5th International Workshop on Surface Engineering & 2nd International Workshop on Applied and Sustainable Engineering

Collection of workshop proceedings in varied subject categories

Abstracts

International Workshop, 04–10 June 2017, Koszalin University of Technology, Poland

Ver. 1.0.4

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Adsorption and desorption from nano-structured surfaces studied by XPS and TPD

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The objective of the present studies is the investigation of how surface properties are changed in doped and nanostructured materials. Various surfaces have been studied by surface analytical tools like X-ray Photoelectron Spectroscopy (XPS) and Temperature Programmed Desorption spectroscopy (TPD). Systems as different as shape memory alloys and carbon cone materials are addressed. The initial phase of oxidation of pure and potassium doped nitinol surfaces has been studied. It was found that deposited K has a pronounced effect on the initial oxide growth. High resolution synchrotron photoemission was performed on oxidation of a Al(111) single crystal. The evolution of the different surface oxides was monitored as a function of oxygen exposure. Carbon nano-cones have been speculated to be of potential interest in hydrogen storage applications. Hydrogen adsorption properties of pure and K doped carbon nano-cone containing materials have been studied by XPS and TPD. We observe a shift to higher hydrogen desorption temperature with increasing potassium doping. Compounds based on rare earths have many interesting properties. Studies of adsorption and desorption of carbon monoxide on Ce-Pt(111) surface alloys have been performed. One interesting result is that the desorption temperature of CO was dramatically reduced for the surface alloy as compared to the pure Pt(111) surface.

Real time measurement of layer thickness, erosion rates and crater depth in glow discharge optical emission spectrometry

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Pulsed Radio Frequency Glow Discharge Optical Emission Spectrometry provides Ultra Fast Elemental Depth Profile of thin and thick films. The technique relies on the sputtering of a representative area of the material of interest by a plasma which also excites the sputtered species. The quantitative information on the elements present in the film can be achieved through the real time analysis of the light emitted from the de-excitation of the excited elements. A new function giving the capability to measure, in real time, the depth of the sputtered crater is being introduced. Such measurement, based on differential interferometry with nanometer sensitivity, is able to provide direct information about the thickness of the layers and their erosion rates. This is crucially important, notably when the investigated materials are non-transparent, as in this case an alternative technique such as ellipsometry cannot be used. The application of this new development to the determination of the thickness of PVD coatings and electroplated samples will be presented.

Development of porous coatings, which are enriched in selected chemical elements, obtained by Plasma Electrolytic Oxidation

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Plasma Electrolytic Oxidation (PEO), known also as Micro Arc Oxidation (MAO), is a widely used technique, to prepare porous coatings on metallic biomaterials such us titanium, tantalum, niobium, zirconium and their alloys. Most important is the fact that with use of different electrolytes it is possible to obtain coatings enriched in chemical elements, such as bactericidal copper, silver, zinc, iodine as well as calcium. These elements are usually helpful in creation the hydroxyapatite-like structure whereas another one, magnesium, is necessary to accelerate healing of surgical wounds. Therefore the electrolyte is an important factor influencing the PEO process and the resulting coating properties. The available literature provides a vast number of possibilities for selection of the electrolytes used in the process. For the PEO oxidation of titanium, the following electrolytes have been used: phosphoric and sulfuric acids, sodium metasilicate pentahydrate, silicon acetate within Ca-β-glycerophosphate and NaOH, Ca-β-glycerophosphate and calcium acetate potassium phosphate with potassium hydroxide, potassium pyrophosphate and potassium hydroxide, calcium glycerophosphate with calcium acetate, tripotassium phosphate and potassium hydroxide with and without monoclinic zirconia powder, sodium silicate with phosphoric acid and potassium hydroxide, tungstosilicic acid, ethylene diamine tetraacetic acid, disodium with calcium oxide and calcium dihydrogen phosphate and sodium metasilicate nonahydrate, sodium phosphate with hydrated sodium borate and sodium tungstate dihydrate and iron(III) oxalate sodium hydroxide with monosodium dihydrogen orthophosphate with and without Cu nanoparticles, β-glycerophosphate disodium salt pentahydrate with calcium acetate hydrate, calcium acetate hydrate with disodium hydrogen phosphate anhydrous. To form porous coatings on titanium under the PEO process, in this work Authors propose new electrolytes based on phosphoric acid with nitrates of copper, zinc, calcium and magnesium.

That work was subsidized by Grant OPUS 11 of National Science Centre, Poland, with registration number 2016/21/B/ST8/01952, titled "Development of models of new porous coatings obtained on titanium by Plasma Electrolytic Oxidation in electrolytes containing phosphoric acid with addition of calcium, magnesium, copper and zinc nitrates".

Removing the Influence of Wind-Park Echoes in Weather-Radar-Measurements

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This talk is concerned with the development of new methods and technologies for overcoming the influence of wind energy turbines to weather radar systems. In particular, we focus on mathematical methods to filling appearing data gaps (caused by wind energy turbines) of weather radar systems. Moreover, as a precise knowledge of vertical wind profiles play in this context also a very important role, we present new concepts for Doppler laser profilers that allow a detailed investigation of the propagation of wind vectors.

Grinding of the gears with depth high processing

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Gear drives are a part of many machines in industry. Although the theoretical knowledge in this area is already well established, it is always possible to find a element of whole system that may be improved. That way, a lot of scientific teams all around the world are still working on that topic. During the presentation, a new, more effective author's method of gear processing techniques, will be presented. In addition, some results of mathematical analysis and 3D computer simulations, will be shown, too. All the experiments were performed in laboratories of TCM and BPM Departments at Technical University of Moldova.

Development of Magnetoelectropolishing Processes

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Magnetoelectropolishing (MEP) is an electrochemical polishing (EP) process performed under the magnetic field. It has been developed by the authors for several years now and proved its usability for a variety of metallic materials, beginning specifically from austenitic stainless steels up to titanium and its alloys. Our experiments have shown that the magnetic field introduced to the process effects in beneficial modification of oxide layer of treated metals, alloys and intermetallic compounds. It appears, numerous physicochemical and mechanical properties are modified by the MEP process in comparison with the properties obtained by a standard electrochemical polishing. At the first sight, surface roughness and gloss are significantly improved. Then the corrosion resistance, as the result of improved surface is also enhanced, even that the passive film on nanometric scale formed on the metal surface in many cases is thinner than that obtained after standard EP. During MEP the stirring is self-imposed by Lorentz Force as a result of interaction of electric and magnetic fields. Thanks to this, the protective oxide formed on the surface differs significantly in morphology, homogeneousness, thickness, kind and quantity of foreign species incorporated in it with oxide obtained during standard EP. Thus the corrosion resistance, biocompatibility, osseointegration, endothelialization, cleanability, anti-galling and anti-seizing properties of metallic biomaterials are achieved. Moreover, some mechanical properties of metallic samples have been also proved to be increased. Our studies on 90-degree bending of nitinol wire samples revealed a considerable increase of numbers of cycles until their fracture. One more important feature of magnetoelectropolishing process is the effect of dehydrogenation. Our introductory studies have shown that the level of hydrogenation of the surface layer after MEP is much lower than that measured on the samples after a standard EP.

Some insight into the mechanism of action of the magnetic field was recently revealed by a group of other researchers. They found that the additional external effect influencing the solid-liquid interphase, such as a magnetic field manages to modify the properties of double layer during MEP process. Therefore, thanks to the magnetic field, much different conditions of the process result in advantageous modifying surface film formed on the metal surface.

Science communication

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It is a well-known fact that English has become "Lingua franca" in contemporary societies regardless of culture, mother tongues and tradition. It adopts, absorbs and exports words, expressions and collocations into varieties of languages while becoming an indispensable tool in a multitude of voices pronounced through different professions. The focus of our Ceepus network is engineering as the universal language applicable everywhere. It can with much conviction be claimed that although science began to emerge as popular discourse in the period of the Renaissance, it was not generally known to the public until the 19th century. However, today`s lifestyle cannot be imagined without science since scientific achievements provide great benefits to society. Science has become a profession but also a very mundane topic. Modern generations are required to be literate in science and scientific notions. A comprehensive manner of educating them should be the objective specially since science communication is generally considered as public communication presenting science-related topics to non-experts and we need to find the appropriate means of bringing closer scientific methods, findings and potential advantages to the public. Whether we decide to apply traditional journalism, live of face-to-face events and online interaction we need to make the public aware of science and technology and their absolute necessity in our lives.

