTKOWSKI, A. – WETZIG, K. Fracture behaviour of Mg-Li matrix composites. In *International Journal of Materials Research*. ISSN 1862-5282, 2009, vol. 100, no. 6, p. 910-914. (0.862 – IF2009)

[22] BALOG, M. – VRETENÁR, V. – VÁVRA, I. – ZHANG, J. – CRIMP, M. A. – KUBIČÁR, Ľ. – LENČÉŠ, Z. Thermophysical properties of electrically conductive SiC-$(Nb, Ti-C)_{SS}$-based cermets. In *International Journal of Thermophysics*. ISSN 0915-928X, 2009, vol. 30, no. 6, p. 1918-1930. (0.702 – IF2009)

[23] BERONSKÁ, N. – IŽDINSKÝ, K. – ŠTEFÁNIK, P. – SIMANČÍK, F. – ZEMÁNKOVÁ, M. – DVORÁK, T. The influence of Cr on structure and thermal expansion of copper matrix composites reinforced with unidirectionally aligned continuous high modulus C fibres. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2009, vol. 47, no. 3, p. 175-184. (1.345 – IF2007)

[24] LAPIN, J. – GEBURA, M. – BAJANA, O. – PELACHOVÁ, T. – NAZMY M. Effect of size and volume fraction of cuboidal γ' precipitates on mechanical properties of single crystal nickel-based superalloy CMSX-4. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2009, vol. 47, no. 3, p. 129-138. (1.345 – IF2007)

[25] LAPIN, J. – GABALCOVÁ, Z. – BAJANA, O. The effect of microstructure on mechanical properties of directionally solidified intermetallic Ti-46Al-8Nb alloy. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2009, vol. 47, no. 3, p. 159-167. (1.345 – IF2007)

[26] ŠEBO, P. – ŠVEC, P. – JANIČKOVIČ, D. – ILLEKOVÁ, E. Influence of indium and copper in Sn3.5Ag0.4CuIn solder on its interaction with copper. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2009, vol. 47, no. 4, p. 275-282. (1.345 – IF2007)

[27] ŠTEFÁNIK, P. – BERONSKÁ, N. – ŠEBO, P. Influence of chromium in copper alloys on wetting of some refractory metals. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2009, vol. 47, no. 5, p. 349-352. (1.345 – IF2007)

[28] BALOG, M. – KOVÁČ, J. – ŠATKA, A. – HAŠKO, D. – ZHANG, J. – CRIMP, M.A. – VÁVRA, O. – VÁVRA, I. SiC-based cermet with electrically conductive grain boundaries. In *Materials Characterization.* ISSN 1044-5803, 2010, vol. 61, p. 420-426. (1.508 – IF2010)

[29] NOSKO, M. – SIMANČÍK, F. – FLOREK, R. Reproducibility of aluminum foam properties: Effect of precursor distribution on the structural anisotropy and the collapse stress and its dispersion. In *Materials Science and Engineering A - Structural Materials Properties Microstructure and Processing*. ISSN 0921-5093, 2010, vol. 527, p. 5900-5908. (2.101 – IF2010)

[30] LAPIN, J. – PELACHOVÁ, T. – STANEKOVÁ, H. – DOMÁNKOVÁ, M. Long-term microstructural stability of intermetallic Ti-46Al-8Ta alloy during ageing at temperatures of 700-800 °C. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2010, vol. 48, p. 337-343. (0.471 – IF2010)

[31] LAPIN, J. – GABALCOVÁ, Z. Solidification behaviour of TiAl-based alloys studies by directional solidification technique. In *Intermetallics*, ISSN 0966-9795, 2011, vol.19, p.797-804. (2.335 – IF2010)

[32] LAPIN, J. – PELACHOVÁ, T. – DOMÁNKOVÁ, M. Creep behaviour of a new air-hardenable intermetallic Ti-46Al-8Ta alloy. In *Intermetallics*, ISSN 0966-9795, 2011, vol.19, p. 814-819. (2.335 – IF2010)

[33] LAPIN, J. – GABALCOVÁ, Z. – PELACHOVÁ, T.. Effect of Y_2O_3 crucible on contamination of directionally solidified intermetallic Ti-46Al-8Nb alloy. In *Intermetallics*, ISSN 0966-9795, 2011, vol. 19, p. 396-403. (2.335 – IF2010)

[34] LAPIN, J. – PELACHOVÁ, T. – WITUSIEWICZ, V.T. – DOBROČKA, E. Effect of long-term ageing on microstructure stability and lattice parameters of coexisting phases in intermetallic Ti-46Al-8Ta alloy. In *Intermetallics*, ISSN 0966-9795, 2011, vol. 19, p.121-124. (2.335 – IF2010)

[35] KLIMAN, V. – KEPKA, M. – VÁCLAVÍK, J. Influence of scatter of cyclic properties of material on operational endurance of construction. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2010, vol. 48, p. 367-378. (0.471 – IF2010)

[36] NOSKO, M. – SIMANČÍK, F. – IŽDINSKÝ, K. – ŠVEC, P. - FLOREK, R. Stabilizing intermetallic phases within aluminum foam. In *Materials Letters*, ISSN 0167-577X, 2011, vol. 65, p.1378-1380. (2.120 – IF2010)

[37] MIKULA, M. - GRANČIČ, B. - ROCH, T. - PLECENIK, T. - VÁVRA, Ivo – DOBROČKA, E. – ŠATKA, A. – BURŠÍKOVÁ, V. - DRŽÍK, M. – ZAHORAN, M. – PLECENIK, A. – KÚŠ, P. The influence of low-energy ion bombardment on the microstructure development and mechanical properties of TiBx coatings. In *Vacuum*, ISSN 0042-207X, 2011, vol. 85, no. 9, p. 866-870. (1.051 – IF2010)

[38] BALOG, M. – POLETTI, C. – SIMANČÍK, F. – WALCHER, M. - RAJNER, W. The effect of native Al_2O_3 skin disruption on properties of fine Al powder compacts. In *Journal of Alloys and Compounds*, ISSN 0925-8388, 2011, vol. 509S, p. S235-S238. (2.138 – IF2010)

[39] ŠEBO, P. – ŠVEC, P. – JANIČKOVIČ, D. – ILLEKOVÁ, E. – PLEVACHUK, Y. Interface between Sn-Sb-Cu solder and copper substrate. In *Materials Science and Engineering A - Structural Materials Properties Microstructure and Processing*, ISSN 0921-5093, 2011, vol. 528, p. 5955-5960. (2.101 – IF2010)

[40] STEIN, G. J. – MÚČKA, P. Study of simultaneous shock and vibration control by a fore-and-aft suspension system of a driver´s seat. In *International Journal of Industrial Ergonomics*, ISSN 0169-8141, 2011, vol. 41, p.520-529. (1.322 – IF2010)

[41] BALOG, M. – SIMANČÍK, F. – WALCHER, M. – RAJNER, W. – POLETTI, C. Extruded Al-Al_2O_3 composites formed in situ during consolidation of ultrafine Al powders: Effect of the powder surface area. In *Materials Science and Engineering A - Structural Materials Properties Microstructure and Processing*, ISSN 0921-5093, 2011, vol. 529, p.131-137. (2.101 – IF2010)

[42] LAPIN, J. – FRKÁŇOVÁ, K. Effect of processing routes on properties of plasma melted intermetallic Ti-Al-Ta ingots. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2011, vol. 49, no. 4, p. 243-251. (0.471 – IF2010)

[43] BERONSKÁ, N. – IŽDINSKÝ, K. – ŠTEFÁNIK, P. – KÚDELA, S. Jr. – SIMANČÍK, F. – VÁVRA, I.– KRIŽANOVÁ, Z. Structure and thermal expansion behaviour of Al/C composites reinforced with unidirectionally aligned continuous high modulus C fibres. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2011, vol. 49, no. 6, p. 427-436. (0.471 – IF2010)

[44] ŠTEFÁNIK, P. – IŽDINSKÝ, K. – KAVECKÝ, Š. – SIMANČÍK, F. – NOSKO, M. Formation of nickel layer deposited on carbon fibres by galvanic method. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2011, vol. 49, no. 6, p. 393-399. (0.471 – IF2010)

[45] KÚDELA, S. – PAWELEK, A. – RANACHOWSKI, Z. – PIATKOWSKI, A. – KÚDELA, S., Jr. – RANACHOWSKI, P. Effect of Al alloying on the Hall-Petch strengthening and AE in

compressed Mg-Li-Al alloys before and after HPT processing. In *Kovove materialy-Metallic Materials.* ISSN 0023-432X, 2011, roč. 49, p. 271-277. (0.471 – IF2010)

ii. List of the selected publications documenting the most important results of applied research

[1] JERZ, J. Production and industrial applications of aluminium foam. In MICHNA, Š. – LUKÁČ, I. – LOUDA, P. – OČENÁŠEK, V. – SCHNEIDER, H. – DRÁPALA, J. – KOŘENÝ, R. – MIŠKUFOVÁ, A. et al. Aluminium materials and technologies from A to Z. Děčín: Alcan Děčín Extrusions s.r.o., 2007. ISBN 978-80-89244, p. 571-581. (Chapt. 10.3.)

[2] JERZ, J. Research, development and technology transfer (R & D & TT) in the field of engineering materials and related technologies. In Advances in technology, education and development. Editor W. Kouwenhoven. Vukovar: In-Teh, 2009. ISBN 978-953-307-011-7, p. 325-342.

[3] BALOG, M. – NAGY, J. – SIMANČÍK, F. – UHRÍK, R. ECAP vs. direct extrusion (Heat resistant ultra-fine grained profiles prepared via consolidation of fine Al powders). In MATRIB'07, Vela Luka, 21-23 June 2007. Zagreb: CSMT, 2007. ISBN 978-953-7040-12-3, p. 415-429.

[4] FLOREK, R. – SIMANČÍK, F. – NOSKO, M. – TOBOLKA, P. – UHRÍK, R. Heating and cooling panels using aluminium foam. In MATRIB'07, Vela Luka, 21-23 June 2007. Zagreb: CSMT, 2007. ISBN 978-953-7040-12-3, p. 430-437.

[5] KORÁB, J. – KRAMER, I. – DVORÁK, T. Properties of tungsten fibres used for production of metal matrix composites. In MATRIB'07, Vela Luka, 21-23 June 2007. Zagreb: CSMT, 2007. ISBN 978-953-7040-12-3, p. 445-450.

[6] BALOG, M. – NAGY, J. – SIMANČÍK, F. ECAP vs. direct extrusion – heat resistant ultrafine grained profiles prepared via consolidation of fine Al powders. In Aluminium 2007. Transactions of the Universities of Košice – The 5th International Conference, Doksy–Staré Splavy, 10.-12.10.2007. Košice: TU, 2007. ISBN 1335-2334. p. 305-311.

[7] JERZ, J. – SIMANČÍK, F. – FLOREK, R. Structural and functional applications of various aluminium foams. In Aluminium 2007. Transactions of the Universities of Košice – The 5th International Conference, Doksy–Staré Splavy, 10.-12.10.2007. Košice: TU, 2007. ISBN 1335-2334. p. 357-362.

[8] KORÁB, J. – DVORÁK, T. – ŠTEFÁNIK, P. – KAVECKÝ, Š. Metal matrix composites for fusion reactor applications. In MATRIB 2008, Vela Luka, 26-28 June 2008. Zagreb: CSMT, 2008. ISBN 978-953-7040-14-7, p. 144-151.

[9] BALOG, M. – KRÍŽIK, P. – SIMANČÍK, F. Structural damping of heat resistant ultra-fine grained profiles prepared via consolidation of fine Al powders. In MATRIB 2008, Vela Luka, 26-28 June 2008. Zagreb: CSMT, 2008. ISBN 978-953-7040-14-7, p. 13-19.

[10] FLOREK, R. – SIMANČÍK, F. – NOSKO, M. – UHRÍK, R. – MIHÁLKA, P. Cooling and heating panels using aluminium foams. In MATRIB 2008, Vela Luka, 26-28 June 2008. Zagreb: CSMT, 2008. ISBN 978-953-7040-14-7, p. 79-82.

[11] JERZ, J. – SIMANČÍK, F. – FLOREK, R. – NOSKO, M. Advanced technique for utilisation of aluminium foams. In MATRIB 2008, Vela Luka, 26-28 June 2008. Zagreb: CSMT, 2008. ISBN 978-953-7040-14-7, p. 121-126.

[12] IŽDINSKÝ, K. – DVORÁK, T. – KAVECKÝ, Š. – ŠTEFÁNIK, P. – FRANKOVIČOVÁ, N. – KORÁB, J. – SIMANČÍK, F. Tungsten wire reinforced copper matrix heat sinks with extremely high thermal stability. In New Materials for Extreme Environments, San Sebastian, June 2-4, 2008. San Sebastián: INASMET-Tecnalia, 2008. ISBN 978-8495520176

[13] IŽDINSKÝ, K. – FRANKOVIČOVÁ, N. – ŠTEFÁNIK, P. – DVORÁK, T. – KAVECKÝ, Š. – KORÁB, J. – SIMANČÍK, F. Heat sink materials reinforced with continuous high modulus carbon fibres. In New Materials for Extreme Environments, San Sebastián, June 2-4, 2008. San Sebastian: INASMET-Tecnalia, 2008. ISBN 978-8495520176.

[14] KOVÁČIK, J. Effect of sample size on aluminium foam properties. In Eufoam 2008. Noordwijk: ESA/ESTEC, 2008, p. 52.

[15] SIMANČÍK, F. – NOSKO, M. – FLOREK, R. – TOBOLKA, P. Reproducibility of mechanical properties within ALPORAS aluminium foam block. In CELLMET 2008. Dresden: Fraunhofer Institute for Manufacturing and Advanced Materials, 2008, p. 77.

[16] SIMANČÍK, F. – FLOREK, R. – NOSKO, M. – TOBOLKA, P. Compression test evaluation method for aluminium foam parts of different alloys and density. In CELLMET 2008. Dresden: Fraunhofer Institute for Manufacturing and Advanced Materials, 2008, p. 65.

[17] SIMANČÍK, F. – FLOREK, R. – NOSKO, M. – TOBOLKA, P. Rapid prototyping for complex 3-D parts of PM aluminium foams. In DFPM 2008. Košice: IMR SAS, 2008, p. 37.

[18] STEIN, J. Active vibration control systems for driver's seats – from basic research to first commercial applications. In Engineering Mechanics 2008, Svratka, 12-15 May, 2008. Prague: IT AS CR, 2008. ISBN 978-80-87012-11-6.

[19] SIMANČÍK, F. PM foams. In Design and Capabilities of PM Components and Materials. Shrewsbury: EPMA, 2008, p. 314-350.

[20] ŠEBO, P. Vplyv india na niektoré vlastnosti spájky SnAgCuIn. In 7. vedecko-technická konferencia Materiál v inžinierskej praxi 2008, Herľany, 15.-17. január 2008. Košice: TU Košice, 2008. ISBN 978-80-8073-954-4. p. 35-38.

[21] NOSKO, M. – SIMANČÍK, F. – FLOREK, R. Assessment of the structure uniformity within standard block of aluminium foam – Alporas®. In CELLMET 2008. Editors G. Stephani, B. Kieback. Dresden: Fraunhofer Institute for Manufacturing and Advanced Materials, 2009, p. 246-251.

[22] ŠTEFÁNIK, P. Galvanické niklovanie uhlíkových vlákien pre použitie v kompozitoch s polymérnou matricou so zlepšeným elektromagnetickým tienením. In 51. medzinárodná galvanická konferencia. Bratislava: STU, 2009. ISBN 978-80-227-3098-3, p. 35-43.

[23] MIKULA, M. – GRANČIČ, B. – VÁVRA, I. – ŠATKA, A. – BURŠÍKOVÁ, V. – KÚŠ, P. Tvrdé a supertvrdé vrstvy pripravené PVD technológiami. (Príspevok v zborníku a vyžiadaná prednáška.) In 51. medzinárodná galvanická konferencia. Bratislava: STU, 2009. ISBN 978-80-227-3098-3, p. 12-19.

[24] MIKULA, M. – GRANČIČ, B. – ROCH, T. – VÁVRA, I. – BURŠÍKOVÁ, V. – ŠATKA, A. – PLECENIK, A. – KÚŠ, P. Coatings for industrial applications. In 17th Conference of Slovak Physicists. Editor M. Reiffers. Bratislava: SPS, 2009. ISBN 978-80-969124-7-6, p. 17-28.

[25] NOSKO, M. – SIMANČÍK, F. – FLOREK, R. – TOBOLKA, P. New manufacturing route for cheeper aluminium foam. In EUROMAT 2009. Glasgow: IOMS, FEMS, 2009, PS1, B11.

[26] KORÁB, J. – DVORÁK, T. – ŠTEFÁNIK, P. – KAVECKÝ, Š. Design of small divertor segments for fusion reaktor applications. In MATRIB 2009. Editors K. Grilec, G. Marić. Zagreb: CSMT, 2009. ISBN 978-953-7040-16-1, p. 363-367.

[27] STEIN, G. J. – MÚČKA, P. – GUNSTON, T. P. A study of locomotive driver's seat vertical suspension system with adjustable damper. In Vehicle System Dynamics. ISSN 0042-3114, 2009, vol. 47, no. 3, p. 363-386. (0.659 – IF2009)

[28] BALOG, M. – ČAVOJSKÝ, M. – SIMANČÍK, F. – IŽDINSKÝ, K. - ŠVEC, P. - JANIČKOVIČ, D. - ILLEKOVA, E. Rapidly solidified AlCr4,4Fe0,9 bulk profiles. In MATRIB 2010. - Zagreb: HDMT, 2010. ISBN 978-953-7040-18-5, 2010, p. 10-17.

[29] KRÍŽIK, P. – ČAVOJSKÝ, M. – BALOG, M. – ŠVEC, P. – JANIČKOVIČ, D.. Mechanical properties of particulate Al - SiCp composite prepared by direct extrusion. In MATRIB 2010. - Zagreb: HDMT, 2010. ISBN 978-953-7040-18-5, 2010, p. 217-223.

