A COMPARISON OF THE STRUCTURE AND PROPERTIES OF HSLA STEEL COLD ROLLED AND SEVERE PLASTIC DEFORMED BY HIGH SPEED HIGH PRESSURE TORSION

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ABSTRACT

A large deformation degree was induced on High Strength Low Alloy steel X60 samples in hot rolled state. The plastic deformation process was conducted on cold rolling mill start to 0.03 up to 3.14 true strain in 43 passes, without intermediate thermal treatments. Also an original severe plastic deformation method – High Speed High Pressure Torsion was applied. The achieved true strain was very similar but had been obtained in one step. Here we report the grain structure evolution from coarse equiaxed grains to fine and ultrafine structure. For cold rolled respectively HSHPT'ed samples was performed a comparison of structures by OM and SEM. However the structure development in each plastic deformation process was strong function of the true strain achieved. Both HS HPT and cold rolling technological parameters were monitored and mechanical properties were determined.

Keywords: Severe plastic deformation, High Speed High Pressure Torsion, High Strength Low Alloy Steel, ultrafine grain structure, OM, SEM, Microhardness

A DAMAGE MODEL FOR FIBER REINFORCED COMPOSITE LAMINATE

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ABSTRACT

In this paper a technique for analyzing mixed mode delamination in laminate plates under in-plane loading conditions is developed. There is used the interface methodology which adopts the first-order shear laminate plate theory. The 2D numerical model of delamination is obtained by using of Finite Element Method in program ANSYS. Displacement, interface reaction and strain energy release rate distribution along the delamination front are illustrated. The results obtained from each mode response analysis are compared.

Keywords: fiber, composite, delamination, displacement, interface reaction, energy release rate

CHARACTERISTICS OF CARBON FOAMS FROM BY-PRODUCTS OF COMMERCIAL POLYETHYLENE PRODUCTION

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ABSTRACT

The aim of this study is to develop methods for obtaining carbon foams of various pore structure and high mechanical strength using polyethylene wax (by-products in polyethylene production) as raw materials. Characteristics of the foams consisted in the determination of the structure, morphology, density, thermal, mechanical and other properties of obtained carbon materials. The relation between physical and chemical properties of obtained carbon materials and conditions of their production was determined.

Keywords: carbon foams, polyethylene by-products, XRD, morphology

COMPARISON OF MECHANICAL PROPERTIES OF STEELS OF THE USUAL METAL POWDERS BASED ON CU AND NI TESTED AT LOW TEMPERATURES

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ABSTRACT

Powder metallurgy industry in Romania is steadily rising on production processes. Producing parts with high mechanical properties and relatively low price led to the analysis of the mechanical properties of common steel and powder metallurgy steels. In this current context, this paper was written.That is why attempts have been made on the behavior of the material at low temperatures of a classical powder metallurgy for the production of masă.Un conventional steel material containing a matrix metal of iron, (0,4 - 0.8)% C, 5 % Ni and Cu (1.5-3)% (whit diffusion alloyed powder plus carbon) shows a wide range of applications due to their static and dynamic mechanical properties and good behavior in sintering. There is generally a good behavior in the cryogenically treated materials to mechanical simple, especially traction. It can be said that there is a higher densification of these materials based on strengthening the bridges between particles.

Keywords: low temperatures, powder metallurgy, matrix metal iron, mechanical properties.

CONSIDERATIONS ON COATINGS OBTAINED BY ELECTROLYTE DEPOSITION MECHANISM

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ABSTRACT

Electrolytic deposition is achieved by electrolysis of aqueous solutions of simple or complex salts containing metal ions to be deposited. Piece is coated cathode and anode current source can be an unassailable metal inert (insoluble anode in electrolysis) or metal coating, which dissolves as ions in solution (soluble anode in electrolysis), moving and discharged (submitted) at the cathode, forming protective metal layer. Electrolyte (electrolytic bath) includes: a metal compound which decomposes and is deposited in well-defined concentration, buffering agents to maintain constant acidity (pH) solution, inorganic substances to increase the electrical conductivity and special additives to improve porosity, adhesion, gloss coating or structure. Because of quality-price-performance ratio and outstanding qualities they possess, composites allow multifunctional pieces, shape simplification mechanisms and improve performances. Layers of composite materials made by deposits fall into the category of advanced materials. Metal matrix composites studied in this paper have the particularity that the matrix is an electrodeposited metal or alloy.