Comparison of standing timber sorting with bucking by harvesters

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Annually, harvester technology in the Czech Republic processes 29 % of annual wood yield, which represents 4.5 mil m3. What remains an open issue is the possibility of electronic scaling and grading of timber from harvesters, which is motivated by two aims of timber suppliers (forest owners). The first aim is to achieve maximum possible yield and consequently maximum receipts for the produced timber. The second aim is to meet the requirements of customers who are in charge of timber sales. Deployment of harvester technology often shifts the preferences towards the latter aim, i.e. it results in submitting to customer requirements or, in a better case, in a compromise between the two possibilities, which may prove unprofitable particularly for forest owners. A comparison of planned production with the proposed grading of standing timber conducted prior to the actual launch of harvesting may guarantee efficient management. At present we can draw on assortment tables (e.g. Pařez and Michalec, 1987; Petráš et al., 1996) or indirectly on available commercial software applications, which are based on assortment tables and classify timber volume within six quality classes, mostly in relation to diameter at breast height, yield class, health status of the given stand, etc.

Another possibility is to apply grading simulation based on data provided e.g. by measurement and control system of harvesters. Cut-to-length logging and consequent grading of spruce by harvesters remains the key application in forest management, as it takes up a major share of the of annual volume of timber production, i.e. approx. 73 % (MZe2015). In extreme cases up to eight different spruce logs in six quality classes are produced by the harvester technology in a single production block, which may result in financial losses caused by misplacing individual assortments in the course of forwarding to roadside landings or giving preference to less valuable assortments during production to satisfy the demands of a particular customer. The quality of grading must be supported by correct methods of timber scaling in forest stands. The primary aim of this paper is to compare the differences in timber scaling by harvester production-recording software and manually within the stands. The second objective is to compare the volume of standing timber assortments with the corresponding volume of harvester-processed timber based on customer specifications. The resulting difference represents 1.5 – 4.7% in electronic calculations of timber volume as compared with "Recommended Rules for the Measurement and Grading of Timber in the Czech Republic". The difference between standing timber grading and harvester-recorded grading ranges between 2.8 and 6.3% in favour of customers in related quality classes.

Spline, NURBS and T-spline

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Spline surfaces are often used in wide area of the technical applications. Nevertheless, the users only apply the well-known methods for their purpose. We present the background theory of different type of spline surfaces and we clearly describe the mathematical base of the structures and the influence of the parameters to the shape of the spline. We also deal with the spline interpolation and approximation methods.

Hydroxyapatite coatings on titanium substrates

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The hydroxyapatite (HAp) coatings are widely used to cover the titanium surfaces and enhance their biocompatibility and bioactivity. The optimisation of coatings is dependent on the substrate, the preliminary surface treatment, the deposition method and its parameters. In our research, the electrophoretic deposition (EPD) was here used to obtain the nanosilver - nanohydroxyapatite coatings of moderate thickness on the Ti13Zr13Nb alloy. The electrocathodically enhanced deposition (ECAD) was applied to cover the diamond and diamond-like-carbon films on the Ti-6A-4V alloy. The ECAD was also used to deposit HAp coatings inside the scaffold structure. The manufacturing the HAp coatings on the Ti-13Zr-13Nb alloy was performed by sol-gel method. In conclusions, we may say that the thickness and properties of the HAp coatings on the Ti13Zr13Nb alloy are determined by the fabrication method giving an opportunity to design such surface modification for a defined medical purpose.

Corrosion of steels utilized for fabrication of automobile engine valves

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Four chromium-nickel steels (X33CrNiMn23-8, X50CrMnNiNbN21-9, X53CrMnNiN20-8 and X55CrMnNiN20-8) are generally utilized for the production of valves in automobile engines. These materials must work in very severe conditions because of rather high operating temperatures (~1173 K), aggressive atmosphere and rapid temperature changes, described in literature as thermal shocks. In the last few years, the problem of valve corrosion became considerably more significant due to the application of LPG and CNG gases, or, in addition to traditional fuels, of bio-components, the combustion products of which are very aggressive. The kinetics and mechanism of engine valve degradation under such conditions have not yet been explained. This is due to their high complexity, mainly as a result of the very complex chemistry of combustion gases. Taking into account the fact that this problem is of fundamental importance, a systematic research program has been established in our laboratory in order to obtain new information on the kinetics and mechanism of valve steel corrosion in combustion gases.

In this presentation, the corrosion behavior of four valve steels in various aggressive atmospheres (air, combustion gases of petrol or diesel oil) is discussed. Corrosion studies were carried out at a constant temperature, as well as under thermal shock conditions. It has been shown that the chemical composition of the steels, in particular their chromium content, determines the corrosion resistance of these materials. Consequently, the X33CrNiMn23-8 steel, which contains the highest chromium concentration, exhibited much better behavior in the investigated atmospheres than the three remaining steels due to the formation of a highly protective chromia scale. It has been also determined that the corrosion rate of all steels can be decreased by means of protective chromium coatings. It has also been demonstrated that the positive effect of chromium addition on the oxidation resistance of investigated steels is observed during a much longer period of time than the life-time of the chromium coating, which strongly supports the idea of tailoring a new generation of high temperature inexpensive coatings for engine valve protection.

Performance characteristics of black glasses in the form of protective-conducting coatings

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The process of burning the high-energetic fuels enriched in carbon, is one of the oldest and the most efficient way to produce the energy. However, a lack of promising alternatives for fossil fuels and progressive climatic changes concerning the emission of greenhouse gases, increased the interest in so-called "indirect" technologies such as fuel cells.

Recently, it is the hydrogen, which is being taken into account as a main source of energy for this technology. Despite many advantages, the cost of pure hydrogen production, caused that reformed fuels based on biogas, ammonia, hydrogen sulfide or hydrocarbons are also taken into consideration. Unfortunately, they create very aggressive working environment of metallic materials, which are under the threat of corrosion due to high temperature and the atmosphere of oxidizing-reducing gases. Hence, there are being sought new methods of protection of metallic elements, which are not only exposed to harmful working conditions in thermal cycles, but also in the case of electricity generation, they have to meet requirement concerning low electrical resistance.

From many solutions, one of the most interesting are ceramic materials with the structure of amorphous silica, so-called black glasses, in which there is known an amount of oxygen ions O^{2-}, replaced by carbon anions C^{4-}. Such a replacement, has its purpose in increasing the bond density resulting in advantageous chemical, mechanical and anti-corrosive properties. Due to the fact, that the carbon content in the structure is limited, there exist an excess of this element in the form free carbon phase responsible for black colour and satisfactory electric properties.

The main objective of the work, was investigation of performance characteristics of black glasses as anti-corrosive coatings on ferritic stainless steel.

The material for coatings, was produced by the means of sol-gel method with the use of appropriate precursors – polisiloxanes, able to incorporate Si-C bonds into the final structure. The layers were deposited using three methods: dip-coating, spin-coating and electrophoresis. Then, the processes of drying and pyrolysis in 800°C in protective argon atmosphere were applied.

Selected coatings with the highest degree of homogeneity and tightness (characterized with structural and microscopic studies - Confocal, SEM with EDX and MIR), were examined with tests evaluating their properties, such as: corrosive (isothermic oxidation in 800°C for 100h), thermal (thermal expansion coefficient TEC) and electrical (Area Specific Resistance versus temperature up to 800°C and time, within 200h). Conducted measurements together with the analysis of surface structure (Raman, XRD) and microstructure of cross section (SEM with EDX) after oxidation, allowed to describe the useful properties of black glasses coatings under harsh environment, simulating working conditions of ferritic stainless steel.

This work was supported by NSC under project 2014/15/B/ST8/02827.