[30] SIMANČÍK, F. – FLOREK, R. – NOSKO, M. – MIHÁLKA, P. Aluminium foam radiator for efficient use of alternative energy resources. In Cellular Materials: proceedings of the international conference on Cellular Materials. - Dresden: DGM, 2010.

[31] FLOREK, R. – GLEICH, A. – SIMANČÍK, F. – NOSKO, M. - TOBOLKA, P. Impact absorber of aluminium foam for railway carriages. In Cellular Materials: proceedings of the international conference on Cellular Materials. - Dresden: DGM, 2010.

[32] NOSKO, M. – SIMANČÍK, F. – FLOREK, R. – ADAMČÍKOVÁ, A. - HARNUŠKOVÁ, J. Reproducibility of aluminium foam properties. In Cellular Materials: proceedings of the international conference on Cellular Materials. - Dresden: DGM, 2010.

[33] SIMANČÍK, F. – FLOREK, R. – NOSKO, M. – TOBOLKA, P. – HARNUŠKOVÁ, J. – ADAMČÍKOVÁ, A. New manufacturing route for cheaper aluminium foam. In Cellular Materials: proceedings of the international conference on Cellular Materials. - Dresden: DGM, 2010.

[34] ČAVOJSKÝ, M. - BALOG, M. - SIMANČÍK, F. - IŽDINSKÝ, K. - ŠVEC, P. - JANIČKOVIČ, D. - ILLEKOVÁ, E. Microstructures and properties of extruded AlCrFe melt-spun ribbons profiles. In NANOVED & NANOTECH & TECHTRANSFER 2010, 5th International Conference on Nanosciences, Nanotechnologies, Nanomaterials, Nanomedicine and Technology Transfer. Editors P. Švec, M. Kadlečíková, J. Kadlečík. Brno: Tribun EU, 2010. ISBN 978-80-7399-949-0.

[35] OSLANEC, P. Magnesium chips recycling. In NANOVED & NANOTECH & TECHTRANSFER 2010, 5th International Conference on Nanosciences, Nanotechnologies, Nanomaterials, Nanomedicine and Technology Transfer. Editors P. Švec, M. Kadlečíková, J. Kadlečík. Brno: Tribun EU, 2010. ISBN 978-80-7399-949-0.

[36] FLOREK, R. – NOSKO, M. – SIMANČÍK, F. – HARNUŠKOVÁ, J. Effect of chemical composition of foamable precursor on the foaming kinetics of aluminium foam ALULIGHT. In MATRIB 2010. - Zagreb: HDMT, 2010. ISBN 978-953-7040-18-5, p.104-108.

[37] STEIN, G. J. – CHMÚRNY, R. – ROSÍK, V. Compact Vibration Measuring System for in-vehicle Applications. In Measurement Science Review: journal of the Institute of Measurement Science, Slovak Academy of Sciences. ISSN 1335-8871, 2011, vol.11, no. 5, p.154-159.

[38] MIKULA, M. – GRANČIČ, B. – HOŠKO, J. – PULC, V. Nanoštruktúrované tvrdé vrstvy v priemyselnej praxi. In Magazín stavebné stroje a mechanizácia: odborný časopis o stavebných strojoch a mechanizácii. ISSN 1336-958X, 2011, roč. 6, č. 1, s. 22-23.

[39] SIMANČÍK, F. – KRÍŽIK, P. – ŠVEC, P. Možnosti odľahčovania konštrukcií pomocou nových materiálov. In Magazín stavebné stroje a mechanizácia : odborný časopis o stavebných strojoch a mechanizácii. ISSN 1336-958X, 2011, roč. 6, č. 3, s. 42-44.

[40] JERZ, J. Platform innovmat supports industrial enterprises by application of advanced engineering materials. In MATRIB 2011: materials - tribology - recycling. - Zagreb: Hrvatsko društvo za materijale i tribologiju, 2011. ISBN 978-953-7040-19-2, p. 23.

[41] LAPIN, J. Current status of research and development in structural TiAl-based alloys. In TECHNOLÓGIA 2011. - Bratislava: STU, 2011. ISBN 978-80-227-3545-2, s. 3-21.

iii. **List of monographs/books published abroad:**

None

iv. List of monographs/books published in Slovakia:

Rozprávanie o materiáloch a technológiách. Editor Jaroslav Jerz. Bratislava: ÚMMS SAV, 2008. 182 p.

v. List of other scientific outputs specifically important for the Organisation
(normalization, standardization, maps, etc.:

As the Institute's research activities in assessed period were to a large extent performed within research contracts with industrial partners or in a frame of large research projects of the 6th and 7th FP EU (all included large industrial participation), many scientific results could not be published in open literature, because of existing non-disclosure agreements. These results however can be found in plenty of progress reports completed for industrial partners (Alulight, Eff-Power, Elektrokarbon, SAPA, etc.), as well as in technical reports for European Community.

vi. Table of research outputs

Research outputs	2007			2008			2009			2010			2011			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
chapters in monographs, books published abroad	1	0,029	1,57	0	0,000	0,00	1	0,029	1,40	0	0,000	0,00	0	0,000	0,00	2	0,4	0,012	0,58
chapters in monographs, books published in Slovakia	0	0,000	0,00	7	0,215	10,25	1	0,029	1,40	0	0,000	0,00	0	0,000	0,00	8	1,6	0,048	2,33
CC publications	13	0,375	20,44	18	0,553	26,35	22	0,635	30,77	9	0,280	12,91	24	0,706	34,33	86	17,2	0,512	25,07
scientific publications indexed by other databases (specify)	0	0,000	0,00	0	0,000	0,00	0	0,000	0,00	0	0,000	0,00	0	0,000	0,00	0	0,0	0,000	0,00
scientific publications in other journals	12	0,346	18,87	15	0,461	21,96	10	0,289	13,99	26	0,808	37,30	9	0,265	12,88	72	14,4	0,428	20,99
publications in proc. of international scientific conferences	26	0,749	40,88	23	0,707	33,67	24	0,693	33,57	23	0,715	33,00	32	0,941	45,78	128	25,6	0,762	37,32
publications in proc. of nat. scientific conferences	9	0,259	14,15	3	0,092	4,39	4	0,115	5,59	3	0,093	4,30	9	0,265	12,88	28	5,6	0,167	8,16
active participations at international conferences	44	1,268	69,18	51	1,567	74,67	49	1,414	68,53	47	1,461	67,43	54	1,588	77,25	245	49,0	1,458	71,43
active participations at national conferences	11	0,317	17,30	9	0,277	13,18	6	0,173	8,39	5	0,155	7,17	19	0,559	27,18	50	10,0	0,298	14,58

vii. List of registered patents

Registered and granted patents in assessed period:

[1] Method for strengthening a component consisting of a deformable cellular material, said component and the use thereof.
Inventors: SIMANČÍK, FRANTIŠEK – JERZ, JAROSLAV,
Applicant: Institute of Materials and Machine Mechanics SAS (SR).
Original application on 4. 4. 2003 - SK20030000425, Publication number: SK4252003
PCT application on 1. 4. 2004 - WO2004EP50419, JP20060505512T,
Publication number: WO2004087981, EP1611262, JP2006523536T
EP1611262 B1 granted: 16.5.2007
AT362554T T granted: 15.6.2007
DE502004003841D D1 granted: 28.6.2007
ES2285453T T3 granted: 16.11.2007

[2] Method and device for producing dimensionally accurate foam. (Production of foamed bodies, to accurate dimensions as lightweight structural components and panels, uses metal semi-finished powder metallurgy products to be heated in a mold with radiation to trigger foaming.)
Inventors: RAJNER, WALTER – SIMANČÍK, FRANTIŠEK,
Applicant: Alulight International GmbH Ranshofen (Austria.)
Original application on 25.3.2003 - DE20031013321 Publication number: DE10313321

PCT application on 25.3.2004 - WO2004EP03183, EP200407230198, CA20042519964, AT20040723198T, JP20060504866T
Publication numbers: WO2004085688, EP1608476, CA2519964, AT353260T, JP2006521467T
Status: DE10313321 patent granted 15.7.2004
JP2006521467T patent granted 21.9.2006
EP1608476 patent granted 7.2.2007
AT353260T patent granted 15.2.2007
US2007158877 A1 registered 12.7.2007

[3] High temperature nano composite aluminium alloy and method therefore
Inventors: HAYNES THOMAS G III [US]; WALCHER MARTIN [AT]; BALOG MARTIN [SK]
PCT application: WO2007US71233 20070614 (2008)
EP20070868308 20070614 (2009)

viii. Supplementary information and/or comments on the scientific output of the Organisation

It should be noted, that the publication activity in assessed period was strongly affected by the start of ERDF projects, which appeared inevitable for improvement of Institute's research infrastructure. Unfortunately preparation and implementation of such projects is coupled with enormous bureaucracy, which exhausted most of the vital resources of active researchers. IMSAS has applied for 22 ERDF projects in assessed period; in most cases IMSAS scientists and senior researchers actively contributed to preparation of such proposals. This had logical consequence in the reduction of their research and publication activities. It became extremely visible in year 2010, when most of such proposals were prepared. On the other side, new equipment purchased with the help of ERDF projects has already stipulated interesting new publications and in 2011 publication activity returned back to previous numbers.
The publications given in *part III.1 i* of this questionnaire were carefully selected to illustrate the broad spectrum of IMSAS activities and the wide range of actively contributing authors. Only publications with rather high impact factor (in average >1) in CC journals were selected and only those ones, where the main (first) author was IMSAS staff member.
It should be further noted that almost 90% of institute's research employees graduated in engineering (mostly mechanical engineering). Moreover, only 50% of them possess also higher scientific degree level and therefore tend more to the problem solving oriented research dealing mostly with technological problems and not to pure fundamental (curiosity driven) research. This attitude naturally leads to limited publication activity in open literature – the unique results are mostly transferred into comprehensive institute's know-how, which is used in many industrial projects. The quality of output of such research can be documented by successfully running unique serial applications and by constantly growing industrial interest for long term cooperation with institute.
In comparison with previous period the patenting activity of researchers was slightly reduced because of the strongly growing costs of currently active Institute's patents. More than 10 thousands eur are yearly spent for patent protection from own IMSAS resources and there is unfortunately no other financial possibility for new patent protection.

2. Responses to the scientific output

*Table **Citations** shows specified responses to the scientific outputs; these entries are then divided by the FTE employees with a university degree (from Tab. Research staff) for all Organisation at the respective year; finally these entries are divided by the total salary budget (from Tab. Salary budget).*

Citations	2006			2007			2008			2009			2010			total			
	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	No. / FTE	No. / salary budget	number	averaged number per year	av. No. / FTE	av. No. / salary budget
Web of Science	135	3,9	212,3	133	4,1	194,7	192	5,5	268,5	184	5,7	264,0	192	5,6	274,7	836	167,2	5,0	243,7
SCOPUS	8	0,2	12,6	17	0,5	24,9	25	0,7	35,0	74	2,3	106,2	47	1,4	67,2	171	34,2	1,0	49,9
(specify Database 1)	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0	0,0	0,0	0,0
in monographs, conf. proceedings and other publications abroad	18	0,5	28,3	12	0,4	17,6	12	0,3	16,8	0	0,0	0,0	22	0,6	31,5	64	12,8	0,4	18,7
in monographs, conf. proceedings and other publications in Slovakia	13	0,4	20,4	3	0,1	4,4	18	0,5	25,2	0	0,0	0,0	4	0,1	5,7	38	7,6	0,2	11,1

i. List of 10 top-cited publications from staff members since the establishment of the Organisation up to 2010 and number of their citations in the period 2006 - 2010

[1] MEAD, D.J. – MARKUŠ, Š. The forced vibration of three-layer, damped sandwich beam with arbitrary boundary conditions. In *Journal of Sound and Vibration.* ISSN 0022-460X, 1969, vol. 10, no. 2, p. 163–175. **Citations: 75**

[2] DROZD, Z. – TROJANOVÁ, Z. – KÚDELA, S. Deformation behaviour of Mg-Li-Al alloys. In *Journal of Alloys and Compounds*. ISSN 0925-8388, 2004, vol. 378, p. 192-195. **Citations: 51**

[3] LAPIN, J. – ONDRÚŠ, Ľ. – NAZMY, M. Directional solidification of intermetallic Ti-46Al-2W-0,5Si alloy in alumina moulds. In *Intermetallics.* ISSN 0966-9795, 2002, vol. 10, no. 10, p. 1019-1031. **Citations: 26**

[4] KOZA, E. – LEONOWICZ, M. – WOJCIECHOWSKI, S. – SIMANČÍK, F. Compressive strength of aluminium foams. In *Materials Letters.* ISSN 0167-577X, 2004, vol. 58, nos. 1-2, p. 132-135. **Citations: 26**

[5] KOVÁČIK, J. The tensile behaviour of porous metals made by GASAR process. In *Acta Materialia.* ISSN 1359-6454, 1998, vol. 46, no. 15, p. 5413–5422. **Citations: 21**

[6] MARKUŠ, Š. *The mechanics of vibrations of cylindrical shells.* Amsterdam: Elsevier, 1988. ISBN-13: 978-0444989109. **Citations: 21**

[7] LAPIN, J. – NAZMY, M. Microstructure and creep properties of a cast intermetallic Ti-46Al-2W-0.5Si alloy for gas turbine applications. In *Materials Science and Engineering A.* ISSN 0921-5093, 2004, vol. 380, nos. 1-2, p. 298-307. **Citations: 16**

[8] KORÁB, J. – ŠTEFÁNIK, P. – KAVECKÝ, Š. – ŠEBO, P. – KORB, G. Thermal conductivity of unidirectional copper matrix carbon fibber composites. In *Composites Part A.* ISSN 1359-835X , 2002, vol. 33, no. 4, p. 577–581. **Citations: 15**

[9] MATEJKA, D. – BENKO, B. *Plasma spraying of metallic and ceramic powders materials.* Chichester: John Wiley and Sons, 1989. 280 s. ISBN 978-0-471-91876-9. **Citations: 15**

[10] MEAD, D.J. – MARKUŠ, Š. Loss factors and resonant frequencies of encastré damped sandwich beams. In *Journal of Sound and Vibration.* ISSN 0022-460X, 1970, vol. 12, no. 1, p. 99-112. **Citations: 14**

ii. List of 10 top-cited publications from staff members published 2000 - 2010 and number of their citations in the period 2006 - 2010

[1] DROZD, Z. - TROJANOVÁ, Z. – KÚDELA, S. Deformation behaviour of Mg-Li-Al alloys. In Journal of Alloys and Compounds [serial]. - ISSN 0925-8388. - Vol. 378 (2004), p. 192-195. **Citations: 51**

[2] LAPIN, J. – ONDRÚŠ, Ľ. – NAZMY, M. Directional solidification of intermetallic Ti-46Al-2W-0,5Si alloy in alumina moulds. In *Intermetallics.* ISSN 0966-9795, 2002, vol. 10, no. 10, p. 1019-1031. **Citations: 26**

[3] KOZA, E. – LEONOWICZ, M. – WOJCIECHOWSKI, S. – SIMANČÍK, F. Compressive strength of aluminium foams. In *Materials Letters.* ISSN 0167-577X, 2004, vol. 58, nos. 1-2, p. 132-135. **Citations: 26**

[4] LAPIN, J. – NAZMY, M. Microstructure and creep properties of a cast intermetallic Ti-46Al-2W-0.5Si alloy for gas turbine applications. In *Materials Science and Engineering A.* ISSN 0921-5093, 2004, vol. 380, nos. 1-2, p. 298-307. **Citations: 16**

[5] KORÁB, J. – ŠTEFÁNIK, P. – KAVECKÝ, Š. – ŠEBO, P. – KORB, G. Thermal conductivity of unidirectional copper matrix carbon fibber composites. In *Composites Part A.* ISSN 1359-835X , 2002, vol. 33, no. 4, p. 577–581. **Citations: 15**

[6] LAPIN, J. Creep behaviour of a cast TiAl-based alloy for industrial applications. In *Intermetallics*. - Oxford : Elsevier Science Ltd. ISSN 0966-9795, 2006, vol. 14, no.2, p.115-122. **Citations: 13**

[7] KROPÁČ, Oldřich - MÚČKA, Peter. Be careful when using the International Roughness Index as an indicator of road unevenness. In *Journal of Sound and Vibration*. ISSN 0022-460 X, 2005, vol. 287, p. 989-1003. **Citations: 13**

[8] SIMANČÍK, F. – BEHULOVÁ, K. – BORŠ, L. Effect of ambient atmosphere on metal foam expansion. In *Cellular Metals and Metal Foaming Technology.* Brémy: MIT Verlag, 2001. ISBN 3-935538-11-1, p. 89-92. **Citations: 11**

[9] KÚDELA, S. Magnesium-lithium matrix composites – an overview. In *International Journal of Materials & Product Technology.* ISSN 0268-1900, 2003, vol. 18, nos. 1/2/3, p. 91-115. **Citations: 11**

[10] SEVOSTIANOV, Igor - KOVÁČIK, Jaroslav - SIMANČÍK, František. Elastic and electric properties of closed-cell aluminium foams Cross-property connection. In *Materials Science and Engineering A : Structural materials properties microstructure and processing*. - Lausanne : Elsevier Science SA. ISSN 0921-5093, 2006, vol. 420, p.87-99. **Citations: 10**

iii. List of top-cited authors from the Organisation (at most 10 % of the research employees) and their number of citations in the period 2006 - 2010

[1] Juraj LAPIN – 180
[2] Štefan MARKUŠ – 153
[3] Jaroslav KOVÁČIK – 136
[4] František SIMANČÍK – 129
[5] Stanislav KÚDELA St. – 110

iv. Supplementary information and/or comments on responses to the scientific output of the Organisation

Some citations are related to our former workers. In this case only citations of works that had been completed at the Institute are assigned.