Keywords: electrodeposition, cathode, anode, layer, metal, alloy, conditions.

CONSIDERATIONS ON SURFACE FATIGUE BEHAVIOR OF PM STEEL

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ABSTRACT

Latest research in the field of powder metallurgy show concern over attempts fatigue. Have been made to predict the the endurance limit to fatigue for predicting the effect of residual porosiy an the tensil strenght. It was found that the surface finish of the samples has a great influence on the fatigue strength. The sample containing pores - those caused by transient liquid phase by the Mo particle - the adverse effect of such flaws on the fatigue strength, which was also found by testing the fatigue PushPull was prepared perceptible only to the surface as is customary metallographic sections, that is, while if the influence of surface defects of the conventional polishing was masked by the closure of the pores. It highlighted the negative effect of secondary pores generated by Mo transition. They are the results of fatigue test of a high-strength sintered steel based material containing iron (0.6-0.8)% C, (1,5-2%)Mo, and 0,6% Cu. Fatigue response of the samples depends on the shape and nature of the pore is tension concentrators.

Keywords: pores, fatigue strength, powder metallurgy, sintered steels, microhardness.

CONTROL TUNING IN A CLOSED LOOP CAPACITIVE MEMS ACCELEROMETER

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ABSTRACT

This paper presents the mechanism used to close the loop for a MEMS capacity accelerometer, not only in terms of mathematical modeling, but also in terms of numerical simulation. By using the linear model of the mathematical model, some analysis related to the system quality is performed in frequencies. Because of the great nonlinearities present in the system at the level of the capacitive transducer, to extend the utility of the accelerometer, we need to close its loop. In the case of the micro-accelerometers, an electrostatic force is usually used as feedback. To improve the dynamic characteristics of the accelerometer, the feedback voltage is taken from a controller mounted on the direct way of the accelerometer, after the phase sensitive demodulator. The controller type is established using the transfer function of the linearized system and is tuned by using various integral criteria, as the minimum error surface criteria Ziegler-Nichols, and Kaya-Scheib method. Finally, the dynamic performances of the closed loop accelerometer are tested and discussed for all criteria used in tuning.

Keywords: inertial sensors, MEMS, closed loop, control tuning

DOXYCYCLINE ENCAPSULATION STUDIES INTO MESOPOROUS SBA-15 SILICA TYPE CARRIERS AND *IN VITRO* RELEASE

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ABSTRACT

The doxycycline encapsulation procedure on mesoporous SBA-15 silica has been studied and optimized. The supports (SBA-15 and aminopropyl-modified SBA-15) and hybrid materials containing doxycycline were synthesized and characterized by small and wide angle powder X-ray diffraction, N_2 adsorption-desorption isotherms, FT-IR spectroscopy, scanning electron microscopy and thermal analysis. Doxycycline uptake and its release profiles in phosphate buffer solution at pH 5.5 and 37 ^{o}C were determined by UV-VIS spectroscopy. The doxycycline encapsulation protocol onto the mesoporous supports was established.

Keywords: mesoporous silica, doxycycline, drug delivery systems, SBA-15

EFFECT OF SEVERE AUSFORMING ON THE SHAPE MEMORY MICROSTRUCTURE OF A COPPER BASED ALLOY

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ABSTRACT

Thermomechanical treatments provide requirements of good mechanical properties withal better and precise shape memory properties. The present work has been studied morphology, chemical structure and elemental mapping of Cu-based shape memory alloys after ausforming applied at high temperature range. Ausforming implies plastic deformation of austenite, introduced lattice defects which modify structure of martensite and increase strength of the alloys. Thus, ausformed alloys have great potential for novel actuators in commercially valuable applications, at certain transformation temperatures. The samples plastic deformed with different deformation degree were systematically investigated by scanning electron microscope (SEM) and energy dispersive X-ray analysis (EDX). Subtle changes in composition have been studied for ausformed samples in different conditions (temperature of deformation between 1000˚C and 800˚C, deformation degree from 8 to 40%) to determine the properties of CuAlNi shape alloys and become workable in the production. Transformation temperatures of specimens determined by DSC were correlated with changing the structure of martensite.