Composite layers constituted of silicon oxycarbide modified with carbon nanoforms deposited on metallic substrates

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The aim of the study was to obtain nanocomposite layers formed black glasses based on silsesquioxanes and carbon nanoforms, especially multiwalled carbon nanotubes (CNT). This type of layers is a new generation of materials. They possess unique properties and are characterised with high structure hierarchy with very specific micro- and nanotopography. By proper modifications of the layer components, it is possible to obtain superhydrophobic, self-cleaning, antifouling, durable coatings of high electrical and thermal conductivity, mechanical parameters [1].

The layers were formed with the use of electrophoretic deposition with the use of polysilsesquioxane sol containing carbon nanotubes [2]. After deposition, the material was dried and subsequently ceramised [3,4]. Detailed study of the surface of the layers demonstrated their continuity and tightness. Composite layers had excellent adhesion to the metallic substrate and mechanical parameters, what was proved by scratch test and nanoindentation, respectively. Moreover, so-called Kokubo test indicated bioactivity of the coatings.

Summarising, the obtained layers are promising materials for applications such as materials for medicine due to their physicochemical and surface properties. The chosen path of formation of the coatings was effective and enable to control material parameters in a wide range.

This work was supported by NSC under project 2014/15/B/ST8/02827.

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Modeling of Liquid Flow Through Porous Materials of Different Microstructure

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Porous media are encountered in different areas of science and technology: chemical, civil and petroleum engineering, agricultural and soil sciences. Transport in porous media plays an important role in degradation of refractory materials as well as manufacturing of metal and polymer matrix composites. Modeling of those processes allows optimization of the process as well as an improvement of microstructure and longer lifetime. In this work different models of liquid transport in porous material are presented. A simplified model assuming the microstructure as a system of spheres (solid particles/grains) with given diameter and a critical minimum distance between them allows investigating the influence of porosity on the velocity field and the pressure distribution during infiltration process. Additional simulations were performed for a real geometry obtained from the experimental microstructure of carbon and graphite materials. The process of melt iron flow in porous materials is described by the incompressible NavierStokes and mass balance equations with the proper initial and boundary conditions. Calculated results were compared to the results obtained by the model of infiltration in macro scale described by the incompressible Brinkman equation and mass balance equations. Numerical calculations were performed using the COMSOL Multiphysics software.

Modification of grain boundaries in BaCeO3-based composites

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Barium cerium oxide based compounds may be considered for application in different electrochemical devices due to relatively high proton conductivity. The main disadvantage of these materials is the poor chemical stability in the presence of CO2 and H2O in ambient atmospheres and insufficient electrical properties. The improvement of these properties may be achieved by doping or formation of solid solutions. Currently proposed approach is the modification of grain boundary properties by introduction of second phase to the host material and formation of composite materials. The objective of the current study is to discuss the influence of the Ba-Ce-Y-P-Si-O glassy phase addition on the selected properties of BaCe(Y)O3 host material. It was found that formation of composite material may be beneficial from the point of view of both chemical stability and electrical properties improvement.

This work was financed in the framework of Statutory Project for Science (Grant for Young Scientists no. 15.11.160.763, 2017) at the Department of Inorganic Chemistry, Faculty of Materials Science and Ceramics, AGH University of Science and Technology, Krakow, Poland.

Selected Products of Superfoods as a Way to Enrichment the Diet in the Components Supporting the Treatment of Gout

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Superfoods is a natural functional food. These products are rich in a lot of mineral compounds, vitamins and bioactive substances, which show a beneficial effect on health over the effect of nourishing, in typically consumed doses [1].

Products that can be used in assisting treatment of gout are for instance Aegopodium podagraria L., Betulae folium, Nigella sativa and sour cherries. These plants are rich in anti-inflamatory, antiseptic, analgesic and antioxidant compounds [2, 3]. Diet in a treatment of gout is a very stricte and a very difficult to use, and superfoods, which can supporting to treatment of gout is a very important [2].

Aegopodium podagraria L. are rich in flavonoids and phenolic acids, which exhibit anti-inflamantory, anti-microbial and anti-tumour effects [2, 4]. Medicinal substances in Betulae folium are flavonoids, saponins, catechin tannins, triterpens, polyprenols, and essentials oils. Effects of these substances is diuretic effects and removes chloridium and sodium ions [2, 5] and also uric acid with urine [2, 6]. Sour cherries have flavonoids: antocyanins and quercetin, and also hydrocsycynamonian, potasium, carotenoids, vitamin C and fiber. Sour cherries and extract from these fruits is very important in treatment of gout: substances from cherries have anti-inflamatory effect and anti-oxidative effect [2, 7, 8]. Moreover it may have effects to reduces uric acid level in the blood [2, 9, 10, 11].

Nigella sativa seeds have analgesic, anti-inflamatory, anti-bacterial, anti-viral, anti-fungal, anti-parasitic, antihistaminic, anti-allergic, anti-cancer, anti-oxidant, anti-hipertensive, antiasthmatic and hypoglycemic effect, and it is an immune stymulant. Bioactive subtances in Nigella sativa seeds are thymol, tymo quinone, thymohydroquinone, dithymoquinone, nigellicine, nigellone, nigellidine, nigellimine-N-oxide, arvacrol, 6-methoxy-coumarin, 7-hydroxy-coumarin, oxy-coumarin, steryl-glucoside, alpha-hedrin, tannins, essential fatty acids, ascorbic acid, essential amino acids [3].

Gout is a rheumatic disease, associated with an increased content of uric acid in the blood, and as a result it is followed by crystallization of sodium urate in various tissues, but first of all it includes the joint, but also kidneys and skin [2, 12]. Then appears the inflammation, erosion, destruction of joint and bones [13]. Treatment of gout is based on the decreased of uric acid level in the blood, remove uric acid crystals and reducing inflammation and pain [5]. These products are very strong effect on these problems.

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Polysiloxane-silazane networks as matrices for metallic palladium

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Palladium has been known for a long time as a valuable heterogeneous catalyst. This metal is widely applied in industry, typically supported on inorganic oxides (Al_2O_3). Incorporation of metals into polymeric networks has been attracting attention. In the present work polysiloxane-silazane networks have been applied as matrices for palladium catalysts.

Polysiloxane-silazane networks were obtained by hydrosilylation reaction. Commercially available poly(methylhydrosiloxane) (PMHS) was cross-linked with two vinylsilazanes. Linear, non-branched divinylsilazane, i.e. 1,1,3,3-tetramethyl-1,3-divinyldisilazane and cyclic 1,3,5,7- tetramethyl-1,3,5,7-tetravinylcyclotetrasilazane were used. In cross-linking reactions various molar ratios of Si-H groups (from the polymer) to vinyl groups (from the cross-linking agent) were applied. The proccess was carried out without any solvent at 60oC, in the inert atmosphere – Ar. Karstedt catalyst was aplied in the reaction. Palladium was introduced into the obtained polysiloxane networks from the solution of palladium(II) acetate in tetrahydrofuran. Amounts of palladium in the prepared networks were equal to 1 wt. % and 3 wt. %. Pd incorporation process was monitored by UV-Vis spectroscopy.

The obtained systems were characterized by several methods. Swelling experiments were performed. The results of these experiments allowed establishing that the prepared polysiloxane-silazane networks showed various cross-linking degrees. Using FTIR spectroscopy, it was found that Pd2+ ions were reduced by the Si-H groups. X-ray diffraction measurements showed that in Pd incorporation processes, reduction of Pd2+ to Pd0 occurred. Materials were examined by scanning electron microscopy (SEM). BSE detection showed dispersion of palladium particles on the surface of matrices. The surface of the obtained materials was examined by ESCA. Contents of palladium in the systems were verified by X-ray fluorescence measurements. Catalytic experiments (test reaction: conversion of isopropyl alcohol) were performed. It was found that all the obtained networks containg palladium are active redox catalysts.

The study shows that polysiloxane-silazane networks can be used as matrices for palladium incorporation. The obtained materials are active redox catalysts.

The work was supported by the Polish National Science Centre (NCN) grant No. 2014/13/B/ST5/ 01924.