It should be noted that to a positive response to Institute's research activities also belong:

- Long term research partnership with industrial partners (Aluligt 17 years, Effpower 11 years, Elektrokarbon 30 years, SAPA 12 years)
- Invitations in international (FP7) and national (ERDF) research consortia (see later)
- Offer to organise prestigious world congress on Cellular metals Metfoam 2009 in Bratislava
- Award of several prestigious prices (see later)
- 20 invited lectures to international conferences/scientific events during reported period
- grant of 8 international patents during reported period (based on 3 patent applications)

3. Research status of the Organisation in the international and national context

- **International/European position of the Organisation**

i. List of the most important research activities documenting international importance of the research performed by the Organisation, incl. major projects (details of projects should be supplied under Indicator 4). Provide the arguments why the selected projects are particularly important and represent the international position of the Organisation).

Main research activities of IMSAS and obtained results in reported period were in more details presented in the Chapter II of this questionnaire.
As can be seen Institute has an ambition to be competitive at least on European level. Therefore almost all research work is performed within bilateral or multilateral international cooperation with recognised research institutions as well as with leading industrial partners.
The main research topics, where IMSAS activities can be considered as internationally fully competitive are:

[1] Metal matrix composites and technologies for their manufacturing

In this field the international competence of IMSAS was recognized by the participation in three major EU projects:

- **Integrated large project ExtreMat** within 6th FP EU, involving 38 research organisations in the development of special materials aimed to work under extreme environmental conditions (high temperature, irradiation, large mechanical and thermal stresses, chemical attack etc.). Institute played one of the leading roles in the consortium, i. e. coordination of one of 4 subprojects, namely SP2: “Heat sink materials” devoted to the development of highly conductive MMC able to work at elevated temperatures for applications in power electronics, microelectronics or in fusion reactor. In SP2 (EC funding ~ 5 mil. €.) IMSAS coordinated 16 partners, whereas most of them also closely cooperated directly with IMSAS researchers and belongs among well recognized R&D organizations such as ARCS - Austrian Research Centre Seibersdorf, CEIT - San Sebastian, DLR – Bonn, EADS – Ottobrun, EMPA - Thun, EPFL - Lausanne, FZJ – Jülich, IFAM FhG - Dresden, INASMET-San Sebastian , IPP-Max Planck - Garching, Plansee AG - Reutte, Siemens AG - Munich, TU-Vienna, TU-Warsaw, University of Alicante.
- **7th FP EU Siltrans** (priority NMP) devoted to the development of novel composites based on silicide matrix reinforced with percolating refractory skeleton for high temperature applications, beyond possibilities of currently used Ni superalloys. IMSAS initiated this project (EC funding ~ 3 mil. €) and is the **principal coordinator** of 7 partners: EADS – Ottobrun, EPFL - Lausanne, IFAM FhG - Dresden, TU-Vienna, ATL Ltd (UK), Kochanek GmbH (D), Cleanair GmbH (A).
- **7th FP EU Matrans** (priority NMP, 18 partners, EC funding ~ 3,5 mil. €) devoted to the development of novel composites based on copper and NiAl matrices for automotive applications (brakes, engine valves). IMSAS is important partner providing demonstrator samples for industrial testing. Main partners are Centro Richerche Fiat, TU Darmstadt, TU Warsaw, EADS – Ottobrun, IFAM FhG - Dresden.

Beside research activities within EU framework programme IMSAS activities in MMC’s have been devoted also to bilateral (contractual) cooperation with industrial partner EFF - Power, Sweden aimed in the development of ceramic/lead composites by the melt infiltration process for the battery applications. This cooperation is successfully lasting from 1999, bringing substantial financial support to IMSAS, supplementary to public funding.

IMSAS has got an invitation to join a consortium in current NMP call in 7th FP EU for preparation of research proposal for the project ULTRARODES aimed in the development of MMCs for special electrodes for plasma drilling or waste treatment. Proposal was successfully evaluated in 1st stage and consortium was invited to submit full size proposal in 2nd stage.

[2] Intermetallic alloys for high-temperature applications

Similarly as in previous case IMSAS played an important role in a frame of another integrated project IMPRESS of the 6th FP EU. Up to 45 research organizations from 15 EU countries were involved in this project anchoring thus the research in the solid base of ERA. IMSAS coordinated the workpackage WP 2a: “Fundamentals of solidification on earth and space” (6 partners, funding: 1,300.000,- €) The most important and closely cooperating research partners included: European Space Agency (NL); Leibnitz Inst. for Solids and Mat. Research, Dresden (D); Inst. Nat. Polytech. Lorraine (F); University of Cambridge (UK); Inst. of Structural and Macrokinetics and Mat. Sci., Moskow (RUS); EPFL Lausanne (CH), DLR Bonn (D); IRC - University of Birmingham, (UK); IFAM FhG Bremen (D); etc.
Results obtained in the research on intermetallics were frequently exchanged and discussed also in a frame of COST project No. 538 “Evolution and degradation of microstructure of CMSX4 superalloy during ageing and creep exposure”
IMSAS participates also on running international research project with European Space Agency (NL) entitled "Gravity Dependence of CET in Peritectic TiAl Alloys". The cooperating research partners include Access e.V., RWTH-Aachen, Aachen (D); Ecole des Mines de Nancy, Institut Jean Lamour, SI2M, Nancy (F); Deutsches Zentrum für Luft- und Raumfahrt, Institut für Materialphysik im Weltraum, Köln (D); Dublin Institute of Technology, Dublin, (IE); Research Institute for Solid State Physics and Optics, Hungarian Academy of Sciences, Budapest (H).

[3] Research on metal foams

In this field IMSAS contractually cooperates mainly with foreign industrial partners in a frame of exclusive long term research projects:

- Development of powder metallurgical (PM) aluminium foams Alulight (bilateral cooperation with ALULIGHT-International, Ltd., Ranshofen, Austria and Mepura, Ltd., Ranshofen since 1993)
- Development of structural components using aluminium foam ALPORAS and investigation of their application possibilities (bilateral cooperation with GLEICH GmbH Metallplatten-Service, Kaltenkirchen, Germany)

In the research on aluminium foams IMSAS belongs to leading European institutions, what can be illustrated e.g. by many invitations to most important international conferences (among them 3 opening plenary lectures) and more than 20 granted international patents. As recognition of leading position, IMSAS was invited to organise prestigious world congress on cellular materials Metfoam 2009 in Bratislava. IMSAS also significantly contributed to the development of several original serial applications of aluminium foam (profile stiffener in Ferrari Modena, crash absorber in Audi Q7, crash box for railway carriages). The last two mentioned applications were awarded by prestigious “Application award for best industrial application of cellular metal” at international conference Cellmet 2008 (prize for IMSAS) and 2010 (prize for Alulight).

[4] Research on powder based aluminium materials with enhanced structural stability at high temperatures

The research on PM aluminium alloys at IMSAS is rather new, nevertheless the obtained results has already attracted larger international interest. The main research activities aimed to develop bulk nanostructured aluminium components with unique properties were performed within 6th FP EU MNT ERANET project Hightemal, where IMSAS coordinated 5 partners from Austria and Slovakia. The project was evaluated as MNT ERANET success story in 2011. Strong industrial cooperation with Austrian company New Materials Development Ltd and SAPA profily has been launched with excellent research output - large serial application of stator rings for camshaft phaser of BMW engine, or testing piston prototypes for F1 racing car.

ii. List of international conferences (co-) organised by the Organisation

[1] International Conference "MATRIB 2007 - Materials, Tribology, Processing", 21st - 23rd June 2007, Vela Luka, Croatia.

[2] International Conference "MATRIB 2008 - Materials, Tribology, Processing", 26th - 28th June 2008, Vela Luka, Croatia.

[3] Seminar for PhD Students (IMMM SAS Bratislava, TU Vienna, Montanuniversität Leoben, Eötvös Loránd University Budapest), 2nd - 3rd October 2008, Bratislava.

[4] International Conference "MATRIB 2009 - Materials, Tribology, Processing", 24th - 26th June 2009, Vela Luka, Croatia.

[5] 6th International Conference on Porous Metals and Metallic Foams "MetFoam 2009", 1st – 4th September 2009, Bratislava, Hotel Park Inn.

[6] International Conference "MATRIB 2010 - Materials, Tribology, Processing", 23rd - 25th June 2010, Vela Luka, Croatia.

[7] 1st International Conference on Mechanical Technology and Structural Materials 2010, 21st - 22nd October 2010, Split, Croatia.

[8] International Conference "MATRIB 2011 - Materials, Tribology, Processing", 29th June - 1st July 2011, Vela Luka, Croatia.

[9] 2nd International Conference on Mechanical Technology and Structural Materials 2011, 29th - 30th September 2011, Split, Croatia.

[10] Workshop Materials and Technologies for Lightweight Design, INNOVMAT, 13th - 14th December 2011, Smolenice.

iii. List of international journals edited/published by the Organisation

[1] **Kovové materiály-Metallic Materials,**
Journal publishes original and experimental works devoted to structure, properties and processing of metallic and selected non-metallic materials
published since: 1963 bimonthly, ISSN: 0023-432X,
language: English,
cited by: Materials Science Citation Index (MSCI), Institute for Scientific Information, Philadelphia, USA, Impact Factor (ISI Journal Citation Reports 2007: 1.138 and 2010: 0.471),
URL: http://www.kovmat.sav.sk/.

[2] **Strojnícky časopis - Journal of Mechanical Engineering,**
The Journal is dedicated entirely to the full range of science and technology associated with machine dynamics,
published since: 1950 bimonthly, ISSN: 0039-2472,
language: Slovak/Czech and English,
scaned by: Shock and Vibration Digest, Sage Publications, Inc., Thousand Oaks, CA, U.S.A a Applied Mechanics Reviews (Journal of the American Society of Mechanical Engineers), Fairfield, NJ, U.S.A.),
URL: http://www.strojcas.sav.sk/.

[3] **Powder Metallurgy Progress,**
Journal of science and technology of particle materials, published by Institute of Materials Research SAS Košice, Institute of Materials & Machine Mechanics SAS and Miba Slovakia, s.r.o., Dolný Kubín.
URL: http://www.imr.saske.sk/umv/pmp.htm.

iv. List of edited proceedings from international scientific conferences and other proceedings

[1] Porous Metals and Metallic Foams: proceedings of the 6th international conference on Porous Metals and Metallic Foam. Editors: František Simančík and Jaroslav Jerz. Bratislava: Institute of Materials & Machine Mechanics SAS, 2011. S.629. ISBN 978-80-970771-0-5.

- **National position of the Organisation**
- **List of selected most important national projects (provide the arguments why the selected projects are particularly important and represent the international position of the Organisation)**

The most important projects representing the national position of IMSAS in assessed period are undoubtedly the ERDF projects. IMSAS has created and now coordinates two major national consortia devoted to the development of lightweight structural materials and composites:

- Scientific ***Centre of excellence "CEKOMAT*** for the research and development of structural composites for engineering, construction and medical applications", comprising 5 SAS institutes and Slovak University of Technology – the main research activities are located in Bratislava and their general objective is to create state-of-the-art research infrastructure and excellent competencies in preparation, characterisation and testing of advanced MMCs, with strong focus on simulation and modelling activities.
- Application oriented ***Centre of Competency INOVAL*** – for applied research on light metals and composites, comprising 12 partners among them University of Zilina, Technical University Kosice and 9 important industrial partners working in aluminium and related sectors (SAPA Profily, Fagor, Thermosolar, Spinea, Matador Automotive, SlCP, Esox, Tuvatech). The centre is located in Žiar nad Hronom in the region with highest importance for research on aluminium in Slovakia (more than 40 potential industrial partners have been identified so far). The Centre should serve as the incubator for efficient transfer of research results into the praxis. Some strategic bilateral partnerships with industry have already been launched. The main objective of INOVAL is to develop the competencies for lightweight construction, modelling and simulation of temperature fields and mechanical stresses, usually arising during manufacturing of Al-based components. The efficient recycling of aluminium scrap is addressed as well.

IMSAS is also a partner in the "***Competency Centre for new materials, advanced technologies and energy***", located in Bratislava, where its main objective is to develop original non destructive techniques for characterisation and testing of power plant components including estimation of their endurance limits. The Centre comprises main global players in energy sector in Slovakia, incl. ENEL, EON, Siemens, etc.
An interesting ERDF project has been launched in mutual cooperation of four SAS institutes and Slovak Technical University under coordination of the Institute of Technology SAS. The project ENERGOZ is oriented to study effective management of production and consumption of renewable energy. For this purpose a smartgrid laboratory equipped with 30kW photovoltaic power station, concentrated thermosolar panels, heat pumps for conversion of geothermal energy from 4 drilled 100 m deep holes, heat storage vessels and advanced control units will be built in the experimental hall of IMSAS. For Institute this will create an extraordinary possibility to build up the unique competency in this rapidly developing and very important research field. The orientation of future institute's research activities towards the research on advanced materials for the efficient use of renewable energy is thus foreseen.

Beside mentioned major projects IMSAS participates also in several ERDF bilateral projects as partner for national industry. The projects are mostly aimed in the innovation of various industrial components and technologies (the detailed list is given in Chapter 4)
Altogether IMSAS has proposed 22 ERDF projects in assessed period: 11 were successfully launched, 3 are still under evaluation, 2 were rejected due to formal errors and 6 were not ranked for funding.

Beside ERDF projects IMSAS was also participating in many APVV projects (full list is in Chapter 4). The most important among them were:

- ***Lowcostfoam*** - aimed in development of industrially and economically feasible technology for the production of complex aluminium foam components
- ***Wallfoam*** - aimed in the development of unique heating/cooling panels made of aluminium foam
- ***Intermatex*** – aimed in the development of unique intermetallic materials and technologies for their manufacturing (vacuum and plasma melting)

- ***Ultralight*** – aimed in the development of lightweight stiff structures based on novel complex Al alloys, composites and foams
- ***Soperti*** – aimed in the research on solidification and properties of novel peritectic TiAl - based alloys
- ***Nanohardcoat*** – aimed in the development of novel ultra hard nanocomposite TiB_2 based coatings

Two important bilateral projects funded directly by industry need to be added to this selection:
- project with Elektrokarbon a.s., Topolcany aimed in the development of graphite based composites for sliding contacts for trolley vehicles, which has finished with successful delivery of world unique infiltration technology for serial production of developed components
- project with SAPA Profily a.s., Žiar nad Hronom aimed in the development of extruded aluminium PM materials, which has finished with successful world unique serial production of lightweight camshaft phasers for BMW engine

Both mentioned projects started strategic partnership between IMSAS and important national industrial partner and significantly contributed to the positive IMSAS and also SAS reputation in Slovak population.

- **List of national scientific conferences (co)-organised by the Organisation**

[1] 12th International Acoustic Conference *"Noise and vibration in practice"*, 4th - 5th June 2007, Kočovce.

[2] International Conference „Nanoved 2007", 11th - 14th November 2007, Bratislava.

[3] Workshop: "*Spájanie materiálov"*, 5.6.2007, Bratislava.

[4] Workshop: "*Nové materiály s výnimočnými fyzikálnymi vlastnosťami pre elektrotechniku"*, 3.4.2007, ÚMMS SAV, Bratislava.

[5] Training course focuses on modern principles for designing of machine components and constructions with support of software Cambridge Engineering Selector, IMSAS, 12.4.-14.6.2007 (10 lessons).

[6] 13th International Acoustic Conference *"Noise and vibration in practice"*, 2nd - 3rd June 2008, Kočovce.

[7] Workshop: "*Konštrukčné povlaky a renovácie súčiastok",* 5.2.2008, IMSAS, Bratislava.

[8] Workshop: "*Konštrukčné materiály pre vysokoteplotné aplikácie*", 26.2.2008, IMSAS, Bratislava.

[9] Workshop: "*Progresívne metódy štúdia mikroštruktúry materiálov"*, 18.4.2008**,** IMSAS, Bratislava.

[10] Training course focuses on modern methods for designing of structural components and structures with support of software Cambridge Engineering Selector, IMSAS 7.2.-10.4.2008 (10 lessons – I. stage), 17.4.–3.7.2008 (10 lesons – II. stage), IMSAS, Bratislava.

[11] 14th International Acoustic Conference *"Noise and vibration in practice"*, 1st - 2nd June 2009, Kočovce.

[12] 15th International Acoustic Conference *"Noise and vibration in practice"*, 31st May - 1st June 2010, Kočovce.

[13] 16th International Acoustic Conference *"Noise and vibration in practice"*, 30th - 31st May 2011, Kočovce.

[14] Workshop: "*Použitie moderných NDT metód vo výskume nových materiálov v rámci centra CEKOMAT"*, 17.02.2011, Bratislava.

[15] Workshop: "Predstavenie analytického elektrónového mikroskopu JSM-7600F/EDS/WDS/EBSD", 15.11.2011, Bratislava.

[16] Conference: TransferTech, Hotel Sitno, Vyhne, 29.11.-30.11.2011

- **List of national journals published by the Organisation**
  None

- **List of edited proceedings of national scientific conferences/events**

  Použitie moderných nedeštruktívnych meracích metód vo výskume nových materiálov v rámci centra excelentnosti CEKOMAT. Editori M. Hain, K. Karovič, J. Jerz. Bratislava: Ústav merania SAV, 2011. 100 s. ISBN 978-80-969672-3-0.

- **International/European position of the individual researchers**

i. List of invited/keynote presentations at international conferences, documented by an invitation letter or programme

[1] IŽDINSKÝ, K. Long fibre reinforced composites for advanced thermal management applications. In *2nd KMM-NoE Integration Conference*, Vienna, 24-25 October, 2007.

[2] SIMANČÍK, F. MMC-Lösungen für Kühlkőrper. In *16. Symposium: Verbundwerkstoffe Werkstoffverbunde,* Bremen, 14-16 March, 2007.

[3] SIMANČÍK, F. MMC solutions for novel heat sink materials. IN *2nd KMM-NoE Integration Conference*, Vienna, 24-25 October, 2007.

[4] JERZ, J. - KOŠÚT, J. The importance of effective knowledge transfer of modern engineering materials and advanced technologies into the industrial praxis. *In ICERI 2008 International Conference of Education, Research and Innovation*, Madrid, Spain, 17-19 November 2008.