Keywords: Shape memory alloy, Martensitic transformation, Ausforming, Scanning Electron Microscopy, Energy Dispersive X-ray Analysis

EPOXY/CARBON COMPOSITES. THE CURING BEHAVIOUR AND MORPHOLOGY DEPENDED ON THE DEGREE OF STRUCTURE ORDER

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ABSTRACT

The aim of this work was to study the influence of the degree of the structure ordering for a series of carbon fillers, which includes, on one hand, anthracite consisting of graphene planes with various degree of organization, and, on the other hand, graphite that is composed of well-ordered graphene sheets, on the curing behavior and morphology of epoxy composites containing these fillers. The systematic studies was performed for composites based on low molecular weight diglycidyl ether of bisphenol A cross-linked with aliphatic amines. Raw Svierdlovski anthracite (Donbas, Ukraine) of turbostratic structure, and the anthracite thermally treated at 950, 1400, 1700 and 2000 °C, with the structure changing gradually as a result of increasing calcination temperature toward the graphite-like structure, were used as carbon fillers. The anthracite fillers were compared to natural graphite that is composed of well-ordered graphene sheets. Epoxy composites with thermally modified anthracites, as well as natural graphite were prepared according to procedure including the breakdown of the filler agglomerates by use of an ultrasonic disintegrator and shear mixing.

Keywords: anthracite fillers, graphene sheets, epoxy composites, curing reactions, morphology

EVALUATION THE EFFECTIVENESS SOLUTION OF LOWER STRUCTURE FOR ENERGY EFFICIENT BUILDINGS

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ABSTRACT

Do you think that passive houses are the inventions of recent years? That is not exactly true. Even if they use more advanced technology, some of the basic principles goes back several hundreds years. The History of passive houses have their roots in the 19th century, where the first building was not a building, but research ship of polar explorer Fridtjof Nansen called fram in 1883. The walls and the sandwich construction deck had a thickness of 400 mm, which fulfill the function of a thermal insulation layer of felt and the linoleum fulfill the function of a vapour barrier. The glass treated windows were triple and worked with controlled ventilation with electric ventilators. [4,7]
The building, which is directly on the ground is in direct interaction with the subsoil and its thermal state. Some amount of heat is primarily destined for the creation of thermal comfort in the interior spaces from the foundational construction and the floor on the ground to the cooler sub grade. The outgoing heat represents heat losses, which unfavorably affect the overall energetic effectiveness of the building. The heat loss represents approximately 15 to 20 % of the overall heat loss of the building. This number is a clear antecedent of need of isolation and minimizes the flow of heat from the building to the sub grade. [3,5,6]

Keywords: history of passive houses, building construction, thermal insulation, building on the terrain, energy efficient buildings

EXPLOSIVE CONSOLIDATION OF NANOCRYSTALLINE Si POWDERS

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ABSTRACT

Nanoscale and coarse Si powders (average particle size, 40nm) was object of the investigations. The large grained coarse Si particles preliminary were treated in vibration and planetary ball mill for transformation of powder in nanoscale. The nanopowder was placed in a steel container and compacted by explosively induced shock waves of cylindrical symmetry. Industrial explosives were used for the generation of shock waves. Explosive compaction experiments were performed in range of pressure impulses of 3-20 GPa. This densification process performed in two stages: a) static and b) dynamic loadings. The relationships between the nanopowder preparation, compacting conditions, the precursor particle sizes and properties of the consolidated bulk nanostructured material are discussed in the paper.

Keywords: Nanocrystalline Powder, Si, Shock Wave, Explosive, Compaction

HIGH SPEED HIGH PRESSURE TORSION EFFECTS ON A DIFFICULT DEFORMABLE SHAPE MEMORY ALLOY

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ABSTRACT

High pressure torsion (HPT) is a severe plastic deformation process, able to reduce grain size, down to nanostructure or amorphous level, in bulk materials. In the experiments a modified high speed HPT (HS-HPT) technique was used. It was ideally suited for products about 50 mm in diameter, contributing to a meaningful increase of mechanical properties. This type of severe plastic deformation generates large plastic deformation in entire volume of sample under the effect of high pressure cumulated with high rotation. On the strength of friction and pressure the sample was heated, took place grain fragmentation up to (ultra)fine grains, nanocrystalline or amorphous areas, without recrystallization. The effect of severe plastic deformation via High Pressure Torsion (HPT) on microstructure of the Cu-Al-Ni shape memory alloys was investigated by optical (OM). The reversible martensitic transformation temperatures were investigated using differential scanning calorimetry (DSC) as effect of microstructure refinement appropriate to different deformation degrees. The hardness tests demonstrate that creating ultrafine grain with high strength can produce reliable lightweight metallic parts. The presence of monoclinic and orthorhombic martensite, together with nanocrystalline areas were confirmed by X-ray diffraction (XRD).