Science as a source of metaphors in everyday communication

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The traditional view of metaphor seems somewhat limiting as its proponents believe that, predominantly, metaphorical language is the language of rhetoricians, poets or those with special linguistic talents. The view of cognitive linguists is much less confining. It is claimed that every language user, consciously or otherwise, employs metaphors in ordinary communication. Furthermore, in their book Metaphors We Live By, Lakoff and Johnson (1980: xii) argue that people's "conceptual system is shaped by […] constant successful functioning in the physical and cultural environment". This in turn implies that when people conceptualize abstract ideas they perceive them through more mundane domains. For example, such sentences as My mind just isn't operating today, I'm a little rusty today, or We're still trying to grind out the solution to this equation, indicate that people perceive the human mind as a machine (THE MIND IS A MACHINE metaphor). In this presentation, I shall endeavour to show that science (physics, engineering, mechanics) is an experiential domain which has been metaphorically productive.

FeCrNi-aC:H based amorphous nanocolumnar coatings, deposition and properties

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Austenitic stainless steels (ASS) are widely used in harsh, corrosive environments and frequently exposed to frictional wear. Surface treatment of these steels, resulting in an increase of surface hardness accompanied by slight enhancement of corrosion resistance is mainly based on low temperature nitriding, carburizing or carbonitriding.That treatmentleads to formation of relatively hard and wear resistant so called S-phase or expanded austenite layers where nitrogen or carbon content can reach 30 and 12 at.%, respectively.

An alternative approach is a deposition of expanded austenite layers by reactive sputtering of ASS targets in nitrogen or hydrocarbon containing atmosphere.

Deposits are crystalline in whole range of nitrogen content but quickly become amorphous when carbon content exceeds the solubility limit. Further introduction of carbon, above 12 at.% leads to formation of a unique nanocomposite structure where free carbon is released and segregates forming an amorphous matrix.

The structure, phase composition together with mechanical and tribological properties of FeCrNi-aC:H coatings are presented and discussed.

Code of Practice for universities concerning the management of intellectual property in knowledge transfer activities

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The principles for an internal intellectual property policy constitute the basic set of principles which public research organizations should implement in order to effectively manage the intellectual property resulting from their — own or collaborative — activities in the field of research and development.

This presentation will explore the European standards and principles for an internal intellectual property policy. The assumption of this presentation is the thesis that the most important area of modern economy is the creative sector as a creative area of scientific, technical and economic activity. We intend to demonstrate the link between intellectual property management in knowledge transfer and the Code of Conduct for Universities and the development of a creative economy.

Surface condition effect on oxidation kinetics of Ni-base superalloy

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The materials used at high temperature, like in gas turbines or jet engines, need to fulfill a number of requirements, e.g. high creep strength and oxidation resistance at a wide range of operating temperatures, environments and loading condition as well as a suitable ductility at low temperature. Such a properties are obtained in Ni-base superalloys, due to their microstructure consisting of thermodynamically stable γ-Ni matrix with combination of strengthening γ'-Ni3Al phase. However, when one expose the alloys at high temperature, an oxidation process occurs and the material starts to form an oxide scale. The Ni-Cr-Al based alloys can be classified into the three groups of materials in term of formed oxide scales: NiO-forming, chromia forming and an alumina forming alloys. Formation of protective oxides like Al2O3 or Cr2O3 substantially increase the lifetime of the component exposed at high temperature. To provide a resistance against oxidation a protective coatings such as MCrAlY (where M is mainly Ni or Co) or β-NiAl which are an alumina forming materials are applied. However, coatings production is time consuming, results in additional component costs, and can negatively affect alloy mechanical properties, such as e.g. fatigue strength. Therefore, another, cheaper method to force material to form a protective oxide scale is proposed. Namely, effect of a different surface preparation of Ni-base superalloys, like grinding, polishing, sand blasting etc. on oxide scale formation during exposure at high temperature will be presented.

Mechanical properties of models created using fused deposition modeling (FDM) method

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Fused deposition modeling is the one of most popular rapid prototyping methods because of its low-cost characteristics and relatively high quality of models. Mechanical properties of models fabricated using FDM method vary from its construction, process parameters as well as characteristics of used material. In the article were described the tensile strength and elastic modulus of 3D printed models made by the most common materials (ABS and PLA) on the basis of the literature analysis. This study shows, that components created using FDM method can be considered as fully functional in a wide range of applications.

Assumptions for implementation strategy of innovative grinding wheels in tool industry

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In the article were described an assumptions for implementation strategy of innovative grinding wheels in tool industry. Proposed methodology involves four tasks, to achieve its objectives in a systematic and complementary way. The first task concerns the concept of economic exploitation of the innovative grinding wheels in the field of grinding processes of hard-to-cut materials. The second task is aimed at activities related to identifying potential industrial partners, along with a detailed presentation of the proposed solutions, as well as their modification and development according to the specific technological requirements. Third task involves carrying out activities aimed at securing the copyrights relating to certain technologies which would be the subject of potential industrial implementation. In the fourth task should be focused at economic analysis of specific technological solutions with regard to investments made to the implementation, the benefits of technology, implementation time and increase of competitiveness in relation to existing solutions.

Problems in regeneration of technical blades using abrasive machining methods

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Technical blades are commonly used in many industries, like: food processing, paper production, machine industry etc. Usually technical blades should meet the high requirements according to the shape accuracy, surface quality as well as durability and life time. One of the main problem in using technical blades is its high cost and short shelf time. To enlarge the time of using and reduce purchase costs the regeneration process can be conducted. Regeneration using abrasive machining methods (usually in grinding process with bonded abrasive tools) can be made may times and significantly extend life time of the blade. In the article were described the most important problems that need to be overcome when technical blades regeneration is conducted using abrasive machining. In particular were analyzed: kinematics of grinding process, selection of the abrasive tools characteristics, optimization of process parameters as well as an effective methods of cooling the machining zone.

A measurement apparatus for assessing the impact of various factors on foam quality

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Foam occurs in many industries, both in the food industry (whipped cream, protein foam), cosmetology (shaving foam, shampoo) as well in the extractive and fire industry. The quality of foam, as a volumetric and stability in time, has a great impact on application of foam in cleaning process. The paper presents a laboratory measurement apparatus for the evaluation of cleaning foam quality by the Ross Miles method. By this method the impact of temperature and concentration solutions, hardness of water, their chemical composition and impurities on cleaning foam can be evaluated.

Corrosiveness of foodstuffs and cleaning agents

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The safety of produced food depends mainly on the quality of the surface which is in contact with food products. The food industry currently uses mainly stainless steel surfaces or Teflon surfaces approved to contact with food. Machines and equipment, internal and external parts, pipelines are made of either stainless steel or acid-resistant steel. The use of such materials contributes to easier hygiene maintaining and interrupts the formation of deposits and the build-up of biofilms. Stainless steel, despite its name, also submits to corrosion.

Keeping hygiene on surfaces of production, and not only is connected with the need to use cleaning agents based on acids, bases or enzymes. In reference with the formation on the production surface the optimal conditions (temperature, humidity, food) for microbial growth ,it is necessary to frequently (as often as every few hours) washing and disinfection. Detergents are more and more effective and includes in its composition more components to improve not only the efficiency of removal of sludges, but also increase the protection of the washed items.

Modern detergents contain corrosion inhibitors to protect surfaces against the effects of aggressive factors. Detergents themselves exhibit passivating cleaning surfaces. The surface after the washing process should be clean, shiny with a metallic sheen and so passivated. Improperly conducted process of washing and remaining on the surface contamination limits the access of oxygen to the surface and does not causes phenomenon of passivation.

In the food industry, in association with the use of various cleaning agents, there is not a big problem with corrosion. In a much greater extent we observe the phenomenon of corrosion in pipes and tanks of water and sewage systems. The processes of cleaning and disinfection are carried out sporadically. The surfaces are constantly exposed to the negative impact of water and wastewater.

The work presents a study on the impact of detergent and foodstuff on the corrosiveness of stainless steel. In the framework was examined the steel in terms of its composition to accurately identify, analyze the chemical composition of the washing agents, it was checked for acidity, pH and conductivity in concentration of 2% 4% 6% and 8%. In the following tests were performed detergent concentration effect on the corrosivity of steel. Some foods such as beer, milk, juice and honey were examined in terms of corrosivity.