[5] SIMANČÍK, F. Improvement of structural stability of ultrafine grain metals via strengthening of grain boundaries. In *WUT – NIMS – EMPA Workshop on Nanomaterials for Energy and Environment Protection*, Warsaw, 16-17 June 2008.

[6] SIMANČÍK, F. PM foams. In *Design and Capabilities of PM Components and Materials,* Acqui Terme, Italy, 21-29 June, 2008.

[7] IŽDINSKÝ, K. Problematika štúdia štruktúry progresívnych konštrukčných materiálov. Nanotechnologické aplikace přístrojů částicové optiky. TESCAN Performance in Nanospace. Brno, 19 August 2009.

[8] LAPIN, J. TiAl-based alloys: present status and future perspectives. In *International Conference METAL 2009*. Červený zámek, Hradec nad Moravicí, Czech Republic.

[9] LAPIN, J. - GABALCOVÁ, Z. - PELACHOVÁ, T. - BAJANA, O. Microstructure and Mechanical Properties of a Cast Intermetallic Ti-46Al-8Ta Alloy. In *THERMEC 2009 - International Conference on Processing & Manufacturing of Advanced Materials*, Berlin, Germany, 25-29 August 2009.

[10] SIMANČÍK, F. Recent Developments in Manufacturing and Use of Foamed Metals. In *EUROMAT 2009*, 7-10 September 2009.

[11] SIMANČÍK, F. Situation in Slovakia, In *International conference organized in the frame of project CERIM (Program Interreg Central Europe)*, Bratislava, 6 May 2009.

[12] SIMANČÍK, F. - FLOREK, R. - NOSKO, M. - TOBOLKA, P. – HARNÚŠKOVÁ, J. - ADAMČÍKOVÁ, A. New manufacturing route for cheaper aluminium foam. In *Cellmat 2010, International Conference on Cellular Materials,* Dresden, Germany, 27-29 October, 2010.

[13] SIMANČÍK, F. Advanced metallic materials developed by IMMM SAS, In Innovation and Technology Forum, Istanbul, Turecko, 3 November 2010.

[14] LAPIN, J. Solidification behaviour of TiAl-based alloys studied by directional solidification technique. In *TiAl Meeting*, Birmingham, UK, 12-14 May 2010.

[15] LAPIN, J. Creep behaviour of a new air-hardenable intermetallic Ti–46Al–8Ta alloy. In *TiAl Meeting*, Birmingham, UK, 12-14 May 2010.

[16] JERZ, J. Modern Engineering Materials for Design of Sustainable Products. In *1st International Conference on Mechanical Technology and Structural Materials 2010*, Split, Croatia, 21-22 October, 2010.

[17] JERZ, J. Platform INNOVMAT Supports Industrial Enterprises by Application of Advanced Engineering Materials. In *International Conference MATRIB 2009 - Materials, Tribology, Processing*, 29 June - 1 July 2011, Vela Luka, Croatia.

[18] JERZ, J. Knowledge transfer in the field of advanced engineering materials in the region Vienna – Bratislava. Summer School organized by the Austrian Economic Chamber, Melk, Austria, 28 July 2011.

[19] LAPIN, J. Microstructure evolution during solidification and solid phase transformations in TiAl-based alloy. In *4th International Workshop on Titanium Aluminides*, 13-16 September 2011, Nuremberg, Germany.

[20] LAPIN, J. Mechanical behaviour of Ti-46Al-8Ta alloy. In *4th International Workshop on Titanium Aluminides*, 13-16 September 2011, Nuremberg, Germany.

ii. List of employees who served as members of the organising and/or programme committees for international conferences

[1] Dr. František Simančík
- coordinator of the symposium B41 „Heat Sink and High Temperature Composites“, EUROMAT 2007 - European Congress on Advanced Materials and Processes, Nürnberg, Germany, 10-13 September 2007.
- chairman of the session 1C “Foaming I”, 5th International Conference on Porous Metals and Metallic Foams METFOAM 2007, Montreal, Kanada, 5-7 September 2007.
- member of the programme committee and session chairman, International Conference New Materials for Extreme Environments EXTREMAT 2008, San Sebastian, Spain, 2-4 June 2008.
- member of the programme committee and session chairman, International Conference CELLMET 2008, Dresden, Germany, 8-10 October 2008.
- coordinator of the 6th International Conference on Porous Metals and Metallic Foams METFOAM 2009, Bratislava, 1-4 September 2009.
- member of the programme committee of the 7th International Conference on Porous Metals and Metallic Foams METFOAM 2011, Busan, Korea, 18-21 September 2011.
- member of the programme committee of the annual International Conferences MATRIB - Materials, Tribology, Processing, Vela Luka, Croatia (2007-2011).
- member of the programme committee of the International Conferences MTSM – Mechanical Technologies and Structural Materials, Split, Croatia (2010 – 2011).

[2] Ing. Juraj Lapin, DrSc.
- member of the programme committee of the 11th International Symposium on Physics of Materials (ISPM), Praha, Czech Republic, 24-28 August 2008.
- member of the programme committee of the 12th International Symposium on Physics of Materials (ISPM), Praha, Czech Republic, 2011.
- member of the programme committee of the 3rd International Symposium on Advances in Solidification Process (ICASP-3), Aachen, Germany, 2011.

[3] Dr. Ing. Jaroslav Jerz
- chairman of the session „Knowledge Management”, International Technology, Education and Development Conference - INTED 2008, Valencia, Spain, 3-5 March 2008.
- member of the scientific advisory board and chairman of the session „Knowledge Management & Business Intelligence”, International Conference of Education, Research and Innovation - ICERI 2008, Madrid, Spain, 17-19 November 2008.

- member of the programme committee of the annual International Conferences MATRIB - Materials, Tribology, Processing, Vela Luka, Croatia (2007 – 2011).
- member of the programme committee of the International Conferences MTSM – Mechanical Technologies and Structural Materials, Split, Croatia (2010 – 2011).

[4] Ing. Ivan Kramer
- member of the steering committee of the International Conference MATRIB 2007 - Materials, Tribology, Processing, Vela Luka, Croatia, 21-23 June 2007.

iii. List of employees who served as members of important international scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

[1] Ing. Vladimír Kliman, DrSc.
- member of the European Structural Integrity Society (2007-2011)
- member of editorial board of the journal Strojnícky časopis (2007 - 2011)

[2] RNDr. Pavol Šebo, DrSc.
- national delegate in the EU COST programme MP 0602: Advanced Solder Materials for High Temperature Application (2007 - 2008)
- member of editorial board of the journal Kovové materiály-Metallic Materials (2007 - 2011)

[3] Doc. Ing. Jozef Čačko, DrSc.
- member of the European Structural Integrity Society (2007-2011)
- member of the International Advisory Board, Centre of Excellence in Structural Integrity, TU Opole, Poľsko (2007-2011)

[4] Ing. Vladimír Oravský, PhD.
- member of the international IFToMM Commission A (2007 - 2011)
- member of the Vibration Institute of India (2007-2011)

[5] Ing. Juraj Stein, PhD.
- member of the International Institute of Acoustics and Vibration, USA (2007 - 2011)
- member of the European Mechanics Society (EUROMECH) (2007 - 2011)
- member of editorial board of the journal Strojnícky časopis (2007 - 2011)

[6] RNDr. Erich Wiszt, PhD.
- member of the Central European Associations for Computational Mechanics (CEACM) (2007 - 2008)

[7] Ing. Oldřich Šlížek
- member of the Central European Associations for Computational Mechanics (CEACM) (2007 - 2008)

[8] Ing. Juraj Lapin, DrSc.
- expert of the EU commission for the evaluation of 7 FP (2007 - 2011)
- editor-in chief of the journal Kovové materiály-Metallic Materials (2007 - 2011)
- member of editorial board of the journal Acta Metallurgica Slovaca (2009 - 2011)
- member of the Materials Research Society (2011)
- member of the Society for New Materials and Technologies (2011)
- member of the Minerals, Metals and Materials Society (2011)

[9] Dr. Ing. František Simančík
- independent expert in the programme committee of 6 FP of EU Integrating and Strenhtening the ERA (2007 - 2009)
- member of editorial board of the journal Kovové materiály-Metallic Materials (2007 - 2011)
- member of editorial board of the journal Zváranie - Svařování (2007 - 2011)
- member of editorial board of the journal Powder Metallurgy Progress (2007 - 2011)

[10] RNDr. Ing. Stanislav Kúdela, PhD.
- member of editorial board of the journal Kovové materiály-Metallic Materials (2007 - 2011)

[11] Ing. Vladimír Giba, PhD.
- editor-in chief of the journal Strojnícky časopis (2007 - 2011)
- member of editorial board of the journal Zvárač (2007 - 2010)

[12] Ing. Marek Gebura, PhD.
- editor-in chief of the internet journal Materials Engineering/Materiálový inžinier (2009 - 2011)

iv. List of international scientific awards and distinctions

[1] IMSAS – „Application Award"- International Conference CELLMET 2008, Dresden, Germany, 8-10 October 2008.

[2] IMSAS – "Transnational Success Stories 02 - MNT ERANET" by Steering Committee of MNT ERANET in 2011 for the project "Nanostructured aluminium profiles for high temperature applications" (HIGHTEMAL) - Project of 6th FP EU MNT ERANET (2007-044-SK41).

- **National position of the individual researchers**

i. List of invited/keynote presentations at national conferences documented by an invitation letter or programme

[1] SIMANČÍK, F. PM foams. In *PM Summer school 2007*, Košice, 23 June – 1 July, 2007.

[2] BALOG, M. - SIMANČÍK, F. ECAP as a technique for consolidation of rapidly solidified Al based particles. In *Deformation and Fracture in Structural PM Materials*, *DFPM 2008*, Stará Lesná, October 19-22, 2008.

[3] MIKULA, M. - GRANČIČ, B. - VÁVRA, I. - ŠATKA, A. - BURŠÍKOVÁ, V. - KÚŠ, P. Tvrdé a supertvrdé vrstvy pripravené PVD technológiami. *51. medzinárodná galvanická konferencia*, Gabčíkovo, 16-17 June, 2009.

[4] SIMANČÍK, F. - ŠAJGALÍK, P. Nové materiály a technológie pre moderné konštrukcie. *Konferencia Veda politika a štát*, Bratislava, 26. 11. 2009.

[5] JANÍČEK, F. - LAPIN, J. Tradičné a alternatívne zdroje energie. *Konferencia Veda politika a štát*, Bratislava, 26. 11. 2009.

[6] SIMANČÍK, F. Manažment tvorby a využívania technológií a techniky - ich vplyv na výrobu produktov uspokojujúcich potreby ľudí, zamestnanosť a prírodu. *Konferencia Súčasné a budúce úlohy manažmentu*, Bratislava, 25. 3. 2009.

[7] SIMANČÍK, F. Vysokopevné materiály v automobilovom priemysle, kovy, plasty, kompozity. *Medzinárodná konferencia CEAI*, Žilina, 12.-13. 5. 2009.

[8] SIMANČÍK, F. Comercialization of the research results at IMSAS, *Záverečná konferencia projektu 7. RP EÚ "Emergence of Research Driven Clusters in the Central Europe"*, Bratislava, Hotel Tatra, 24.5.2010.

[9] SIMANČÍK, F. Lecture about R&D activities of IMSAS on meeting with delegation of Taiwan scientists led by Taiwan Minister of Science prof. L.C.Lee, ÚACH SAV, Bratislava, 7.9.2010.

[10] SIMANČÍK, F. Nové ľahké materiály pre moderné konštrukcie. *Výstava Chemistry Slovakia/CARplast*. 14.04.2011, Incheba, Bratislava.

[11] SIMANČÍK, F. Podnikanie, inovácie a kvalita života; Kritériá výberu materiálov a technológií pre inovatívne strojárske konštrukcie; Nové materiály a technológie. *Konferencia „Komplexný rozvojový program pre manažérov - Moderný priemysel & product"*; 13.7.2011, training center of KIA Slovakia, Gbeľany.

[12] SIMANČÍK, F. - OSLANEC, P. Od výbuchu k sériovej výrobe komponentov pre BMW. *Konferencia „Príklady dobrej praxe výskumnej spolupráce akademickej a priemyselnej sféry"*. 14.9.2011, CVTI, Bratislava.

[13] SIMANČÍK, F. Nebojme sa koordinovať projekty 7 RP EU. *Konferencia „Príklady dobrej praxe výskumnej spolupráce akademickej a priemyselnej sféry“*. 14.9.2011, CVTI, Bratislava.

[14] SIMANČÍK, F. INOVAL – Inovačné centrum Slovenskej akadémie vied pre technológie spracovania hliníka a výrobkov z neho. *Informačný deň na podporu inovácií v Banskobystrickom kraji*. 29.9.2011, TU Zvolen.

[15] SIMANČÍK, F. Possibilities for weight reduction of automotive structures using advanced materials. *Siemens PLM Automotive Forum*, 13.10.2011 Bratislava.

[16] SIMANČÍK, F. Inovácie výrobkov a procesov jediná cesta k zvyšovaniu kvality života. *Konferencia Strojárstvo 2011 – Stav a perspektívy*. 20.10.2011, STU, Bratislava.

[17] SIMANČÍK, F. Centrum excelentnosti na výskum a vývoj konštrukčných kompozitných materiálov pre strojárske, stavebné a medicínske aplikácie. *Konferencia ASFEÚ - EUROPROJEKT 2011*, 25. 10. 2011, Častá-Papiernička.

[18] SIMANČÍK, F. Innovations of products and processes- the only way for sustainable quality of life. *Inovačný deň platformy INNOVMAT: „New Materials & Material Technologies“*, 21.11.2011, Bratislava.

[19] SIMANČÍK, F. Factors influencing the development of advanced metallic materials. *Inovačný deň platformy INNOVMAT: „New Materials & Material Technologies“,* 21.11.2011, Bratislava.

[20] JERZ, J. INNOVMAT – Platform for Transfer of Knowledge Aimed at the Application of Advanced Engineering Materials in the Region of Vienna – Bratislava. *Inovačný deň platformy INNOVMAT: „New Materials & Material Technologies“*, 21.11.2011, CVTI, Bratislava.

[21] JERZ, J. Advanced Engineering Materials for Production of Innovative Products with Extremely High Added Value. *5. Slovenská kooperačná burza*, 22.10.2011, Žilina (v rámci panelovej diskusie: „Inovatívny automobilový priemysel – E-Mobility – Trendy a príležitosti“).

[22] JERZ, J. Podpora konkurencieschopnosti priemyslu zvyšovaním záujmu o štúdium materiálového inžinierstva. *Konferencia „Quo Vadis vzdelávanie k vede a technike na stredných školách 2011“*, 7. – 9. 11. 2011, Technopol, Bratislava.

[23] LAPIN, J. Current status of research and development in structural TiAl-based alloys. In *12th International Conference TECHNOLOGY 2011*, 13.9.2011, STU, Bratislava.

ii. List of employees who served as members of organising and programme committees of national conferences

[1] Dr. Ing. František Simančík
- co-chairman of the International Conference NANOVED 2007, Bratislava, 11-14 November 2007.
- member of the programme committee of International Acoustic Conference “Noise and vibration in practice”, Kočovce (2007-2011)
- member of the programme committee of International Conference TECHNOLOGY, Bratislava (2007-2011)
- member of the advisory board of the Conference Deformation and Fracture in Structural PM Materials, DFPM 2011, Stará Lesná, 6-8 November 2011.

[2] RNDr. Pavol Šebo, DrSc.
- expert guarantee of the session „Metallic and non-metallic materials“, International Conference TECHNOLOGY 2007, Bratislava, 19-20 September 2007

[3] Ing. Pavol Štefánik, PhD.
- member of the steering committee of 16. expert seminar meeting „Metal science in teaching of materials “,11-13 June 2007, Smolenice

iii. List of employees serving in important national scientific bodies (e.g. boards, committees, editorial boards of scientific journals)

[1] Doc. Ing. Jozef Čačko, DrSc.
- member of technical board - TK 71- Applications of statistical methods (2007 - 2008)

[2] Ing. Juraj Stein, PhD.
- member of the Slovak National Committee IMEKO, TC22 “Vibration Measurement” (2011)
- member of technical board - TK 21- Acustics and vibrations (2007 - 2011)

[3] Ing. Oldřich Šlížek
- member of technical group of regional node of SANET in Martin (2007 - 2008)

[4] RNDr. Ján Kudlička, CSc.
- member of technical board - TK 71 - Applications of statistical methods in quality control (2007 - 2008)

[5] Prof. Ing. Igor Ballo, DrSc.
- member of the Slovak National Committee of IFToMM (2007)

[6] Ing. Juraj Lapin, DrSc.
- member of Board for participation of SR on collaboration with European Space Agency established at Ministry of education SR (2009)
- deputy chairman of the Board for participation of SR on collaboration with European Space Agency established at Ministry of Education, Science, Research and Sport of the SR (2010 - 2011)
- member of the Commission to review applications for incentives for research and development at Ministry of Education, Science, Research and Sport of the SR (2010 - 2011)
- member of scientific board SAS (2009 - 2011)
- deputy chairman of SAS for the I. department of sciences of SAS (2009 - 2011)
- member of Ad hoc board for working-out of new organisational structure of P SAS (2009)
- member of Ad hoc board for issues of suitable economic model of SAS (2009)
- member of Board of SAS for economic questions (2009 - 2011)
- member of Board of SAS for equal opportunities (2009 - 2011)
- member of Board of SAS for collaboration with universities (2009 - 2011)
- member of Board of SAS for science policy and forcasts of science and society development (2009 - 2011)
- member of Jury for International award of SAS (2009 - 2011)
- member of Council of programe of centres of excelence SAS (2009 - 2011)
- member of Council of SAS for education and doctoral study (2009 - 2011)
- member of Damage Board of SAS (2009 - 2011)
- chaiman of Board of SAS for space activities (2010 - 2011)
- deputy chirman of Board of VEGA No. 5 for machinery, metalurgy and material engineering (2007)