Keywords: Severe Plastic Deformation, High Pressure Torsion, Shape Memory Alloys, Structure, Transformation Temperature, Martensite, Cu-Al-Ni shape memory alloy, grain size

INVESTIGATION OF THE ACTIVITY OF RUTHENIUM CARBOXYLATE COMPLEXE IN HYDROGENATION REACTION

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ABSTRACT

This study examined investigation of the catalytic activity of ruthenium carboxylates with triphenylphosphine and tributylphosphine ligands in hydrogenation reaction. The hydrogenation reaction is one of the most important reactions in the ground and fine organic synthesis, in the desulfurization of hydrocarbons and in the production of intermediates. To analyze the conversion ethyl trans-cinnamate the ^{1}H NMR spectroscopy was used. To stabilize the ruthenium complexes were used sterically demanding triphenylphosphine and tributylphosphine and to increase the solubility of organic solvents was specifically synthesized carboxylates with methoxy, methoxyethoxy and metoxydietoxy groups. All used catalysts were tested by the pressure of hydrogen 40-100 bar. Increasing the pressure increases the catalytic conversion according to Le Chatelier's principle.

Keywords: catalytic activity, ruthenium catalysts, hydrogenation reactions, ruthenium carboxylats, homogeneous catalyses, nanoparticle, homogeneous catalyses.

MECHANICAL PROPERTIES OF EXPANDED GRAPHITE / SILICONE RESIN COMPOSITES

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ABSTRACT

In this study mechanical properties of silicone resin polymer composites filled with different amounts expanded graphite (EG) were studied. An equipment is designed and manufactured for testing at elevated temperatures. A method is developed for determining the mechanical properties under compression of composite materials based on expanded graphite in the range of operating temperatures. Mechanical tests at 20 and 400 °C.

Keywords: composites, expanded graphite, waste products, silicone resin, mechanical testing

MESOSTRUCTURED ALUMINOSILICATES AS CARRIERS FOR DOXYCYCLINE-BASED DRUG DELIVERY SYSTEMS

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ABSTRACT

A mesostructured AlSBA-15 material has been obtained by direct "acid-free" sol-gel method using aluminum sulfate and tetraethyl orthosilicate as precursors and triblock copolymer Pluronic P123 as structure-directing agent. 3-aminopropyl moieties have been introduced by a post-synthesis grafting procedure and the resulting mesoporous materials have been applied as carriers for doxycycline delivery systems. The mesostructured supports and doxycycline-loaded materials have been characterized by small and wide angle powder X-ray diffraction, N_2 adsorption-desorption isotherms, FT-IR spectroscopy, scanning electron microscopy coupled with energy dispersive X-ray analysis, as well as thermal analysis. The drug release behavior is discussed in light of the doxycycline-aluminosilicate interactions.

Keywords: mesoporous aluminosilicate, AlSBA-15, acid-free medium, doxycycline, drug release

MORPHOLOGY AND THERMO–MECHANICAL PROPERTIES OF EPOXY COMPOSITES WITH GLASSY CARBON

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ABSTRACT

The application of carbon fillers to polymer matrices requires basic knowledge about characteristics of both phases. Interactions between a filler and polymer matrix affecting the morphology and dynamics of polymer's chains molecular motion in such mixtures should be also taken into considerations. The novel filler used in this study was glassy carbon having specific layered structure.

Glassy carbon is an advanced material combining glassy and ceramic properties with those of graphite. However, unlike graphite, glassy carbon has a fullerene-like microstructure, which leads to a great variety of unique material properties, i.e. high temperature resistance, corrosion resistance, high hardness and strength, low density, and isotropy of physical and chemical properties. It is expected that the epoxy composites with glassy carbon as a filler should have interesting properties from point of view of possible applications.