Cybersecurity of the Baltic Pipe and the Nord Stream gas pipeline - international legal outlook on a pipeline crossing agreement

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The increasing digitization and modernization of technology in the oil and gas sector has many benefits, including a more reliable and continuous supply of energy resources. However, these benefits bring a growing number of cyber security threats that are emerging as a result of the convergence of networks. The industry is already witnessing some of this phenomenon in the form of an increased number of cyber security attacks on its energy infrastructure. Securing assets such as pipelines will require not only a combination of training, technology and industry standards, but also specific international and bilateral legal regulations. From the Polish perspective, it is essential to introduce the cooperation with the Nord Stream consortium to avoid potential cyber attacks that could be launched indirectly against the Baltic Pipe through cyber intrusion into the Nord Stream infrastructure.

The purpose of the presentation is to answer the question whether international law regimes do provide a possibility to enforce addressing cyber security in a respective pipeline crossing agreement.

The Quality of the 5251 Aluminium Alloy's Surface after Abrasive Waterjet Cutting Process

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Authors describes the possibility of using acoustic emission (AE) signal analysis for the purpose of evaluation of the surface obtained in cutting through aluminium with high-pressure abrasive waterjet. The analyses of the influence of the cutting head feed speed onto the flatness, waviness, and roughness of the cut surfaces were conducted. In second part of research, authors focuses on the analysis of the influence of changing the cutting process quality onto values of the selected descriptors of the emitted AE signal. The obtained research results showed a clear influence of the machining conditions onto the geometric structure of the obtained cuts and the registered values of the emitted stress waves.

The test results proved that it is possible to use the high-frequency AE signal analysis in evaluating the quality of the surface obtained in the cutting process. Determining the mathematical dependence between the given process quality indicator and the registered selected AE signal parameters in the frequency field will make it possible to forecast microgeometry of the obtained cuts solely on the basis of the AE signal emitted during the machining process.

Nanomaterials in food packaging

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Intelligent packaging is a promising application of innovation using nanotechnology to develop antimicrobial packaging. Intelligent packaging can react to environmental conditions or to react to warnings alone and warn the consumer about the contamination and the presence of pathogens. Nanotechnology and nanoscience have great potential for use in food processing and food chemistry. It should raise awareness about the mechanisms of interaction of nanoparticles with food ingredients and packaging for food [1]. Today we can find a copious number of smart food packages that are competent in facilitating antibacterial effect, scavenging moisture, oxygen, and carbon dioxide inside the package, and even indicating whether the food is in a safely consumable condition [2]. Furthermore, antibacterial smart food packages have been introduced to improve the shelf-life of processed meat, fish, cheese, and dairy products [2]. The potential to act as a barrier to heat, UV light, oxygen, moisture, and facilitation of antimicrobial conditions are the pivotal improvements of these smart food packages [2]. The prominent strategies used to produce hybrid materials for food packaging include blending of polymers and polymer nanocomposites. Nanocomposites are composites or hybrid materials that comprise a dispersion of nanometer size particles in a polymer matrix [3]. Adhesion-resistant surfaces are a kind of antimicrobial surfaces that without requiring the presence of an antimicrobial by itself, indirectly promotes bacteria removal [4]. Basically, these surfaces repel the adhesion of microbes via different physical repulsion techniques thus avoiding biofouling formation on them. Very low surface energies give very weak adhesions that can be reverted by water frictional force [4]. The research on the development of more potent antimicrobial polymeric materials without compromising the human toxicity is increasing and will be enhanced in the upcoming years [4]. The research on the development of more potent antimicrobial polymeric materials without compromising the human toxicity is increasing and will be enhanced in the upcoming years.

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An Innovative Virtual Reality Educational Environment for School Physics Education

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Over the past decade, the OECD Programme for International Student Assessment, PISA, has become the world's premier yardstick for evaluating the quality, equity and efficiency of school systems. The latest PISA assessment in 2015 focused on science and according to results of this survey in many European countries the students achievements in science are alarmingly low and special actions are needed to address and assists school to improve science education.

For example, in Slovakia average score in science as percentage difference from the OECD average is -6.5%, in Greece -7.7%, Romania -11.8% and even in Cyprus -12.8%. So, there is a clear necessity to address students' science and physics performance and improve the quality of education, assist students' learning and also enhance their understanding and their performance. These are absolutely necessary in order to achieve the aim of the EU to reduce by 2020 the proportion of 15 year-olds students with low achievement in science to less than 15%. So, specific actions and initiations should be designed towards this direction.

The article presents the project "WoP - An innovative virtual reality educational environment for school physics education" which aims to assist students in studying physics domain with the utilization of innovative technologies like 3D virtual reality.

The main aim of WoP project is to develop an educational environment developed innovative educational infrastructure offer immersive and efficient learning opportunities, engaging students in various educational activities, learning scenarios and offering students an attractive, entertaining and efficient way to learn various topics of the challenging domain of physics. The virtual educational environment and the laboratories are designed in a way that support students to form appropriate mental models of involved concepts, by visualizing them and allowing interactions with the virtual phenomena and processes.

Heatproduction by burning of agricultural biomass

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This work deals with problems of heat burning of agricultural biomass in boilers with an output up to 100 kW. The search was oriented on burning wheat straw, barley straw and corn stalk. The aim of this work was to determine combustion heat and calorific value of the investigated materials, perform the energy balance of the combustion and analyse the amount of harmful emissions arising from the combustion. Were observed gaseous emissions of CO, NO and NOx.

Part of this work was the design the systems for granulation and pelletizing the biomass in the laboratory conditions. We designed a system that allows to monitor the amount of gas emissions resulting from the combustion of biomass under laboratory conditions and to measure the amount of heat generated by burning biomass.

First Application and Market Introduction of Device for Continual Electricity for Single Phase Appliance

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Houses and buildings are usually connected to an electricity network, which uses three phases. A failure on one of the phases will not affect all appliances in the household, however some appliances that are connected to the malfunctioned phase will be stop working. The users does not have to notice the failure in the electricity network, which can cause serious damage on equipment, goods or materials that are impaired after failure. This applies to cooling and heating equipment, air conditioning, security systems, ventilation and others. 1PhEnergyOn project is a solution which ensures continuity of power supply to single-phase appliances. The device was developed on a research of electricity failures in villages and peripheries of cities, where property damage occurred repeatedly in specific conditions. The developed prototype has been tested for two years in continuous operation with a positive outcome. The invention is protected as a utility model PUV 162-2015 at a national level and the owner is Slovak University of Agriculture. Communication about the next steps was carried with the staff from SPUs Transfer centre and staff from CVTI SR. Based on this communication, the employees of CVTI SR provided a research on the condition of the technology from patent and scientific databases, professional processing of PCT patent to protect the invention in 38 countries of the European Patent Convention. Services of patent office were covered by the project NITT SK that was implemented by CVTI SR. Commercial potential was estimated in cooperation between Transfer centre SPU and CVTI which eventuated in a marketing studies for the preparation of the business model and spin-off. We communicated with potential customers in order to align price and quality parameters in different varieties, which are interesting for the market. Last activity was intended to create final products and their pilot testing. The prototype is on the sixth level according to Technology Readiness Level, we used this fact for preparing a project under the call FTIPilot-01-2016 - "Fast Track to Innovation Pilot", which supports the transfer of innovation into practice with a focus to socio-economic impact. Consortium of four partners was created in accordance with the terms of the invitation – SPU in Nitra, German energy consulting company Cleopa GmbH, Czech producer of circuit boards Marpos s. r. o. and multinational company Muehlbauer. An important part of the project FTIP is extensive pilot testing of the product. Agreements have been signed with several municipal authorities, schools and private companies in Slovakia, Czech Republic and Germany, which precisely specify the conditions for pilot verification of the device in the duration of 18 months.