[7] Dr. Ing. František Simančík
- member of the committee High level group ManuFuture SK – Ministry of Economy SR (2009 - 2011)
- member of committee of Slovak society for new materials and technologies which is member of European society FEMS (2008 - 2011)
- member of the Council of the Slovak R&D Agency for program R&D for SMEs (2007 - 2011)
- member of Council of evaluators of applied research projects of Ministry of education SR (2007 - 2011)
- member of Objector council for evaluation of Ministry of education projects directed to offering of stimuli for R&D (2011)
- member of Scientific advisory board of SAS for electronics, material research and technologies (2007 - 2011)

- member of Ad hoc board for new economic model of SAS (2009 - 2011)

[8] Ing. P. Štefánik, PhD.
- controller of the Slovak Metal Science Society (2007 - 2011)

[9] Ing. Jozef Murin, DrSc.
- member of the Slovak National Committee for theoretical and applied mechanics IUTAM (2007 - 2011)

[10] Ing. Karol Iždinský, PhD.
- member of the Council of the Slovak R&D Agency for engineering sciences (2007 - 2011)
- member of council and chairman of Concilium of SAS (2007 - 2009)
- member, chirman of the 1st chamber of SAS (2010 - 2011)
- member of SAS board for expensive instruments (2007 - 2008)
- member of SAS board for information and communication technologies (2007 - 2008)
- member of SAS board for infrastructure (2009 - 2011)
- member of SAS board for international scientific and technology collaboration (2009 - 2011)
- member of SAS board for evaluation of international projects (2009 - 2011)

[11] Ing. Vladimír Kliman, DrSc.
- member of Scientific advisory board of SAS for electronics, material research and technologies (2007 - 2011)
- member of SAS board for appreciation of scientific qualification of employees (2007 - 2011)
- member of Board of VEGA No. 5 for machinery, metalurgy and material engineering (2007)

[12] Ing Vladimír Giba, CSc.
- member of Scientific advisory board of SAS for electronics, material research and technologies (2007 - 2010)
- member of Board of SAS for economic questions (2007 - 2009)
- member of Board of VEGA No. 5 for machinery, metalurgy and material engineering (2008)
- member of Board of VEGA No. 7 (2009 - 2011)

[13] Dr. Ing. Jaroslav Jerz
- member of SAS board for intelectual property (2007 - 2011)

[14] Ing. Zuzana Gabalcová, PhD.
- member of Board of SAS for equal opportunities (2009 - 2011)

[15] Ing. Mária Lazarová
- member of Board of SAS for economic questions (2009 - 2011)

[16] Dr. Ing. Jaroslav Kováčik
- member of Board of VEGA No. 5 for machinery, metalurgy and material engineering (2007)
- member of Board of VEGA No. 7 (2009 - 2011)

[17] Ing. RNDr. Stanislav Kúdela, CSc.
- member of Board of VEGA No. 7 (2008 - 2011)

iv. List of national awards and distinctions

[1] IMSAS - a certificate of merit for the attractive presentation of the scientific knowledge application in the civil engineering – by INCHEBA expo Bratislava at 28th trade fair of civil engineering CONECO 20.-24.3.2007

[2] Dr. Ing. František Simančík - a commemorative plaque on the occasion of 70th anniversary of the establishment of the Slovak University of Technology in Bratislava (2007)

[3] Dr. Ing. František Simančík - a commemorative plaque of the Dean of the Faculty of Mechanical Engineering, Slovak University of Technology in Bratislava for contribution to the development of faculty, granted on 20.10.2010 at the ceremonial meeting held on the 70th anniversary of the commencement of teaching of engineers in Slovakia.

[4] Dr. Ing. František Simančík - "Crystal Wing in medicine and science" by Crystal Wing Ltd. Bratislava for introduction of the original technology of copper infiltration of graphite components in manufacturing of innovative sliding contacts of locomotives and trolleybuses, for the development of special aluminum materials for high temperature applications in pistons of internal combustion engines, as well as a revolutionary innovation of cooling and heating of residential or office spaces. The Crystal Wing for 2011 was handed over to Dr. F. Simančík during a gala evening on 15th Janury 2012 in Bratislava Incheba.

[5] Dr. Ing. František Simančík – "Personality of science and technology 2011" by Ministry of Education, Science, Research and Sport of the Slovak Republic for a significant contribution to the development of new materials based on light metals

[6] IMSAS - Nomination for EUROPROJEKT 2011 in the category of Research and Development by ASFEU - Agency of the Ministry of Education, Science, Research and Sport Minister for EU structural funds. The nominated project was solved at IMMM SAS – Creation of CE on research and development of structural composite materials for engineering, construction and medical applications - CEKOMAT (6 projects were nominated from 70, the project was not awarded).

[7] Ing. Augustín Schweighofer, CSc. - "Significant personality of SAS 2011" by SAS for significant contribution to the development of scientific knowledge in the field of composite materials production technology by pressure infiltration, as well as for contribution to orientation of IMMM SAS research and development activities to applied research and collaboration with industrial partners. The award recognizes Ing. A. Schweighofer on the occasion of his 80's birthday.

v. Supplementary information and/or comments documenting international and national status of the Organisation

IMSAS has been involved into wide international cooperation at all levels of R&D activities – fundamental research and education with universities; problem oriented and applied research with R&D centres and transfer of knowledge with industrial partners. The most important international partners of IMSAS currently include (only real cooperation including information and/or sample material exchange):

Universities:	**Research centres**	**Industry:**
Charles university Prague (CZ)	IFAM FhG Bremen + Dresden (D)	Alulight Ranshofen (A)
Inst. Nat. Polytech. Lorraine, (F)	EADS Ottobrun (D)	LMT GmbH Laakirchen (A)
Warsaw TU (PL)	Centro Richerche Fiat (I)	Gleich Kaltenkirchen (D)
TU Vienna (A, 3 institutes)	IPP Max Planck Garching (D)	Eff Power Hisings Backa (S)
TU + HMI Berlin (D)	ARCS Seibersdorf (A)	SAPA AB, (S)
EPFL Lausanne (CH)	Institute of Physics CAS (CZ)	NMD GmbH St.Pantaleon (A)
Wroclaw Technical University (PL)	Fagor Edertek (Sp)	SHW GmbH Wasseralfingen (D)
TU Darmstadt (D)	IMM PAN Krakow (PL)	ATL Ltd. Marlow UK
	IPMS UAS Kiev (UA)	Kochanek Entw. GmbH Neustadt (D)

4. Project structure, research grants and other funding resources

- **International projects and funding**

i. List of major projects within the European Research Area – 6th and 7th Framework Programme of the EU, European Science Foundation, NATO, COST, INTAS, CERN, ESA etc. (here and in items below please specify: type of project, title, grant number, duration, total funding and funding for the Organisation, responsible person in the Organisation and his/her status in the project, e.g. coordinator, work package leader, investigator)

[1] **Type of project:** 6thFP EU
Project title: New Materials for Extreme Environments (Nové materiály pre extrémne prostredie)
Project number: NMP3-CT-2004-500253 (IP of the 6th FP EU – "EXTREMAT")
Total funding: 29,49 mil. €
Total funding for the Organisation: 561 722 €
Duration: 12/2004 – 05/2010
Funding for Organisation within 2007-2011 (EUR): 300 907 €
Responsible person in the Organisation: Dr. Ing. František Simančík
His status in project: work package leader
Role of the Organisation: partner

[2] **Type of project:** 6thFP EU
Project title: Intermetallic Materials Processing in Relation to Earth and Space Solidification (Výroba intermetalických materiálov v spojitosti s ich kryštalizáciou na Zemi a v kozme)
Project number: NMP-CT-2004-500635 (IP of the 6th FP EU - "IMPRESS")
Duration: 11/2004 – 10/2009
Total funding: 15,89 mil. EUR
Total funding for the Organisation: 520 469 €
Funding for Organisation within 2007-2011 (EUR): 278 900 €
Responsible person in the Organisation: Ing. Juraj Lapin, DrSc.
His status in project: work package leader
Role of the Organisation: partner

[3] **Type of project:** 7thFP EU
Project title: Micro and Nanocrystalline Silicide - Refractory Metals FGM for Materials Innovation in Transport Applications (Mikro a nanokryštalické FGM na báze silicidov vysokotaviteľných kovov určené pre materiálne inovácie v dopravných aplikáciách)
Project number: NMP3-SL-2009-229127 (7th FP EU – "SILTRANS")
Total funding: 4 296 231 € (EU, APVV, MVTS)
Total funding for the Organisation: 746 940 €
Duration: 10/2009 – 09/2013
Funding for Organisation within 2007-2011 (EUR): 251 287 €
Responsible person in the Organisation: Dr. Ing. František Simančík
His status in project: co-ordinator
Role of the Organisation: co-ordinator

[4] **Type of project:** 7thFP EU
Project title: Micro and Nanocrystalline Functionally Graded Materials for Transport Applications (Mikro a nanokryštalické funkčne gradientné materiály pre dopravné aplikácie)
Project number: NMP-2008/SMALL-2, FP7-228869 (7th FP EU – "MATRANS")
Duration: 02/2010 – 01/2013
Total funding: 4 926 993 € (EU, APVV, MVTS**)**
Total funding for the Organisation: 201 933 €
Funding for Organisation within 2007-2011 (EUR): 112 606 €
Responsible person in the Organisation: Dr. Ing. František Simančík
His status in project: work package leader

Role of the Organisation: partner

[5] **Type of project:** 7thFP EU
Project title: Emergence of Research Driven Clusters in Central Europe (Iniciácia vývojom podporovaných klastrov v Strednej Európe)
Project number: FP7-REGIONS-2007-2/202855 (7th FP EU – "ERDC")
Duration: 06/2008 – 5/2010
Total funding: 190 000 €
Total funding for the Organisation: 19 477 €
Funding for Organisation within 2007-2011 (EUR): 19 477 €
Responsible person in the Organisation: Dr. Ing. Jaroslav Jerz
His status in project: investigator
Role of the Organisation: partner

[6] **Type of project:** Operational Programme for Cross-border Cooperation between Austria and Slovakia in the period 2007 – 2013 financially supported by the European Regional Development Fund (ERDF)
Project title: Establishment of cross-border platform for technology transfer focused on the application of advanced engineering materials in the region of Vienna – Bratislava; Acronym: INNOVMAT (Zriadenie cezhraničnej platformy technologického transferu zameraného na aplikáciu progresívnych technických materiálov v regióne Viedeň – Bratislava)
Project number: N_00081
Duration: 06/2010-11/2012
Total funding: 655 087 €
Total funding for Organisation: 116 617 €
Funding for Organisation within 2007-2011 (EUR): 68 730 €
Responsible person in the Organisation: Dr. Ing. Jaroslav Jerz
His status in project: work package leader
Role of the Organisation: partner

[7] **Type of project:** 6thFP EU
Project title: Nanoscience in the European Research Area (Nanovedy v európskom výskumnom priestore – NanoSci-ERA)
Project number: ERA-NET-016146
Duration: 03/2005 - 02/2008
Total funding: 0 €
Total funding for Organisation: 0 €
Funding for Organisation within 2007-2011 (EUR): 0 €
Responsible person in the Organisation: Ing. Karol Iždinský, PhD.
His status in project: work package leader
Role of the Organisation: partner

[8] **Type of project:** 6thFP EU
Project title: Bulk Nanostructered Al Profiles for Applications at Elevated Temperatures (Nanoštruktúrne hliníkové profily určené pre vysokoteplotné aplikácie -MNT-EraNet)
Project number: 2007-044-SK
Duration: 1/2008 – 12/2010
Total funding: 141 075 €
Total funding for Organisation: 88 514 €
Funding for Organisation within 2007-2011 (EUR): 88 514 €
Responsible person in the Organisation: Dr. Ing. František Simančík
His status in project: work package leader
Role of the Organisation: co-ordinator

[9] **Type of project:** COST
Project title: Lead-free Solder Materials (Bezolovnaté spájkovacie materiály)

Project number: COST 531.1, 51-98-9345-00/2002
Duration: 03/2002 – 03/2007
Total funding for Organisation: 16 512 €
Funding for Organisation within 2007-2011 (EUR): 0 €
Responsible person in the Organisation: RNDr. Pavol Šebo, DrSc.
His status in project: work package leader
Role of the Organisation: partner

[10] **Type of project:** COST
Project title: Evolution and Degradation of Microstructure of CMSX-4 Superalloy During Ageing and Creep Exposure (Vývoj a degradácia mikroštruktúry superzliatiny CMSX-4 v priebehu starnutia a creepu)
Project number: COST 2005/1
Duration: 01/2005 – 12/2008
Total funding for Organisation: 13 982 €
Funding for Organisation within 2007-2011 (EUR): 6 639 €
Responsible person in the Organisation: Ing. Juraj Lapin, DrSc.
His status in project: work package leader
Role of the Organisation: partner

[11] **Type of project:** COST
Project title: Advanced Solder Materials for High Temperature Application – their Nature, Design, Process and Control in a Multiscale Domain. (Pokročilé spájkovacie materiály pre vysokoteplotné aplikácie – ich podstata, návrh, príprava a riadenie v mnohoškálovej oblasti).
Project number: COST Action MP 0602
Duration: 05/2007 – 04/2011
Total funding for Organisation: 17 933 €
Funding for Organisation within 2007-2011 (EUR): 17 933 €
Responsible person in the Organisation: RNDr. Pavol Šebo, DrSc.
His status in project: work package leader
Role of the Organisation: partner

[12] **Type of project:** Projekt financially supported by Austrian Science and Research Liaison Office – ASO and Slovak Academic Information Agency – SAIA n.o.)
Project title: Organizing of the International Conference „Nanoved 2007“, 11th - 14th November 2007, Bratislava.
Project number: SK-0607-BA-011
Duration: 03/2007 – 11/2007
Total funding for Organisation: 5 571 €
Funding for Organisation within 2007-2011 (EUR): 5 571 €
Responsible person in the Organisation: Dr. Ing. František Simančík
His status in project: work package leader
Role of the Organisation: partner

[13] **Type of project:** European Science Foundation (ESF)
Project title: Gravity Dependence of CET in Peritectic TiAl Alloys (Gravitačná závislosť prechodu kolumnárnych zŕn na rovnoosé v peritektických zliatinách na báze TiAl)
Project number: AO-2009-1105
Duration: 07/2010 – 06/2013
Total funding for Organisation: 60 000 €
Funding for Organisation within 2007-2011 (EUR): 30 000 €
Responsible person in the Organisation: Ing. Juraj Lapin, DrSc.
His status in project: work package leader
Role of the Organisation: partner

ii. List of other international projects incl. total funding and funding for the Organisation

[1] **Type of project:** bilateral international cooperation
Cooperating partner: ALULIGHT-International GmbH, Ranshofen, Austria
Project title: Development and optimisation of the foaming raw-material for production of aluminium foam
Duration: 01/1998 – 12/2010
Funding for Organisation within 2007-2011 (EUR): 252 479 €
Responsible person in the Organisation: Dr. Ing. Roman Florek
(more info in chapter 6. viii)

[2] **Type of project:** bilateral international cooperation
Cooperating partner: Effpower AB, Göteborg, Sweden
Project title: Development of the manufacturing of ceramic/lead composites by the melt infiltration process for the battery applications
Duration: 01/2005 – 12/2011
Funding for Organisation within 2007-2011 (EUR): 834 922 €
Responsible person in the Organisation: Mgr. Stanislav Kúdela, PhD.
(more info in chapter 6. viii)

[3] **Type of project:** bilateral international cooperation
Cooperating partner: GLEICH GmbH Metallplatten-Service, Kaltenkirchen, Germany
Project title: Development of structural components using of aluminium foam and investigation of their application possibilities
Duration: 02/2003 – 12/2011
Funding for Organisation within 2007-2011 (EUR): 177 218 €
Responsible person in the Organisation: Dr. Ing. Roman Florek
(more info in chapter 6. viii)

[4] **Type of project:** bilateral international cooperation
Cooperating partner: New Materials Development GmbH, St. Pantaleon, Austria
Project title: Research and development of advanced materials and components prepared by powder metallurgy of Al-alloys
Duration: 02/2006 - long-term cooperation
Funding for Organisation within 2007-2011 (EUR): 92 492 €
Responsible person in the Organisation: Ing. Martin Balog, PhD.
(more info in chapter 6. viii)

[5] **Type of project:** bilateral international cooperation
Cooperating partner: LMT Metallurgie Beratung GmbH, Oberweis, Austria
Project title: Recycling of magnesium scrap by distillation method
Duration: 01/2009 - long-term cooperation
Funding for Organisation within 2007-2011 (EUR): 39 500 €
Responsible person in the Organisation: Ing. Peter Krížik
(more info in chapter 6. viii)

iii. List of other important projects and collaborations without direct funding

[1] **Type of project:** bilateral international project - the agreement between the Academies of Sciences (UAS-SAS)
Cooperating partner: Institute for Problems of Materials Sciences UAS, Kiev, Ukraine
Project title: Behaviour and effective properties of mechanically and thermally loaded short fiber MMCs
Duration: 01/2006 - 12/2008
Principal investigator from IMSAS: RNDr. Ing. Stanislav Kúdela, PhD.

[2] **Type of project:** bilateral international project - the agreement between the Academies of Sciences (PAS-SAS)
Cooperating partner: Institute of Metallurgy and Materials Science PAN, Krakow, Poland

Project title: Acoustic emission in compressed nanocrystalline Mg and Al alloys and composites
Duration: 01/2007 - 12/2009
Principal investigator from IMSAS: RNDr. Ing. Stanislav Kúdela, PhD.

[3] **Type of project:** bilateral international project - the agreement between the Academies of Sciences (UAS-SAS)
Cooperating partner: Institute for Problems of Materials Sciences UAS, Kiev, Ukraine
Project title: Impregnation processes, interphase interaction and effective properties of aluminum matrix composites reinforced with short carbon and carbide fibers obtained from vegetable precursor
Duration: 01/2007 - 12/2009
Principal investigator from IMSAS: RNDr. Ing. Stanislav Kúdela, PhD.