The aim of this work was to study the influence of glassy carbon structure on morphology and thermo-mechanical properties of resultant composites. The composites based on low molecular weight diglycidyl ether of bisphenol A cross-linked with aliphatic amines with 10 wt. % of the filler were prepared for the study. The following methods were used for characterization of composite materials: optical microscopy, scanning electron microscopy, dynamic mechanical analysis and termogravimetry. The degree of dispersion of filler's particles in the epoxy matrix as well as the character of inter-phase zone between the polymer and the filler were determined in this way. The improvement of thermal stability, stiffness and elastic modulus of composites obtained was observed. The properties of glassy carbon and its epoxy composites were compared with those of anthracite-derived fillers of turbostratic and graphite-like structure and their composites respectively.

Keywords: glassy carbon, carbon fillers, epoxy matrix, SEM, DMA

NEW METHOD FOR SUSTAINABLE POLYMER COMPOSITES PROCESSING

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ABSTRACT

Polymer blends and composites have been obtained in a newly designed multifunctional mixing twin screw extruder. It is assembled as a module that allows for obtaining of two independent polymer streams with separate control. This unit can fulfill as well:

- Longer mixing process so that during polymer melt passing the chemical reactions can be performed more successfully and completely;
- Effective pressure and temperature control in the conditional 'reactive zone' that is a part of the extruder barrel;
- Good homogenizing action, distributive and dispersive mixing. Because of the precise construction the best friction ratio can be obtained that in turn ensures as well the best possible intermeshing in the polymer melt.

The application of newly developed design can turn the processing machine into speedy technological stirred reactor triggering some innovative processes as stable and successful green chemical methods.

Keywords: polymer composites, multifunctional mixing twin-screw, new design

OXIDATION HEAT EFFECTS OF METAL NANOPOWDERS AFTER ELECTRON IRRADIATION

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ABSTRACT

The nanopowders of iron, nickel, molybdenum and copper received by electric explosion of wire were irradiated by an electron current on the liner electron accelerator with the radiation doses of 1, 5, 10 Mrad. Four parameters of activity of nanopowders were evaluated according to the differential thermal analysis: the initial temperature of oxidation, the completeness of oxidation, the maximum speed of metal oxidation and the thermal effect of oxidation. It was ascertained that the thermal effect of combustion increased after irradiation by 1.5-2.5 times. It was shown that the significant increase of the heat of combustion of nanopowders was caused by the increase of the internal stored energy as a result of the ionizing effect of electrons. The electrostatic model of surface charged structures of nanoparticles generated by the ionizing effect of electrons was offered, and its analogue is a spherical capacitor. This model makes it possible to estimate the increase of the surface energy of nanopowders by charging the spherical nanocapacitor with 110-1 100 kJ/mol. It was shown that the lattice parameters of the initial and irradiated metal nanopowders are greater than those of the standard samples of massive metals. Irradiation of nanopowders by accelerated electrons furthers stabilization of interplanar spacings of crystal lattices and brings them closer the standard of massive metals.

Keywords: nanopowders, electron irradiation, the thermal effect, the crystal lattice, energy condensed systems, nanocapacitor

PHYSICAL AND CHEMICAL PROPERTIES AND CRYSTAL STRUCTURE TRANSFORMATION OF BEESWAX DURING HEAT TREATMENT

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ABSTRACT

The object of research is the wax as a waste product of bees in the steppe and mountain areas of Almaty region of Kazakhstan.
Purpose - to study the structure parameters and the homologous phase composition, morphology waxes of alpine and mountain areas of Kazakhstan and the establishment temperature - dependent patterns of their atomic-crystalline state.
Methods: radiography, gas chromatography, scanning electron microscopy and chemical methods of separation of multicomponent systems.
The results obtained in the atomic crystal and molecular structures of beeswax depending on the districts collect materials.
The technique of obtaining radiographs after dissolving beeswax in benzene, hexane and xylene. Submitted thermo-radiographic study samples obtained.
Batch analysis thermo-radiographs waxes after treatment with benzene, hexane and xylene showed that their structure is essentially different from the source and closer to the spectra of the crystallized wax melted and due to annihilation of stacking faults waxes native atoms after their dissolution in hexane, benzene and xylene and subsequent their recrystallization.
The results obtained allow to expand the amount of information on the physico-chemical processes and structural transformations in beeswax as a composite of different genesis biomaterial.
Scope: beekeeping, plant, structural and analytical chemistry, biotechnology and biocomposites.