Examination of Nanostructures by Auger Electron Spectroscopy

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State-of-the-art instrumentation dedicated to Auger electron spectroscopy offers the possibility to push the frontiers of material analysis. Except standard procedures like acquiring Auger spectra and evaluation of concentration profiles, it is possible, in reasonable cases, to acquire Auger images with resolution down to 10 nm which is of inappreciable value within contemporary focus on phenomena based on dimensional confinement. The latter, along with the inherent property of Auger electrons, i.e. escape depth in the range of tens of angströms, provides ideal conditions for investigation of structures with both, exceptional lateral and depth resolutions. Also, Auger analysis of insulating samples has become achievable by exploiting of neutralisation device. In this contribution we demonstrate the possibilities of newly purchased Jeol JAMP 9510F Auger microprobe which has been recently installed at Slovak University of Technology in Bratislava.

EIS Studies on Aluminium: Validation of an Equivalent Circuit

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Electrochemical Impedance Spectroscopy is a powerful tool for the research and development of new materials and new surface treatments with increased corrosion resistance. In the particular case of anodizing of aluminium and aluminium alloys, the application of equivalent circuits provides a unique approach for the assessment of the oxide structure and its effects on corrosion resistance.

In the past, aluminium anodizing for the aircraft industry normally involved the use of chromate containing solutions. However, due to the increasing concern on the use of environmentally hazardous substances such as chromates, the use of this process at a large industrial scale is becoming more and more difficult, as in the surface treatment of aircraft wings, where the volume of the baths is huge.

In the search for an environmentally friendly process, the authors of this work were involved in the study of a sulphuric-boric anodizing process. The results have allowed characterizing the behaviour of anodized aluminium alloy 2024-T3 through electrochemical impedance measurements, and equivalent circuits have been successfully proposed to model the metal/oxide system after exposure in salt spray or SO2 chambers. From the results obtained in those works, a need for a better understanding of the structure of the anodized layer obtained through sulphuric-boric anodizing was felt. In particular, the adequacy of the proposed models and their behaviour for different oxide film conditions needs further attention. This should be done by using simpler conditions, as those obtained by the use of pure aluminium instead of AA 2024-T3.

Thus, the behaviour of pure aluminium after sulphuric acid anodizing in different conditions (applied voltage and anodizing time) was assessed. The EIS data obtained for the different specimens are studied with the input obtained from other techniques, such as oxide structure and thickness determined by scanning electron microscopy and transmission electron microscopy. This has allowed to correlate electrochemically and microscopically-obtained parameters, in order to validate the choice of equivalent circuits.

CQE is financed by FCT under UID/QUI/00100/2013.

Modalities of technological transfer

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Universities have an important role in the context of the technological transfer due to the creative potential available. The creative potential of the universities should be directed to the needs of local, regional and cross-border communities to be turned into account and to contribute to their development. The achievement of the technological transfer with practical applicability implies the existence of the two phases: development of technologies and transfer of the developed technologies. A favourable frame for carrying out the technological transfer implies especially the following aspects: the existence of innovation projects; the potential beneficiaries of the technologies transferred must know and appreciate the level of development of science and technique; the existence of the demand on the market for the products or the technologies that are transferred; the potential beneficiaries of the goods or of the technology transfer (entrepreneurs) should take the risk of the technological development.

Carbon nanotubes as a promising material in the field of nanotechnology

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Carbon nanotubes are very interesting and promising material in the field of nanotechnology. They offer excellent properties and many perspective applications, but synthesis of carbon nanotubes with desired properties is still a challenge.

Carbon nanotube is a cylindrically shaped structure which was discovered in 1991 by Iijima [S. Iijima, Nature, vol. 354, no. 6348, 56–58, (1991)]. Carbon atoms in the tube are arranged in a hexagonal crystal lattice. According to their electronic properties they are semiconducting or metallic. Due to their unique structure (high surface to volume ratio, diameter in nanometer and length in micrometer ranges), carbon nanotubes (CNTs) have many interesting electronic, mechanical and chemical properties.

Nanomaterials are commonly considered to be very sensitive to chemicals and carbon nanotubes are one of the most promising materials in this area. It is important to detect concentration especially of toxic gases at small levels in surrounding environment. Pristine semiconducting carbon nanotubes offer detection of gases such as NO, NO2, NH3 or H2S. The carbon nanotubes are naturally p-type semiconductors. Adsorption of surrounded gaseous molecules to the surface of carbon nanotubes is followed by charge transfer which causes change in conductivity of carbon nanotubes. Carbon nanotube gas sensors exhibit high sensitivity and fast response time at room temperature.

Quality evaluation of coats on the woodworking tools

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The presentation is focused to assessment of the experimental coated tools for woodworking from the point of view suitability of the coat type choice on the tool steels. It characterizes the methods of hard layers creating in relationship to chemical composition and heat treatment of the substrate. It analyses the suitability the applications CrN and TiAlN coats to selected woodworking tools. It introduces the results of microhardness measurement, assessment of transition area quality between layer and substrate, measurement of layers thickness and their chemical composition by using metallographic methods - light and electron microscopy, EDX analysis. From the results is evaluated, whether complex layer-substrate primarily fulfils the requirements and whether the proposed coats can improve the cutting conditions and affect the life of the tools in operate.

Stability Study of the Chemical Solutions Used for Cleaning the Brewery Installation in the CIP System

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The paper presents the essence of cleaning the machines of the brewing industry in the CIP system and the problem of stability of chemical compounds in detergents during storage are also presented in the paper. The study examined acid and soda solutions used for cleaning the road broth and soda used for washing the filter press. Tested solutions were compared with those prepared for the research standard solutions. The solutions were tested for their physical, chemical and microbiological stability, and also checked their cleaning appropriateness after a three-month storage period.

Formation of the optimum structures of technological processes of machining on machine tools of type the machining center

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In the presentation, the processing of the piece in the machining center is shown. Technological dimensional structures are optimum if they are similar to dimensional structure of the piece. This similarity is ensured by using a marker that belongs to the machining center which is the axle of the revolving table. There is the need to resize the piece, which can be made in several variants with major influences on machining accuracy required.

Research on particles' velocity distribution in a whirlpool separator using the PIV method of measurement

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The cylindrical whirlpool is used to separate hot trub from beer wort. When the tank is being filled and the contained mixture is swirled, a phenomenon takes place the main principle of which is formation of a cone of residue in the center of the tank. This paper is aimed at further development of the research on symmetrization of the cone-accumulating flow during tank filling. Herein are presented average values of particles' velocity while in rotational motion in a whrilpool tank of modified structure. The modification is a vertically reduced baffle attached to the tank's bottom. The experiments were conducted for two different filling rates and three different baffle positions. Measurements of particles' velocity were performed with the PIV method. Results have been presented in the form of surface of average particles' velocity distribution for given radius values throughout the entire process. The most advantageous baffle positions were determined.

The effect of enzyme addition Pectinex Yieldmash the quantity and quality of juice obtained from pears

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The paper presents research concerning the influence of a dosage of the Pectinex Yieldmash enzyme on the quantity and quality of juice obtained from pears.

The research part was divided into two stages. The first stage contains an evaluation of the influence of the enzyme's dosage on the quantity and quality of pear juice while the second stage includes an evaluation of the influence of increasing the temperature of fruit pulp maceration and adding citric acid on the quantity and quality of juice. The ripeness of fruits was assessed before conducting research and then juice was obtained. The obtained juice was assessed. The assessment involved the yield of juice, its quality and sensory characteristics. The results were presented in tables and on figures. An analysis was conducted on the basis of the result and conclusions were reached. The Pectinex Yieldmash enzyme dosage of 500ml per tonne of food fruit (0.05%) gave the best results pertaining to the quantity of juice obtained from pears and its quality.

Characterization of materials using transmission electron microscope JEM ARM 200cF with atomic resolution

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Double corrected, analytical transmission electron microscope JEM ARM200cF with atomic resolution, which is installed at the Centre STU for Nanodiagnostic at the Slovak University of Technology in Bratislava allows comprehensive characterization of nanostructured objects on atomic level. Using this microscope two objects spaced 0.078 nm can be visualized. Apart from TEM and STEM imaging with atomic resolution, JEM ARM200cF provides a wealth of complementary spectroscopic and crystallographic information about the sample. These information can be acquired using different techniques of electron diffraction (SAED, nanodiffraction, precession diffraction, CBED), electron energy loss spectroscopy (EELS), and X-ray energy dispersive spectroscopy (XEDS) methods.