[4] **Type of project:** bilateral international project - the agreement between National Research Council (NRC) - Italy and SAS
Cooperating partner: Institute for Energetics and Interphases, Genoa, Italy
Project title: High temperature mechanical behaviour of intermetallic TiAl-based alloys
Duration: 01/2007 - 12/2009
Principal investigator from IMSAS: Ing. Juraj Lapin, DrSc.

[5] **Type of project:** bilateral international project - the agreement between the Academies of Sciences (UAS-SAS)
Cooperating partner: Institute for Problems of Materials Sciences UAS, Kiev, Ukraine
Project title: Behavior and effective properties of short fiber reinforced metal matrix composites
Duration: 01/2008 - 12/2010
Principal investigator from IMSAS: RNDr. Ing. Stanislav Kúdela, PhD.

[6] **Type of project:** bilateral international project - the agreement between the Academies of Sciences (PAS-SAS)
Cooperating partner: Institute of Fundamental Technological Research PAS, Warszawa, Poland
Project title: Application of acoustic methods in testing of ultralight alloys and matrix composites (MMC) based on Mg and Al before and after processing using intensive strain methods
Duration: 01/2010 - 12/2012
Principal investigator from IMSAS: Mgr. Stanislav Kúdela, PhD.

[7] **Type of project:** bilateral international project - the agreement between the Academies of Sciences (PAS-SAS)
Cooperating partner: Institute of Metallurgy and Materials Science PAN, Krakow, Poland
Project title: Acoustic emission in compressed Mg and Al alloys and composites before and after pre-deformation by intensive strain methods
Duration: 01/2010 - 12/2012
Principal investigator from IMSAS: RNDr. Ing. Stanislav Kúdela, PhD.

- **National projects and funding**

i. List of projects supported by the European Social Funds (ESF) and Structural Funds of EU and the role of the Organisation

[1] Project title: Creation of the workplace of further education with a view to a transfer of knowledge with modern materials, technology and machine design into industrial practice (Vytvorenie pracoviska ďalšieho vzdelávania zameraného na prenos poznatkov o moderných materiáloch, technológiách a konštruovaní do priemyselnej praxe)
Project number: ESF - 13120200062, JPD 3 2004/4-084
Duration month/year-month/year: 09/2005 – 08/2008
Funding for Organisation within 2007-2011 (EUR): 56 432 €
(22 931 € (690 808 Sk) / 2007; 33 501 € (1 009 242 Sk) / 2008)
Role of the Organisation: co-ordinator

[2] Project title: Creation of network for innovations, research & development in the field of materials and technologies of their joining - MatNet (Vybudovanie výskumno-vývojovej a inovačnej siete pre oblasť materiálov a technológií ich spájania - MatNet)
Project number: ESF - 13120200076, JPD 3 2005/1-018
Duration month/year-month/year: 4/2006 – 03/2008
Funding for Organisation within 2007-2011 (EUR): 64 652 €
(47 760 € (1 438 832 Sk) / 2007; 16 892 € (511 614 Sk) / 2008)
Role of the Organisation: co-ordinator

[3] Project title: Creation of CE for research and development of composite materials for structural engineering, construction and medical applications (Vytvorenie CE na výskum a vývoj konštrukčných kompozitných materiálov pre strojárske, stavebné a medicínske aplikácie)
Project number: ITMS 26240120006
Duration month/year-month/year: 06/2009 – 05/2011
Funding for Organisation within 2007-2011 (EUR): 628 946.85 €
Role of the Organisation: co-ordinator

[4] Project title: Center for knowledge marketing and intellectual property rights of SAS (Centrum komercializácie poznatkov a ochrany duševného vlastníctva Slovenskej akadémie vied)
Project number: ITMS 26240220006
Duration month/year-month/year: 10/2009-04/2012
Funding for Organisation within 2007-2011 (EUR): 2 838.01 €
Role of the Organisation: partner

[5] Project title: The Innovation center of SAS for technologies of aluminum precessing and products thereof – INOVAL (Inovačné centrum SAV pre technológie spracovania hliníka a výrobkov z neho – INOVAL)
Project number: ITMS 26220220034
Duration month/year-month/year: 01/2010-12/2011
Funding for Organisation within 2007-2011 (EUR): 441 305.79 €
Role of the Organisation: co-ordinator

[6] Project title: Effective management of production and consumption of renewable energy (Efektívne riadenie výroby a spotreby energie z obnoviteľných zdrojov)
Project number: ITMS 26240220028
Duration month/year-month/year: 04/2010-03/2013
Funding for Organisation within 2007-2011 (EUR): 119 831.63 €
Role of the Organisation: partner

[7] Project title: The research on possibility of extruding technology for production of composite materials based on light metals within the framework of cooperation between Sapa Profiles, Inc.

and SAS (Výskum možnosti lisovania kompozitných materiálov na báze ľahkých kovov v rámci spolupráce Sapa Profily, a.s. a SAV)
Project number: ITMS 26220220069
Duration month/year-month/year: 06/2010-02/2014
Funding for Organisation within 2007-2011 (EUR): 45 283.85 €
Role of the Organisation: partner

[9] Project title: Development of CE for research and development in the field of structural composite materials – 2nd stage (Budovanie CE na výskum a vývoj konštrukčných kompozitných materiálov – 2. etapa)
Project number: ITMS 26240120020
Duration month/year-month/year: 07/2010-12/2012
Funding for Organisation within 2007-2011 (EUR): 792 085.45 €
Role of the Organisation: co-ordinator

[10] Project title: Applied research and development of innovative drilling technology for ultra-deep geothermal wells (Aplikovaný výskum a vývoj inovatívnej technológie pre ultra hlboké geotermálne vrty)
Project number: ITMS 26240220042
Duration month/year-month/year: 08/2010-07/2013
Funding for Organisation within 2007-2011 (EUR): 6 929.12 €
Role of the Organisation: partner

[11] Project title: Long-term operation of nuclear power plants of type VVER 440 taking into account the environmental impact (Dlhodobé prevádzkovanie jadrových elektrární typu VVER 440 so zohľadnením vplyvu na životné prostredie)
Project number: ITMS 26220220146
Duration month/year-month/year: 01/2011-06/2013
Funding for Organisation within 2007-2011 (EUR): 12 467.35 €
Role of the Organisation: partner

[12] Project title: Competence center for industrial research and development in the field of light metals and composites (Kompetenčné centrum pre priemyselný výskum a vývoj v oblasti ľahkých kovov a kompozitov)
Project number: ITMS 26220220154
Duration month/year-month/year: 07/2011-10/2014
Funding for Organisation within 2007-2011 (EUR): 9 473.11 €
Role of the Organisation: co-ordinator

[13] Project title: Competence center for new materials, advanced technologies and energetics (Kompetenčné centrum pre nové materiály, pokročilé technológie a energetiku)
Project number: ITMS 26240220073
Duration month/year-month/year: 08/2011-11/2014
Funding for Organisation within 2007-2011 (EUR): 6 448.25 €
Role of the Organisation: partner

ii. List of projects supported by APVV and the role of the Organisation

[1] Project title: Development of structural profiles from extruded powders of aluminium alloys with unique properties (Vývoj konštrukčných profilov z práškových zliatin hliníka s výnimočnými vlastnosťami)
Project number: APVT-51-031204
Duration month/year-month/year: 01/2005 – 12/2007
Funding for Organisation within 2007-2011 (EUR): 46 139.55 €
Role of the Organisation: co-ordinator

[2] Project title: Research of mechatronic systems and progressive technologies for surface material engineering (Výskum mechatronických systémov a progresívnych technológií pre povrchové materiálové inžinierstvo)
Project number: APVT-20-020904
Duration month/year-month/year: 01/2005 – 12/2007
Funding for Organisation within 2007-2011 (EUR): 8 298.48 €
Role of the Organisation: partner

[3] Project title: Electron beam technologies with simultaneous preheat for joining of metallurgically dissimilar materials (Elektrónolúčové technológie so simultánnym predhrevom pre spájanie metalurgicky rôznorodých materiálov)
Project number: APVV-20-P01305
Duration month/year-month/year: 08/2005 – 07/2007
Funding for Organisation within 2007-2011 (EUR): 6 638.78 €
Role of the Organisation: partner

[4] Project title: Modern network control systems for demanding industrial applications (Moderný sieťový riadiaci systém pre náročné priemyselné technológie)
Project number: APVV-99-045805
Duration month/year-month/year: 05/2006 – 04/2009
Funding for Organisation within 2007-2011 (EUR): 15 933.08 €
Role of the Organisation: partner

[5] Project title: Gradient materials prepared by powder metallurgy from micro and nano powders (Gradientné materiály pripravené práškovou metalurgiou z mikro a nano častíc)
Project number: APVV-20-057805
Duration month/year-month/year: 05/2006 – 04/2009
Funding for Organisation within 2007-2011 (EUR): 12 680.08 €
Role of the Organisation: partner

[6] Project title: Metallurgy and development of novel intermetallic materials for extreme loading conditions; Acronym: INTERMATEX (Metalurgická príprava a výskum nových intermetalických materiálov pre extrémne podmienky namáhania)
Project number: APVV-0009-07
Duration month/year-month/year: 06/2008 – 12/2010
Funding for Organisation within 2007-2011 (EUR): 183 330.01 €
Role of the Organisation: co-ordinator

[7] Project title: Development of the low cost technology for manufacturing of complex shaped aluminium foam components; Acronym: LOWCOSTFOAM (Vývoj nízkonákladovej technológie na výrobu tvarovo zložitých súčiastok z penového hliníka)
Project number: APVV-0736-07
Duration month/year-month/year: 06/2008 – 12/2010
Funding for Organisation within 2007-2011 (EUR): 140 576.25 €
Role of the Organisation: co-ordinator

[8] Project title: Fatigue life and reliability of structures operating under complicated loading conditions; Acronym: FATIQUEMENTH (Únavová životnosť a spoľahlivosť konštrukcii pracujúcich v zložitých zaťažovacích podmienkach)
Project number: APVV-0437-07
Duration month/year-month/year: 09/2008 – 12/2010
Funding for Organisation within 2007-2011 (EUR): 90 519.82 €
Role of the Organisation: co-ordinator

[9] Project title: Interactions in metal-liquid metal interfaces;
Acronym: INTERMETAL (Interakcie na rozhraní kov - kvapalný kov)
Project number: APVV-0102-07

Duration month/year-month/year: 09/2008 – 12/2010
Funding for Organisation within 2007-2011 (EUR): 47 734.86 €
Role of the Organisation: partner

[10] Project title: Research of graphite based skeleton materials infiltrated by copper (Výskum uhlíkových skeletových materiálov infiltrovaných meďou)
Project number: VMSP-P-0036-07
Duration month/year-month/year: 01/2008 – 12/2009
Funding for Organisation within 2007-2011 (EUR): 16 596.96 €
Role of the Organisation: partner

[11] Project title: Deformationless welding of cross-beems by four burners; Acronym: 4WELD (Bezdeformačné zváranie halových nosníkov 4 horákmi)
Project number: VMSP-P-0008-07
Duration month/year-month/year: 01/2008 – 12/2008
Funding for Organisation within 2007-2011 (EUR): 13 277.57 € (400 tis. Sk)
Role of the Organisation: partner

[12] Project title: Hard and superhard nanocomposite coatings; Acronym: Nanohardcoat (Tvrdé a supertvrdé nanokompozitné povlaky)
Project number: APVV-0034-07
Duration month/year-month/year: 09/2008 – 12/2010
Funding for Organisation within 2007-2011 (EUR): 26 355.97 €
Role of the Organisation: partner

[13] Project title: The development of aluminum foam panel for ceiling cooling and wall heating; Acronym: WALFOAM (Vývoj panelu z hliníkovej peny pre stropné chladenie a stenové vykurovanie)
Project number: VMSP-P-0153-09
Duration month/year-month/year: 09/2009 – 03/2011
Funding for Organisation within 2007-2011 (EUR): 153 803.06 €
Role of the Organisation: co-ordinator

[14] Project title: Productive welding technologies for repair of nuclear-energetic facilities (Produktívne zváracie technológie pre opravy jadrovoenergetických zariadení)
Project number: VMSP-P-0011-09
Duration month/year-month/year: 09/2009 – 07/2011
Funding for Organisation within 2007-2011 (EUR): 10 000 €
Role of the Organisation: partner

[15] Project title: Refunding of costs for FP7 EU project preparation (Refundácia nákladov na prípravu projektu 7. RP EÚ)
Project number: PP7RP-0102-08
Duration month/year-month/year: 12/2008 – 05/2009
Funding for Organisation within 2007-2011 (EUR): 2 987.45 €
Role of the Organisation: co-ordinator

[16] Project title: Co-financing of FP7 EU project SILTRANS by Slovak R&D Agency (Dofinancovanie projektu 7. RP EÚ SILTRANS z prostriedkov APVV)
Project number: DO7RP-0023-09
Duration month/year-month/year: 06/2009 – 09/2013
Funding for Organisation within 2007-2011 (EUR): 61 768 €
Role of the Organisation: co-ordinator

[17] Project title: High temperature oxidation resistant nanocomposite coatings with improved lifetime (Vysokoteplotné nanokompozitné povlaky so zvýšenou oxidačnou odolnosťou)
Project number: APVV-0520-10

Duration month/year-month/year: 05/2011 – 12/2013
Funding for Organisation within 2007-2011 (EUR): 13 191 €
Role of the Organisation: partner

[18] Project title: Solidification and properties of novel peritectic TiAl - based alloys; Acronym: SOPERTI (Kryštalizácia a vlastnosti nových peritektických zliatin na báze TiAl)
Project number: APVV-0434-10
Duration month/year-month/year: 05/2011 – 10/2014
Funding for Organisation within 2007-2011 (EUR): 36 190 €
Role of the Organisation: co-ordinator

[19] Project title: Application of advanced metallic materials for stiffness enhancement of lightweight structural components (Zvyšovanie tuhosti ľahkých konštrukčných prvkov aplikáciou nových kovových materiálov) / ULTRALIGHT
Project number: APVV-0647-10
Duration month/year-month/year: 05/2011 – 10/2014
Funding for Organisation within 2007-2011 (EUR): 26 560 €
Role of the Organisation: co-ordinator

[20] Project title: Co-financing of FP7 EU project MATRANS by Slovak R&D Agency (Dofinancovanie projektu 7. RP EÚ MATRANS z prostriedkov APVV)
Project number: DO7RP-0008-11
Duration month/year-month/year: 09/2011 – 01/2013
Funding for Organisation within 2007-2011 (EUR): 16 336 €
Role of the Organisation: partner

iii. Number of projects supported by the Scientific Grant Agency of the Slovak Academy of Sciences and the Ministry of Education (VEGA) for each year, and their funding

VEGA	2007	2008	2009	2010	2011
number	9	9	6	8	7
funding in the year (EUR)	40165	44480	40654	58308	56224

Year 2010 – including capital funding in the amount of 13 394 €.

- **Summary of funding from external resources (based on annual financial report of the Organisation)**

External resources	2007	2008	2009	2010	2011	total	average
external resources (milions of EUR) incl. direct funding of VEGA, MVTS, APVV, CE	1,230	1,051	1,040	1,096	1,265	5,682	1,136
external resources transfered to coooperating research organisations (milions of EUR)	0,027	0,010	0,019	0,024	0,000	0,080	0,016
ratio between external resources and total salary budget	1,891	1,524	1,428	1,538	1,810	–	1,638
overall expenditures from external as well as institutional resources (milions of EUR)	2,182	2,107	2,162	2,218	2,457	11,126	2,225

iv. Supplementary information and/or comments on research projects and funding resources

financial resources without ivestments in M€	2007	2008	2009	2010	2011	TOTAL
Institutional funding	1,114	1,186	1,228	1,232	1,231	**5,991**
from this direct funding of VEGA, MVTS, CE, APVV projects	0,161	0,140	0,121	0,117	0,090	**0,629**
External resources	1,069	0,948	0,957	1,022	1,236	**5,232**
total resources without investments	2,183	2,134	2,185	2,254	2,467	**11,223**
result before taxation	0,001	0,027	0,023	0,036	0,010	**0,097**
% of external resources incl. direct funding of projects	56,34	50,98	49,34	50,53	53,75	**52,22**

It can be seen in the above table that the available resources for R&D increased continuously from 2.183 MEUR in 2007 to 2.467 MEUR in 2011 (~13%), despite stagnation of institutional funding. This was achieved by strong involvement of external resources gained in international and national projects. Currently IMSAS needs to cover more than 50 % of its budget by external resources what brings enormous stress to management and researchers who need to spend a lot of time by proposing projects. As there are simply not sufficiently high public resources, strong cooperation with industry in R&D is inevitable. This has a significant influence on the art of research activities – they need to be more application oriented, with higher portion of technological knowhow which forms thus main research output instead of generally required publications. This fact cannot be simply neglected.

5. Organisation of PhD studies, other pedagogical activities

i. List of accredited programmes of doctoral studies (as stipulated in the previously effective legislation as well as in the recently amended Act on the Universities)

[1] Programme Engineering materials in study field 5.2.26 Materials in collaboration with Materiálovotechnologická fakulta STU v Trnave (both, full and part time forms)

[2] Programme Applied mechanics in study field 5.1.7 Applied mechanics in collaboration with Strojnícka fakulta STU v Bratislave (both, full and part time forms) – accredited up to 2010

ii. Summary table on doctoral studies (number of internal/external PhD students; number of students who completed their study by a successful thesis defence; number of PhD students who quitted the programme)

PhD study	31.12.2007			31.12.2008			31.12.2009			31.12.2010			31.12.2011		
number of potential PhD supervisors	17			16			16			17			12		
PhD students	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted	number	defended thesis	students quitted
internal	6	3	0	7	0	0	8	3	0	8	3	0	8	2	0
external	2	1	0	2	0	0	0	0	0	0	0	0	0	0	0
supervised at external institution by the research employees of the assessed organisation	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0

iii. Postdoctoral positions supported by

a) external funding (specify the source)

IMSAS management provides the possibility for most of the doctoral students successfully finishing their study at IMSAS to stay as postdocs or employees at IMSAS. To gain a funding for such position research projects (mostly APVV, EU FP or nowadays ERDF) are prepared well before the end of doctoral study. Following successful postdocs accepted the offer to stay at IMSAS during assessed period:

[1] Ing. Juraj Nagy, PhD.
[2] Ing. Radúz Zahoranský, PhD.
[3] Ing. Marián Jároši, PhD.
[4] Ing. Marián Mikula, PhD.*
[5] Ing. Martin Nosko, PhD.*
[6] Ing. Tomáš Dvorák, PhD.*
[7] Ing. Naďa Berónska, PhD.*
[8] Ing. Zuzana Gabalcová, PhD.*
[9] Ing. Marek Gebura, PhD.
[10] Ing. Peter Oslanec, PhD.*
[11] Ing. Andrea Adamčíková, PhD.*
[12] Ing. Miroslav Čavojský, PhD.*

Most of them (marked with *) are still working at IMSAS.

b) internal funding - the Slovak Academy of Sciences Supporting Fund of Stefan Schwarz

[1] Ing. Martin Balog, PhD. received funding of 22 145,88 € from Fund of Stefan Schwarz in 2007 – 2011 for his postdoc position. He is still actively working at IMSAS, now as senior researcher (IIa).

iv. Summary table on pedagogical activities in undergraduate programmes for each year

Teaching	2007	2008	2009	2010	2011
lectures (hours/year)	114	192	154	65	39
practicum courses (hours/year)	83	130	168	143	78
supervised diploma works (in total)	4	-	8	9	4
members in PhD committees (in total)	1	3	7	4	5
members in DrSc. committees (in total)	1	1	2	2	-
members in university/faculty councils (in total)	2	2	1	2	2
members in habilitation/inauguration committees (in total)	2	1	1	3	1

v. List of published university textbooks

vi. Number of published academic course books

vii. List of joint research laboratories/facilities with the universities

[1] Joint research laboratory between Faculty of Material Sciences and Technology of the Slovak University of Technology and IMMM SAS has been established. The mission of the laboratory is education of students working on metallurgical processing of high reactive and hardly meltable intermetallic materials. The laboratory is equipped with updated induction and plasma furnaces, equipment for cold and hot isostatic pressing, material preparation and characterisation laboratory and includes also meeting space for students. Nowadays, three PhD students and three students working on master thesis of the Slovak University of Technology work on TiAl-based alloy development in this joint research laboratory.

viii. Supplementary information and/or comments on doctoral studies and pedagogical activities

IMSAS is currently able to fully cover the available funding quota for doctoral students with good students. There are 6 – 8 PhD students working regularly in the in the field of Materials Science during whole period of 2007 – 2011. With respect to difficulties connected with rather discriminating legal status of University PhD students on external education institutions – SAS we regard the number of our students as a big success if compared with situation in previous assessment period. On one side it was possible due to creation of comfortable conditions for students, but also due to proposed interesting research topics. Each student is involved in the running research project, mostly EU or APVV project. IMSAS organizes regularly seminars for students. The thematic scope covers the fields of materials engineering, modern technologies

and novel application techniques of advanced materials in machinery products. The seminars are attended not only by doctoral students but also by other young scientific workers.

IMSAS strongly supports the attendance of PhD students on international conferences. The students are encouraged to present their work and their efforts are financially supported.

In order to support the interest of graduated students from Universities to continue in doctoral study, IMSAS decided to participate on project supported by Slovak state program of R&D „Education of special oriented doctoral students for difficult design and development problems“ (more details concerning this project are given at the project web site: http://www.phd.sav.sk/). It has been stated that solution of serious problems concerning the background of doctoral study requires fundamental changes. Such changes can be expected in frame of knowledge society formation, only. An above mentioned project web site “Doctoral study and direction of Slovakia to knowledge society” is one of outputs of the project. The aim of this web site is contribution to creation and strengthening of synergic bonds between the doctoral study, research and industrial area in conditions of knowledge based economy formation in Slovakia.

The web site provides for:

- basic information on the doctoral study and the knowledge society formation in Slovakia and situation in this field abroad, as well,
- presentation of doctoral students from the whole Slovakia (whose need was indicated by the inquiry),
- list of R&D enterprises in Slovakia,
- studies in doctoral study and knowledge society fields,
- long-term survey to monitor doctoral study problems and efficiency,
- discussion forums on topics concerning the doctoral studies and knowledge society,
- job opportunities for PhD graduates and another useful services.

The further educational activities were developed within the frame of the project supported by European Social Fund „Creation of the workplace of further education with a view to a transfer of knowledge with modern materials, technology and machine design into industrial practice“in period of 09/2005 – 08/2008. The main objective was to establish the centre that organizes courses not only for developers and design engineers, but also for university teachers, scientific workers and doctoral students. The aim of these courses is to teach design engineers from industry the new complex principles for designing of machine components and constructions using proper material selection with regard to functionality, service loading and product costs and simultaneously to optimize the component design and to find the appropriate technology of its production in large series. At the education, modern software Cambridge Engineering Selector (CES) is applied. It belongs to the most recognized educational tools in this field at renowned world universities. IMSAS is the only proprietor of multi-licence for this educational product in Slovakia. During the courses, the participants have an opportunity to work on one's own with real databases containing properties of nearly all current materials, as well as modern technologies parameters and to learn the use of these databases for structural design focused on various industrial applications. Further activity was the realisation of three step educational courses „Cambridge Engineering Selector - Aided design“. Additional education activities of IMSAS were directed towards:

- the further education of creative industrial personnel,
- the creation of the workplace of further education with a view to a transfer of knowledge with modern materials, technology and machine design into industrial practice (project supported by European social fund)
- the creation of network for transfer of knowledge, innovations, research & development in the field of advanced materials and technologies (MATNET) in the region of Bratislava (supported by European Social Fund)
- the establishment of cross-border platform (INNOVMAT) aimed to knowledge transfer focused on the application of advanced engineering materials in the region of Vienna – Bratislava within the project of cross-border cooperation between Austria and Slovakia in the period 2007 – 2013 (supported by the European Regional Development Fund).

6. Applied research

i. List of the most important results of applied research projects and their socio-economic impact

Applications that already reached serial production level and were still in production within reporting period:

[1] Lightweight stator of camshaft phaser for automotive engine BMW made from extruded aluminium powder alloy (developed in cooperation with ALULIGHT-International, Ltd., Ranshofen, Austria and SAPA Profiles, Žiar nad Hronom, Slovakia - annual production ~850.000 pcs – the world largest production of PM aluminium components). IMSAS significantly contributed to this development, incl. design and supply of special furnace for heating of powdered billets. The added value of standard production increased by 700 K€ per year.

[2] New types of sliding contacts prepared by gas pressure infiltration of graphite with copper (developed in cooperation with Elektrokarbon, Topoľčany, Slovakia. Supply of world unique fully automatic equipment for infiltration of long contacts for locomotives. The lifetime of contacts increased by 40%, annual production of the segment increased by 400 K€ per year. The company definitely resolved the problems caused by economic crisis in 2009.

[3] Aluminium foam stiffeners for side rail of Ferrari Modena car (developed in cooperation with ALULIGHT-International, Ltd., Ranshofen, Austria - annual production ~8.000 pcs).

[4] Deformation part for AUDI Q7 which is used for enhancement of passenger's safety. The aluminium foam insert is placed into the grid which separates luggage space from the passenger cabin and its main purpose is to absorb luggage impact energy in the case of accident. (developed in cooperation with ALULIGHT-International, Ltd., Ranshofen, Austria - annual production ~200.000 pcs). Awarded by "Best application award" at Cellmat 2010 (prize for Alulight)

[5] Crash box for protection of railway carriages – innovative part able to absorb impact energy of 50 t wagon up to 8 km/h without damage of suspension part (first serial worldwide application of Al foam in railway). Own production of IMSAS business unit for Gleich GmbH Kaltenkirchen Germany. (annual production ~1000 pcs). Awarded by "Best application award" at Cellmat 2008 – and Innovative product of the year 2007 – Award of the Minister of economy SR (both prizes for IMSAS)

[6] The novel heating / cooling panels made from aluminium foam. Pilot application in 260 m^2 open space office room of SAPA Profiles – successfully tested for one year. Further applications are ready for installations. The large scale manufacturing is under preparation. (business unit of IMSAS – possible TT to potential investor).

[7] New ultrafine Al powders based composites for storage of used nuclear fuel (developed in cooperation with New Material Development, Ltd., St. Pantaleon, Austria – patent pending)

Applications at prototype / testing level:

[1] New ultrafine Al powders based engine pistons for racing cars (developed in cooperation with New Material Development, Ltd., St. Pantaleon, Austria)

[2] Metal/ceramic composite for battery anodes produced by hot pressure infiltration (developed in cooperation with EFF – Power, Hisings Backa, Vikmanshyttan, Sweden)

[3] Copper matrix composite material reinforced with tungsten wires that as a mock-up for monoblock of the divertor of ITER fusion reactor survived the most severe testing conditions 100 thermal cycles at 20 MW/m2. (developed within the frame of 6th FP project ExtreMat – for testing in Forschungszentrum Jullich, Germany)

[4] Machinable CuC composite with extremely high thermal conductivity ~ 700 W/mK and controlled thermal expansion for heat sinks in advanced power electronic application (developed for Plansee AG, Reutte, Austria)

[5] Lead-free solders for joining of metal matrix composite materials (developed within the frame COST 531.1 project)

[6] Aluminium foam oil pan, which is applied for the purpose of noise damping of combustion engine (developed in cooperation with ALULIGHT-International, Ltd., Ranshofen, Austria).

[7] Lightweight crash box for trucks with effective absorption of deformation energy in case of impact of personal vehicle into the rear part of truck or trailer. Crash box is an insert of rare aluminium trail. (developed for SAPA Automotive, Sweden)

[8] Aluminium foam insert for hollow Al casting of suspension part applied for the purpose of vibration and noise reduction and stiffening (developed for Fagor Edertek, Spain)

[9] New technology for industrial recycling of hardly contaminated Mg chips, based on sublimation. The pilot equipment for 500 kg charge has been designed, constructed and now undergo systematic testing program with optimisation. (developed for LMT GmbH, Laakirchen, Austria)

ii. List of the most important studies commissioned for the decision-making authorities, the government and NGOs, international and foreign organisations

iii. List of patents issued abroad, incl. revenues

See chapter III.1.vii.

iv. List of the patents issued in Slovakia, incl. revenues

See chapter III.1.vii.

v. List of licences sold abroad, incl. revenues

There are no licenses sold abroad. However contractual agreements exist with industrial partners, which allow them to use institute's patents under special conditions (e.g. long term research projects, lump sum monthly financing the research, etc.)

vi. List of licences sold in Slovakia, incl. revenues

The same as above

vii. List of smaller bilateral contracts with industrial partners, incl. revenues (over 1000 €)

[1] Elektrokarbon Inc., Topoľčany

Impregnation of carbon-graphite preforms with copper and copper alloy

Revenues: 12 604 € (2 840 € / 2007; 9 764 € / 2008)

[2] Metallwerk Plansee GmbH, Reutte, Austria

Application of composites with high thermal conductivity in power electronics

Revenues: 14 987 € (14 987 € / 2008)

[3] Kordservice SK, Inc., Senica

Renovation of rotating rollers for textile machines by plasma spraying

Revenues: 18 402 € (9 252 € / 2007; 7 596 € / 2008; 1 554 € / 2009)

[4] Delta Defence Ltd., Prešov

Development of aluminium foam panels for the protection of military vehicles against the blast wave in case of an explosion of ammunitions

Revenues: 8 936 € (7 592 € / 2007; 1 344 € / 2008)

[5] MKTS Ltd., Sečovce

Software security of databases

Revenues: 4 160 € (1 484 € / 2007; 561 € / 2008; 2 115 € / 2009)

[6] KIWA Ltd., Nitra

Analysis of the composition of surface layers of solder joints

Revenues: 4 689 € (1 363 € / 2007; 1 494 € / 2008; 1 832 € / 2009)

[7] IBOK Inc., Bratislava

Fractographic and structural analysis

Revenues: 6 655 €

[8] B & K, Ltd., Bratislava

Manufacturing of machine parts in a mechanical workshop

Revenues: 5 225 €

[9] EX METAL Ltd, Stará Turá

Plasma spraying and grinding abrasion-resistant coatings on guide ring assembly line

Revenues: 3 343 €

[10] ZTS VVÚ Inc., Košice

Development of lightweight construction of mobile robot using advanced composites and metallic foams

Revenues: 32 000 € (12 000 € / 2010; 20 000 € / 2011)

[11] MATEMMER, Klenová 18, Bratislava

Structural analysis of FeCoMo samples

Revenues: 3 000 € / 2010

[12] IMR GmbH, Austria

Development of aluminum-based powdered precursors for optical applications

Revenues: 1 044 € / 2010

[13] CCN CASTINGS Ltd., Považská Bystrica

Creep tests at temperatures of 600°C – 750°C

Revenues: 4.047 € / 2011

viii. List of bilateral research projects with industrial partners, incl. revenues

Foreign industrial partners:

[1] ALULIGHT-International GmbH, Ranshofen, Austria

Development and optimisation of the foaming raw-material for production of aluminium foam

Revenues: 252 479 € (94 123 € / 2007; 95 807 € / 2008; 50 911 € / 2009; 5 836 € / 2010; 5 802 € / 2011), (more info in chapter 4)

[2] Effpower AB, Göteborg, Sweden

Development of the manufacturing of ceramic/lead composites by the melt infiltration process for the battery applications

Revenues: 834 922 € (183 147 € / 2007; 173 150 € / 2008; 188 540 € / 2009; 199 076 € / 2010; 91 009 € / 2011), (more info in chapter 4)

[3] GLEICH GmbH Metallplatten-Service, Kaltenkirchen, Germany

Development of structural components using of aluminium foam and investigation of their application possibilities

Revenues: 177 218 € (26 729 € / 2007; 32 249 € / 2008; 64 422 € / 2009; 42 664 € / 2010; 11 154 € / 2011), (more info in chapter 4)

[4] New Materials Development GmbH, St. Pantaleon, Austria

Research and development of advanced materials and components prepared by powder metallurgy of Al-alloys

Revenues: 92 492 € (44 329 € / 2007; 38 413 € / 2008; 9 000 € / 2009; 750 € / 2010; 0 € / 2011), (more info in chapter 4)

[5] LMT Metallurgie Beratung GmbH, Oberweis, Austria

Recycling of magnesium scrap by distillation method

Revenues: 39 500 € (10 000 € / 2008; 7 500 € / 2009; 7 000 € / 2010; 15 000 € / 2011), (more info in chapter 4)

[6] Kompetenzzentrum – Das virtuelle Fahrzeug Forschungsgesellschaft GmbH (ViF), Graz, Austria, New Materials and Technologies for vehicle NVH reduction

Revenues: 11.000,- €/2009

Slovak industrial partners:

[7] SAPA Profily Inc., Žiar nad Hronom
Extrusion of aluminium alloy powders
Revenues: 299 811 €
(148 662 € / 2007; 21 270 € / 2008; 36 622 € / 2009; 50 576 € / 2010; 42 681 € / 2011)

[8] Elektrokarbon, Inc., Topoľčany

Development of copper alloy appropriate for technology of infiltration in order to achieve optimized processing parameters of system graphite – Cu-alloy

Revenues: 21 576 € / 2007

[9] Elektrokarbon, Inc., Topoľčany

Development of the technological equipment for pressure infiltration of graphite sliding contacts

Revenues: 180 741 € / 2007

[10] SPINEA, Inc., Prešov

Research on new designs of bearing reducers

ix.

Outreach activities	2007	2008	2009	2010	2011	total
studies for the decision sphere, government and NGOs, international and foreign organisations						0

7. Popularisation of Science

ii. List of the most important popularisation activities

[1] Edition of the popular science book publication: J. Jerz et al. - Talking about materials and technologies (in Slovak), ISBN 978-80-970027-6-3, 184 pages, number of prints: 400 pcs, IMSAS Bratislava 2008.

[2] Edition of the popular science CD publication: J. Jerz et al. - Talking about materials and technologies (in Slovak), ISBN 978-80-970027-6-3, 184 pages, number of copies: 2000 pcs, IMSAS Bratislava 2008.

[3] Participation on Hannover Messe 2008, stand of the Extremat project (21 – 25 April 2008), Germany.

[4] "They wake interest in the application sector", interview with Dr. F. Simančík, newspaper Hospodárske noviny, 27/11/2008, p. 18.

[5] "The companies have more opportunities with innovations", newspaper Hospodárske noviny, 15/12/2008, p. 21 – 22, redactor: Matúš Demko.

[6] "The Trade Fair of industrial technologies started" interview with Dr. J. Jerz about industrial applications of aluminium foams in radio broadcast "Be careful in a curve! (Pozor zákruta!)", 20/02/2008, 13:05; radio station Slovakia; 2 min.; redactor: Igor Daniš.

[7] "Academics at Ferrari - an article on the prestigious price "Application Award", which won IMSAS at the International Symposium on cellular materials CELLMET 2008 in Dresden", Revue priemyslu, No. 12, 05/12/2008, p. 72 – 73, J. Jerz).

[8] Presentation of R&D activities of IMSAS within the accompanying program during the International Trade Fair INDUSTRY EXPO 2008 in Bratislava, (21/02/2008; F. Simančík).

[9] "SAS exhibit in Hanover" - Information about involvement of IMSAS on the world's largest industrial technology trade fair HANNOVER MESSE 2008 focused on the field of engineering innovations, which took place on 21 - 25 April 2008 (04/23/2008; web page of SAS, J. Jerz).

[10] "Patents are not a gold-mine in Slovakia yet" – discussion with Dr. F. Simančík – director of IMSAS and Ing. D. Kyliánová – president of the Slovak Industrial Property Office B. Bystrica about the issue of intellectual property protection, 21/05/2008, 20:45; TV station TA 3; Program: The wallet (Peňaženka); 15 min.; redactor: Lucia Havlíková.

[11] Presentation of results of R&D activities of IMSAS during Scientific Night 2008 in a shopping center Aupark in Bratislava (26/09/2008).