The application of JEM ARM200cF for both HRTEM and STEM imaging and EDS and EELS spectrometry characterizations of nanostructure objects will be illustrated by practical examples. Selected nanostructures will be characterized in terms of crystal structure, crystallinity, defectiveness, crystal size and morphology, surface faceting, dopant distribution at atomic resolution, etc. The main stress will be on characterization of undoped/doped TiO2 nanostructures used for photocatalytic applications, Fe3O4 nanoparticles, but also on characterization of thin films for superhard coatings.

This presentation was created with the support of the Ministry of Education, Science, Research and Sport of the Slovak Republic within the Research and Development Operational Programme for the project "University Science Park of STU Bratislava", ITMS 26240220084, co-funded by the European Regional Development Fund.

Influence of bias voltage on the structure, adhesion and cutting performance of nc-AlCrN/a-SiNx hard coatings deposited by LARC

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A series of Al-Cr-Si-N hard coatings were reactively grown with a negative substrate bias voltage ranging from -50 to -200 V using the LARC® technology on WC-Co substrates. X-ray diffraction of as-deposited Al-Cr-Si-N coatings revealed a single phase cubic B1-structure identified as an AlCrN solid solution. Structural investigation showed a nanocomposite microstructure where cubic c-AlCrN crystals of ~4 to 20 nm were embedded in a thin discontinuous amorphous SiNx matrix. Coatings exhibit a randomly oriented structure at lower bias voltages (≤ -100 V), while higher bias voltages (≥ -120 V) promote texture evolution towards the (002) direction. Residual compressive stresses and hardness increased proportionally with the increase in bias voltage. Stress-induced cracks were observed at high bias voltages, which resulted in stress relaxation and a decline in the overall residual stresses. A Rockwell-C adhesion test demonstrated that excellent adhesion was observed at lower bias voltages of -50 V and -80 V, while further increases in bias voltage up to -200 V led to severe delamination and worsening of the overall adhesion due to increased residual stresses. The tool wear of coated turning carbide inserts was determined in long-term tool life test on the DMG CTX alpha 500 CNC turning center. In the experiment, the same cutting conditions were set. At the earliest, the optimum cutting speed for turning inserts was studied by experiments. The tool wear was measured on Zoller Genius 3s universal measuring machine. The results showed a different tool life of coated turning inserts.

Study of the freezing process of the fish blocks with using of aluminium foil spacers

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Freezing is currently the most common method of food preservation. Reducing of the freezing time is very important. It is also particularly important to shorten phase change time (water to ice). It has an impact on a improving of the quality of frozen food and on the process energy consumption.

The article presents the study of the influence of aluminium foil spacers inside the fish blocks for the freezing process. The influence of the spacers thickness on freezing process kinetics was found. It was found that the use of aluminium foil spacers reduced the total freezing time about 30% and the phase change time about 40% in relation to those total times obtained for blocks without any spacers.

Combining XRD and SEM/EDS Analyses - creating a Powerful Tool for Investigations into Mineral Materials

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Chemical analysis provides important information about the various materials used for construction. Yet, this is in general not sufficient for the characterization of the broad range of inorganic-nonmetallic materials: It is the structure that rules the properties of a material.

The aim of the following presentation is to demonstrate the value of combining xrd and sem/eds analyses as complementary methods by means of some examples from the materials research and testing activities at the department of building materials technology / building physics at the Wismar University of Applied Scienes.

While xrd as is known provides integral information about the phase composition, sem/eds visualizes details of the material's microstructure and beyond that allows for the identification of homogenous components of a structure on the base of qualitative and quantitative element analyses as discrete phases.

Thus, combining xrd and sem/eds-investigations creates a remarkable powerful tool to solve a wide variety of analytical tasks in research and materials testing.

Friction free, hard and super-hard carbon-based coating for industrial application

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Towards the end of the 20th century, nanotechnology and nanomaterials were the subject of numerous studies in laboratories all over the world, as National Programs. This has been associated with a growing interest of industry in the extreme mechanical (especially tribological, electric and magnetic properties) of nanomaterials. Those interest in nanomaterials, especially extremely hard nanocrystaline or nanocomposite films, is due to their high hardness , strength, wear and corrosion resistance along with good adhesion of the film to the substrates (tool and machine-building industry) and biocompatibility (medicine, endoprostheses).

The presented work has been realised within the research project "Copernicus" of the European Union Commission which has it recommended for application in the bearing industry.

The influence of stainless steel surfaces after grinding on its decorative and adhesive characteristics

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Preliminary studies showing the relationship between microstructure of non-directional surfaces made of stainless steel and aluminium were conducted, evaluating their structure on a macro scale characteristic for normal use. For this purpose, surface analysis was performed using a digital microscope and a contactless profilometer, followed by adhesion testing (corrosion angle) and corrosion of selected samples to determine how the particular microstructure material would change under the influence of corrosion. Next stages of the research will be extended by additional experiments to determine the suitability of unloaded surfaces made of stainless steel for daily use, taking into account their ease of cleaning in service.

Cooling process requirements for precision processing processes

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The article presents the cooling method used in the cutting and grinding processes. Compressed air cooling is also used to cool the injection molds. It is used in the machinery industry and can be successfully used on production lines equipped with compressed air systems. Increasingly, there are more and more often found cooling systems using vortex tubes in the automotive and aerospace industries.

Sustainable Soil Surface engineering

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Agricultural Science is a system science discipline, where the agricultural production in systems are analysed and optimised. Interdisciplinary between life science and engineering is necessary to solve the complex challenges in agriculture. According the Brundtland Report (1987) sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It includes the utilization and protection of natural resources. A goal in sustainable agriculture is to use fossil energy more efficiently in crop production. Soil tillage is a great energy consumer depending on the tillage systems. Adapted soil tillage systems can play an important role in solving future challenges in food production. This means that the tillage systems is chosen according site specific factors (soil and climate) and crop species. Soil tillage systems can be classified based on the tillage intensity and soil covering with plant residue. The deposition of organic residues on the surface in ploughless tillage systems reduces run-off and nutrient losses and promotes infiltration through macro-pores made by earthworms. Soil tillage influences soil chemical characteristics and nutrient distribution in the soil and soil physical characteristics like bulk density, pore volume and pore size distribution, infiltration, soil water supply, aggregate stability and penetration resistance. In addition, the bearing capacity of the topsoil and the subsoil can be improved, which reduces the risk of soil compaction by applying conservation tillage. Ploughless tillage systems (-conservation tillage with more than 30% of plant residues on the soil surface after seeding) reduces fuel consumption, fossil CO2-emission and working time requirement. Additional the soil water storage capacity in conservation tillage systems in the semi-arid regions of Austria was higher than the on soil-turning systems. Conservation tillage systems can be an adaptation strategy for climate change. A long term investigation at the experimental farm of the university of natural resources and life sciences, Vienna (BOKU) in the pannonian region of Austria shows, that the tillage effect on crops yield is lower than the year effect (mainly determined by the amount of rainfall). Energy efficiency parameter are also depending on the climate (rainfall and temperature). The long term investigation in the semi-arid region of Austria shows, that conservation tillage systems reach higher yields and energy efficiency parameter than tillage systems with plough. This can be mainly explained by the better water storage capacity in the soil.

Micronization of hard coal using high-pressure water jet method

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Comminution processes have found a wide application in many branches of minerals and materials processing. Intense comminution of materials, known as micronization, has been used in order to enrich minerals powders. Often a method that utilizes high-pressure water jet has been implemented. The disintegration mechanisms of brittle materials in this method are very complicated. Increase of water pressure leads to an increase in internal tensile stresses within the material with brittle ores being very susceptible to this attack. Moreover at sufficiently high water pressure, the kinetic energy of the particle increases to a level that generates an internal network of cracks. The intense penetration of water into the material creates and grows internal cracks and intensifies brittle fracture.

These phenomena have been typically used to implement hydro jetting methods of brittle material milling. In such conditions the disintegration of materials proceeds through gaps and micro-cracks in the material, intensifying at the grain boundaries. Such micronization provides a distinct increase in the surface area of the processed material. Beyond the basic idea this approach leads to a new technology that utilizes high-pressure water jet. This paper presents some research results of high-pressure water jet usability in the micronization of coal.

Unconventional hydro-jetting technologies

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The Unconventional HydroJetting Technology Center is presently unique in the world and the only one in Poland research institution dealing with basic and research studies, aiming to complex utilization of high-pressure waterjet as versatile erosion tool. Principal objective of this Center is transfer of the newest world's technologies utilizing high-pressure waterjet energy and leading studies over hydrojetting technologies and integration of science sphere and economy through innovative creating in aid of hydrojetting technology development and their practical applications. The Center's activities are adjust on international activity but in first place we offer our service to the polish institutions and organizations, especially small and medium companies. Currently The Unconventional HydroJetting Technology Center owns several complete pump units and high-pressure hydromonitors with solid technological fittings, mostly made in Germany, Japan and America. Those devices were built to realize determinate technological processes including original BorJet and MicroBorJet systems used to slurry jet cutting and many others connected with it research stations. Center possesses also specialist investigative and measuring apparatus as well as apparatus used to evaluation of processed surfaces such as complex three-dimensional surface analyser Talysurf CLI 2000, Taylor-Hobson.

Measuring apparatus located in Unconventional Hydrojetting Technology Center

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The impact of pressure on the distribution of water pulses generated in the self-excited pulse head

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Dynamic influence of water jet of periodically changeable structure is suitable in different areas of techniques. A special construction of self-excited pulsing head have been elaborated for that purpose. Computer simulation of its function let to develop and to optimize its construction as well as to determine the mechanism deciding of pulsing water jet generation. Examination of water jet generated inside the head show out occurrence of periodical changes in its internal structure as well as frequency of such pulses and its suitability for different materials erosion.

The impact of the mass and velocity on the overload during collision of a car with constant barrier

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The hereby article discusses the issues of reconstruction of traffic accidents. It describes the process of collision with a constant barrier. An analysis of overloads that might contribute to various body damage, created during the collision with different velocity and vehicle mass was carried out.

Influence of road parameters on the overload during collision of a truck with constant barrier

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The hereby article discusses the process of collision of truck with a constant barrier. It also presents the influence of the car velocity on the braking distance with different loads. An analysis of overloads that might contribute to various body damage, created during the collision with different velocity and vehicle mass was carried out. The analysed cases were accompanied by a presentation of the vehicle deformations created after collision with the obstacle.

Mobile biomass pelletizing systems

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There were presented solutions of mobile and semi mobile machines used for the producing biomass pellets. Company Krone constructed the first full mobile machine Premos 5000. Krone Premos 5000 collects and pellets straw and hay directly from the swath in the field. Another kind of solutions are lines to pellet production are constructed as a compact and modular.

Development of stirling engine vehicles

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There were presented constructions of cars with Stirling engine. Many companies tried to use this engine to car driven. There were created concepts of the Stirling engine use for direct driven of cars and for the hybrid drive but no one model was mass produced. The new concept of Stirling engine use in cars is as a device for energy recovery from exhaust gases.

Drone use to road accidents documentation

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In the poster was presented method of using drones to obtaining documentation for the traffic accidents reconstruction was presented. This method gives possibility quickly returns to a full-fledged event model and, if necessary, replenishes the missing data during the investigation. This method allows also for quick work of experts at the place of accident and reduces the dangers which could be caused by the traffic stopping.

UAV Road Rescue System

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There was presented the Drone Road Rescue System, which would be created from combining drones used for road monitoring and traffic accident identification, drones for delivery of necessary medical equipment and drones for remote transportation of victims to the hospital. Based on the already existing solutions, the various components of the system are discussed.

Using drones to environmental pollution monitoring

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The article discusses examples of the use of drones - Unmanned Aerial Vehicle (UAV) to evaluation of air quality. Measurement systems using sensors are used to measure the parameters of low emission of dust and gases suspended in the air were described . There were also described methods of indirect measurement of air by means of drones, consisting of sampling and delivery them to the laboratory.

Welding of Two-Phase Corrosion Resistant Steel

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Arc welding of duplex steel is possible depending on the conditions and production volume using the following welding methods: Shielded Metal Arc Welding (SMAW), Gas Tungsten Arc (GTA), Gas Metal Arc Welding (GMAW), Flux-Cored Arc Welding (FCAW), Submerged Arc Welding (SAW) and Plasma Arc Welding (PAW). For technical reasons, adequate mechanical properties such as tensile strength, bending strength, ductility, impact resistance, and the resistance to aggressive media are required from welded joints made of corrosion resistant two-phase steel.

Effect of Stir Welding Speed On The Microstructure and Mechanical Properties of Duplex Stainless Steels

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The good weldability of duplex stainless steel is ensured only if proper choice of base material and binder are provided. The binders should have a higher Ni content relative to the base material, thus allowing for reduction of the ferrite content and achieving optimum plastic properties. The decisive influence on the content of ferrite and coarse grain structure in HAZ (heat-affected zone) has the equivalent ratio of chromium-to-nickel equivalent. It is assumed that the lower limit of ferrite content is about 25%, otherwise there is no certainty that the stress corrosion resistance is assured. For the structures where certain plasticity must be ensured, the upper limit of ferrite content in HAZ and in binders (75%) is also determined. The content of ferrite, HAZ width, relative volume, size and morphology of the phase grains greatly affect the rate of cooling of the weld metal. Therefore, when making the joint, a special attention should be paid to the amount of heat delivered (linear weld energy), weld structure and interstitial temperature.

Green and Biodegradable Electronics

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We live in the world where the life cycle of electronics is getting shorter, approaching the average age of several months. This creates a growing environmental problem. There are many organic biodegradable, safe and non-toxic materials that contain compounds of natural origin. In addition, they have unique features that are useful in biofunction electronics, with the features not available for traditional inorganic compounds. Such materials can lead to fully biodegradable and even biocompatible electronic components.

Modeling and Simulation of The Terms and Conditions of Thermal Zone Dry Grinding Wheels With The Use of Substances Impregnated Lubricant And Compressed Cooled Air

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Thorough cognition of the phenomena occurring in the process of friction and knowledge of lubricants to control friction allowed for developing a method of grinding without any lubricant. In this method, the role of the lubricant is performed by the impregnants contained in the grinding wheel, and as the coolant, the compressed chilled air is used. This solution reduces the machining time to the desired workpiece parameters. The SSP method does not require an oil and only a grinding impregnating agent is needed. This method is less energy consuming and does not require the entire PCS treatment infrastructure. The shavings and the machine remain dry. The production process is shortened as the cleaning and degreasing of the finished products can be eliminated.

Pure a Gold

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The deposition of gold coatings on the welded stained glass caused large problems with the darkening of the gold coatings at the first stage. Gold coatings darkened during deposition of gold not in the bath but during electrolysis that worked at 10-12 Ah. The parallel studies of indium and gallium, which are the subject of research, let us assume by analogy that the thallium in the same subsystem of the periodic system will have the same or similar inhibiting features in the process of formation of cyanide complexes. Indium and gal introduced into the bath to settle in electrothermal conditions coincided with gold which thallium did not do. Consequently, thallium was selected as a stabilizer for the gold process in both "AUROBOND V" and "PURE - A - GOLD". Stabilization of the gold plating process consists of preventing the formation of polymer, which deposits together with gold and causes darkening of coatings. Dark gold coatings also have a higher porosity and, therefore, worse thermal resistance. Thallium and its compounds commercially available as reagents are contaminated by lead which negatively affects the quality of the coating. Therefore, it is necessary to prepare such a compound of thallium, which is soluble in liquids, and most importantly, this compound of monovalent flux does not pollute the bath with its accompanying lead. Talad acetate preparation was developed, which became the basic ingredient of all three "Make up", "PA" and "PP" stabilizers. In addition, the "PP" stabilizer is designed to stabilize the gold-plating process in the "Aurobond" capillaries. It contains potassium oxalate which precipitates such metals as Fe, Co, Ni and others. Potassium oxalate does not, however, completely deplete ionic ions. Hence, attention is drawn to the exact synthesis of tall metal acetate from the metallic thallium and the complete purification of the preparation from the lead compounds during synthesis.

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