[12] "Application Award" for IMSAS – information about the prestigious award, which IMSAS obtained during international symposium on cellular materials CELLMET 2008 in Dresden (30/10/2008; TASR – The News Agency of the SR)

[13] "Titanium alloys" – discussion with Dr. J. Lapin about titanium intermetallic alloys, utilization of microgravity conditions and importance of international scientific co-operation coordinated by the European Space Agency by their investigation (Quark No. 11, November 2008, p. 8 – 9).

[14] Presentation of results of R&D activities of IMSAS during Slovakia - Taiwan bilateral seminar, Small Kongress Center of SAS (Bratislava; 07/11/2008; J. Jerz).

[15] "Slovaks investigate for Ferrari", article about industrial applications of materials developed at IMSAS, www.eTrend.sk, 15/11/2008, redactors: Martin Jesný and Jozef Andacký.

[16] Scientific sweetshop – lecture and discussion with students of secondary schools: "Enginiering materials of near and far future", the Centre of Scientific and Technical Information, National Center for Popularisation of Science and Technology, Association of Young Scientists in Slovakia (Bratislava, 21/11/2008, J. Jerz).

[17] "Innovative people received Oscars (Inovatívcom dali Oskarov)" – article in newspaper "Hospodárske noviny" about award „Innovative Act of the Year 2007", which was awarded

to IMSAS by Minstery of Economy SR in the category of “Product innovation” for aluminum foam bumper of railway carriage (Hospodárske noviny; 01/12/2008; p. 25; www.hnonline.sk)

[18] Public doors open day organized by IMSAS on 5th November 2009.

[19] Lecture: "Advanced Metallic Materials Developed by IMSAS" on meeting of delegates of U.S. Army International Technology Center - Atlantic with scientists of SAS, Aula SAV in Bratislave, Patrónka (18/11/2009; J. Jerz).

[20] Participation on Hannover Trade Fair 2010, stand of the CE CEKOMAT (19 – 23 April 2010), Germany.

[21] “Applied research of IMSAS: Presentation of IMSAS activities during the Hanover Trade Fair 2010”. In TRANSFER: Science – research – technology transfer. ISSN 1337-9747, 2010, Volume 2, No. 2, p. 24-25 (J. Jerz).

[22] “Ultralight Composites - new materials and technologies”, TV documentary broadcast on 15/06/2010 at 21:05 - STV2 TV station in the cycle “Spectrum of science” (Spektrum vedy)”.

[23] “Aluminium foam – our pride” – discussion with Dr. J. Jerz on industrial aplications of aluminium foams (Quark, No. 8, November 2010, p. 32 – 33, ISSN 1337-8422).

[24] Video interview with Dr. J. Jerz on industrial applications of advanced materials developed by IMSAS, www.eQuark.sk, 01/08/2010 (http://www.equark.sk/index.php?cl=article&iid=1581&action=itemclick&tname=top&pr=click%2Cdefault).

[25] Presentation of results of R&D activities of IMSAS during Scientific Night 2010 in a shopping center Avion in Bratislava (24/09/2010).

[26] Participation of IMSAS on “Scientific Night 2010”, report on 27/09/2010, radio Regina.

[27] Guests of the program “Solarium” (Radio Devín, 20/10/2010) were M. Nosko and R. Florek from IMSAS.

[28] “The development for BMW and Audi is for SAPA advantageous”, article about cooperation of IMSAS with SAPA Profily, Ltd. Žiar nad Hronom, newspaper Pravda, 25/10/2010, p. 12.

[29] Metallurgy of Ti-Al-Ta intermetallics alloys: poster. In SASO Expo, Split Croatia, 2010 (M. Gebura).

[30] “Poklady.sk”, TV documentary broadcast on 24/10/2010 – STV station (directed by: Roman Bürger; produced by V.I.T Slovakia, Ltd. for STV).

[31] “Slovak Science in Istanbul”, report on 05/11/2010, 19:30 – STV station, STV News (redactor Peter Majer).

[32] “Research – development – innovations”, article about industrial applications of materials developed at IMSAS, newspaper Hospodárske noviny, 02/12/2010, p. 16.

[33] “The knowledge society is creating new knowledge”, report on 07/12/2010, TV Markíza, 22:00, 3 min., redactors: Zlatica Puškárová and Rado Igaz (F. Simančík)

[34] “Guest in the studio” (Hosť v štúdiu), report on 08/06/2011, TA3 TV Station (F. Simančík).

[35] “Successful scientists are as the golden eggs”, report in program TV News of TV Markíza, 02/01/2011, 19:00, 2 min., redactor: Rado Igaz (F. Simančík)

[36] presentation of results of R&D activities of IMSAS during Scientific Night 2011 in a shopping center Avion in Bratislava (23/09/2011)

[37] Scientific sweetshop – Special: “Science, its history, today and future”, the Centre of Scientific and Technical Information, Bratislava (23/09/2011, P. Oslanec).

[38] “That good ideas do not remain in the socket”, video interview Trend, 15/09/2011, redactor: Jozef Andacký (F. Simančík).

[39] Excursion of a group of Chinese students at IMSAS combined with lecture and discussion, organized in collaboration with the Slovak Association of Young Scientists, 13/06/2011.

[40] "We have saved Ferrari over Christmas", video interview SME, 10/12/2011, redactor: Tomáš Prokopčák, http://veda.sme.sk/c/6173682/frantisek-simancik-ferrari-sme-zachranili-cez-vianoce.html (F. Simančík).

ii. Summary of outreach activities

Popularisation of science	2007	2008	2009	2010	2011	total
articles in press media/internet popularising results of science, in particular those achieved by the Organization	7	28	3	9	10	57
appearances in telecommunication media popularising results of science, in particular those achieved by the Organization	3	2	2	8	3	18
public popularisation lectures	1	4	2	2	4	13

iii. Supplementary information and/or comments on popularisation activities

The most attractive popularisation events in the assessed period was presentations of institute`s R&D activities during Scientific Nights in a shopping centre Aupark (2008) and Avion (2010 and 2011) in Bratislava as well as on the world's largest industrial technology trade fair "HANNOVER MESSE" (2008 and 2010) in Germany. The main aim of these exhibitions was to attract young people – visitors of our exhibition stands - for study of material science and mechanical engineering. PhD students of IMSAS demonstrated attractive experiments of aluminium foam components production in our exhibition stands during whole these events. The scientists of IMSAS discussed with professional public about potential possibilities of cooperation in R&D activities aimed to development of products with extremely high added value by using of our knowledge in abovementioned scientific field.

8. Background and management. Staffing policy and implementation of findings from previous assessments

i. Summary table of personnel

Personnel	2007	2008	2009	2010	2011
all personnel	83	80	85	80	81
research employees from Tab. Research staff	40	38	43	41	44
FTE from Tab. Research staff	34,69	32,54	34,65	32,17	34
average age of research employees with university degree	44,3	44,17	45,2	45,6	44,9

ii. Professional qualification structure

Number of	2007	2008	2009	2010	2011
vedúci vedecký pracovník DrSc./ research professor DrSc.	4	4	4	4	4
Vedúci vedecký pracovník CSc., PhD/research professor CSc., PhD	0	0	0	0	0
samostatný vedecký pracovník/ senior scientist	14	13	13	14	12
vedecký pracovník/research scientist	7	7	10	12	12
profesor/professor	0	0	0	0	0
docent/assoc. prof.	1	1	1	1	1

Vyplňte podľa prílohy A, správy o činnosti organizácie.

iii. Status and development of research infrastructure incl. experimental, computing and technical base (description of the present infrastructure, premises, and material and technical resources. Infrastructure, instrumentation and major technical equipment necessary for the achievement of the objectives specified in the research Concept)

Investments in k€		2007	2008	2009	2010	2011	TOTAL
Institutional funding		4	214	51	219	21	**509**
Structural Funds		0	0	0	869	869	**1 738**
External sources		62	45	238	38	12	**395**
Total		66	259	289	1 126	902	**2 642**
from this	Building reconstruction	2	214	232	216	22	**686**
	Equipment incl. Computer technique	65	44	57	909	881	**1 956**

The investments made by IMSAS in assessed period are given in above table in k€. Totally, about 2,6 mil.€ has been invested into reconstruction of institute buildings and to the purchase of advanced characterisation and testing equipment. This sum is similar to IMSAS yearly budget and significantly exceeds even most optimistic expectation. The revolutionary change

has happened in 2010 with the start of ERDF projects, when massive investments into novel R&D equipment have become possible for well prepared groups.

The investments into infrastructure were planned according to following philosophy:

- Fill the missing gaps in already unique technological equipment to be fully independent from external suppliers in preparation of materials specimens (vacuum casting, preparation of alloys, powder atomisation, advanced powder compaction) and simplify manufacturing of prototypes for flexible and quicker technology transfer (rapid prototyping techniques, 3D prints, CNC manufacturing)
- Significantly strengthen equipment for characterisation of materials structure at nanoresolution (updated metallography, high resolution microscopy, nanoindentor), with focus on non destructive approaches (X-ray nanotomography, acoustic emission). The most expensive equipment is planned to be shared among 10 institutes collaborating in a frame of consortium coordinated by Institute of Technology on material and technology related research
- Acquire some unique equipment to build unique competency in ERA (powder atomisation, tomography, high speed camera, high resolution microscopy, FIB) and thus strengthen the possibility for joint research project at EU level

Before actual start of ERDF projects suitable laboratory space needed to be prepared – for this purpose all available institutional resources were used. With these funds it has been possible to renovate the experimental hall at Patronka almost completely (new - cca. 500 m^2 laboratory space has been created followed by complex recovery of main testing hall), and also radically improve working environment in the main building at Racianska (new windows, facade isolation, completely renovated laboratories, etc.). It is to be stressed out that all the reconstruction and up-dating activities were co-financed from own financial resources gained exclusively by the research activities with industrial partners.
Then the consortia for joint preparation of ERDF project proposals were established which have applied for funding (mostly successfully).

At the moment almost all originally planned equipment is either purchased or contracted, giving the unique chance to built excellent modern research infrastructure within relatively small distances small place with easy access for interesting researchers.
Together, with already existing devices, the currently available Institute's research infrastructure includes:

Technological facilities:

- 5 autoclaves for pressure infiltration with graphite and induction heating for samples with the diameter up to 300 mm and length of 550 mm
- furnace for foaming of aluminium panels
- equipment for injection molding of metallic foams
- foam expandometer
- vacuum press for hot diffusion bonding (up to 300 000 kp)
- cold isostatic pressing (CIP) max. pressure 400 MPa.
- hot isostatic pressing (HIP) max. pressure 200 MPa, max. temperature 1800 °C
- plasma spraying of metallic and ceramic coatings with two separate powder supply units for preparation of composite coatings with various even gradient volume fractions of constituents on flat and round surfaces
- continuous electroless or galvanic coating of carbon fibres with metals Cu, Ni, etc.
- PVD magnetron
- furnace for unidirectional solidification
- 2 plasma melting furnaces
- vacuum furnaces for thermal treatments
- extrusion and ECAP hydraulic presses (up to 500 000 kp)
- equipment for preparation of rapid solidified ribbons from Al alloys with amorphous structure (metallic glasses) via „Melt Spinning" a „Planar Flow Casting"
- complete set of equipment for machining of prototypes and moulds

Structure characterisation equipment:

- metallographic equipment
- light optical microscopy (Olympus GX 51 equipped with CCD digital camera ARTCAM 300 MI)
- fully automated microhardness tester FM-ARS 9000 (10 – 500 p)
- X-ray tomography with resolution better than 0.5 μm
- scanning electron microscope JEOL 7600F FEG with resolution from 1 nm equipped with energy and wave dispersive spectrometers (EDS; WDS) and electron backscatter diffraction (EBSD)
- scanning electron microscope JEOL JSM 5310 with energy dispersive spectroscope KEVEX DELTA IV equipped with thin window for analysis of light elements
- transmission electron microscope JEOL JEM 100 C
- high speed ion milling machine (Balzers)
- optical emission spectrometer with laser induced emission (LIBS – LEA S500) with spectral range from 170 nm
- mass spectrometry
- computer controlled dilatometer measurements, DTA, DSC, TG (up to 1600 °C; Linseis, Netsch),
- easy accessible is also porosimetry, BET measurement, DMA tester, etc.

Materials testing equipment:

- universal computer controlled testing machine for determination of mechanical properties under static loading (tensile, compressive, bending tests) (Zwick; 10 000 kp loading force)
- static creep tests,
- thermomechanical testing
- fatigue tests (hydropulsator MTS, EDYZ)
- abrasive wear testing
- thermal conductivity measurement
- vibration and noise measurement and analysis (Bruel & Kjaer)
- hardness measurements (Vickers, Rockwell, Brinell)

This infrastructure is further supported with unique equipment for preparation of advanced materials and latest characterization facilities located in Institute´s branch INOVAL, Ladomerská Vieska, which is also built up using ERDF. These include:

- workstation equipped with CAD software;
- 3D scanner and 3D printer for preparation of real models directly from digital drawings;
- numerically controlled lathe and milling machine for machining of prototypes directly from digital drawings;
- rapid prototyping centre (casting of prototypes from aluminium alloys using the wax model method);
- equipment for metallographic preparation of samples (saw, grinding/polishing machine; embedding press);
- universal machine for thermo-mechanical (deformation) tests of materials at elevated temperatures Gleeble (100kN);
- light microscope;
- hardness tester;
- differential thermal analysis (DTA);
- equipment for metal casting in protective atmosphere (induction melting up to the metal volume of 2 l).

Following interesting equipment is under contract negotiation:

- atomising unit for manufacturing of Al powders
- high speed camera with shooting frequency up to 1MHz
- X-ray defectoscopy
- Acoustic emission device

iv. Status and development of bibliographic resources, activities of the Organisation's library and/or information centre

Institute's library and information centre offer – apart from standard loan service from own holdings – possibility of interlibrary and international interlibrary loans. It ensure journals subscription and monographs and other literary sources acquisition, journal circulation service; provide information on new publications and offers of publishing houses, scientific information retrieval on request and copy service. The library keeps registration databases of scientific publications and citations of Institute's workers and prepares bibliographies or citations compilations for project and other reports. At the same time, the publications are registered in ARL system.

The Institute's workers have electronic access to variety of full text and other scientific databases as the Institute participates in a number of consortia by means of Central Library SAS and thanks to the fact every workplace has appropriate hardware equipment.

Library holdings status and development:

Year	*Items*	*Scientific journals*
2007	13 723	32
2008	13 919	32
2009	13 935	31
2010	11 573	14
2011	11 595	10

The library of IMSAS's branch in Martin has been cancelled in 2010 due to delimitation of the IMSAS's branch in Martin to Center for Molecular Medicine SAS.

v. Describe how the results and suggestions of the previous assessment were taken into account

In the previous assessment (2007) Institute was evaluated with high "A" degree gaining 19.27 out of 24 points.

Following suggestions were given by the Assessment commission:

- ***orientation towards the research of advanced materials: nanomaterials, metallic foams, intermetallic alloys, metal matrix composites should be proceeded;***

The decisive part of the research is oriented towards advanced materials particularly to nanomaterials, metallic foams, intermetallic alloys and metal matrix composites.

- ***entering new research areas e.g. combine experiments and simulations;***

New research areas are entered mostly with the purchase of new experimental equipment e.g. laser induced breakthrough spectroscopy (LIBS); wave dispersive spectroscopy (WDS); electron backscatter diffraction (EBSD). Simulations are mostly introduced when required by the particular method (e.g. Monte Carlo simulation for the determination of X-ray generation volume). Nevertheless the simulation remains mostly a supporting tool for experiments at the Institute. Modelling and simulations are available in top level within the consortium CEKOMAT and INOVAL coordinated by IMSAS.

- ***searching for optimal ratio between basic and applied research;***

Ratio between basic and applied research is basically determined by the objectives, quality and importance of gained projects and available resources. The attention is paid rather to complex and multidisciplinary research than to the separate assessment of basic and applied research.

It should be mentioned that the lack of public financial support needs to involve a large portion of the research capacities into problem solving research activities for industry, where the necessary resources can be attracted in easier and more flexible way. Nevertheless, the publications of scientific results in high ranked journals and radically increased citation

response to the published results, parallelly with sound institute's financing and well developed doctoral study confirm a good proportion between fundamental and applied research.

- ***publication activities should be expanded into wider spectrum of quality scientific journals;***

The achieved results were successfully published in wide spectrum of high quality journals ranking from most prestigious Acta Materialia. The publications selected in chapter 2 were published in journals exceeding in average impact factor 1, whereas all 45 have been prepared by institute's staff members as first authors.

- ***taking care in order to achieve more even participation of all research teams on publication activities;***

The subject fields of interest of particular teams differ sometimes significantly by nature, what is reflected in corresponding scatter of their publication activities. Nevertheless all institute research activities are well covered with good scientific publications, (with and exception of confidential results from industry driven projects)

- ***intensify the involvement of PhD students in scientific projects and in publication activities;***

All PhD students are involved in most prestigious projects including 7th FP Siltrans, Matrans, or most important APVV projects. The publication activity of PhD students is highly encouraged and also financially supported

- ***in spite of essential innovation further upgrade of several experimental equipments should be followed in order to be able to gained planned scientific goals more effectively;***

Tremendous improvement of experimental infrastructure has been achieved in the assessed period of time and contracted ERDF project promise further and still better improvements.

- ***further scientific orientation of Institute´s branch in Martin should be re-defined.***

The Institute´s branch in Martin was joined with a Centre for Molecular Medicine of SAS and now represents a base for intense cooperation with Jessenius Faculty of Medicine in Martin in a frame of coming ERDF projects which may radically improve research infrastructure and competencies of the researchers.

vi. Supplementary information and/or comments on management, research infrastructure, and trends in personnel development

9. Supplementary information and/or comments important for the assessment of organisation which are not explicitly mentioned in the questionnaire (concerning each previously mentioned evaluation criteria, facts not included, evaluation of research teams by ARRA, etc.)

Two main institute's research teams headed by Juraj Lapin and Frantisek Simancik were identified by ARRA as excellent research teams, exceeding the level of average European research groups working in related topics.

Other information relevant to the assessment