Keywords: Wax; Composite biomaterial; Radiography; Defect structure

PREPARATION AND THERMAL STABILITY EVALUATION OF SOLID LIPID PARTICLES LOADED WITH ALENDRONATE

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ABSTRACT

Sodium alendronate (AL) is a therapeutical agent in the bisphosphonate (BFs) class. The main biomedical applications of BFs are the inhibition of bone resorption, its use as carrier and bone targeted delivery agent of other drugs, and restenosis inhibition and osteogenesis stimulation near bone implants. Currently, AL is used in conventional release tablets. Its low oral bioavailability (1-3%) is caused by several factors such as low permeability determined by the negatively charged molecules, the short plasma half-time ($T_{½}$ = 0.5 – 2 h) and its chelatation by Ca^{2+} ions resulting in non-absorbable complexes. Aiming at increasing AL bioavailability both on oral and on other routes of administration (e.g. nasal and rectal mucosa), we have decided to load AL in solid lipid particles (SLPs). This research intends to assess AL stability when associated with lipidic excipients and during lyophilization. We prepared 8 self-emulsifying lipidic mixtures based on Compritol 888 (glyceryl behenate), Gelucire 44/14 (a mixture of glycerol and PEG1500 esters of long fatty acids) and Cremophor A 25 (the 25 mole ethoxylate of a blend of cetyl and stearyl alcohols). The hydrophilic-lipophilic balance of those mixtures ranges from 10.4 to 11.4. The aqueous AL solution was dispersed by ultrasonication in these mixtures. The obtained emulsions were lyophilized at – 57 °C and 0.016 mbar for 15 hours. The stability of AL was evaluated by 3 specific methods: differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and FTIR spectroscopy (FTIR). *DSC* was carried out with a Perkin Elmer device under the following conditions: the samples (4-4.5 mg) sealed in an aluminum pan and placed in inert atmosphere were dynamically analyzed at a temperature ranging between 50 and 300°C. *TGA* was performed on 3-6 mg samples using a derivatograph Mettler Toledo in a nitrogen atmosphere with a flow rate of 20 mL/min, a heating speed of 10°C/min (25-600°C). *FTIR* spectra were obtained with a Vertex 70 equipment using KBr pellets technique, and obtained spectra were compared with those available in literature. The results have confirmed the stability of AL in association with the selected lipidic excipients. All three thermal analysis methods have shown identical characteristics for AL both in its raw and in its SLPs loaded state.

Keywords: alendronate, solid lipid particles, Cremophor

RESEARCH ON BENZENE VAPOR DETECTION USING POROUS SILICON

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ABSTRACT

Porous silicon (PS) has been an attractive material for enhancing the optical properties of silicon. Its large surface area for sensor applications and compatibility with silicon-based technologies has been the driving force for this technology development. In this study, benzene vapor detection properties of porous silicon have been investigated at room temperature. Electrical (DC) and photoluminescence (PL) spectra measurements in a controlled atmosphere (Nitrogen gas and the benzene vapor mix) were performed to test the sensor response towards the benzene vapor. It was find that PS surface very sensitive against to the vapor and electrical/optical properties changes with exposure the vapor. The experimental results suggested that PS surface is candidate a promising material for sensing the benzene vapor.

Keywords: Porous silicon, benzene vapor sensing, luminescence, DC measurement

RESEARCH ON TECHNICAL INSPECTION OF CYLINDERS FILLED WITH COMPRESSED GASES, LIQUEFIED OR DISSOLVED UNDER PRESSURE USING ULTRASONIC TECHNOLOGY

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ABSTRACT

The technology for measuring thickness is an ultrasonic non-destructive measurement technique widely used to measure the thickness for various materials. It is fast, reliable, versatile and unlike a micrometer requires access to only one side of the test piece.

Using the ultrasonic technique, almost any material can be measured: metal, plastic, composite, fiberglass, ceramics, rubber and glass. Ultrasonic measurement is completely non-destructive and does not require cutting or sectioning the material.

To extend the lifetime of the cylinders, they will be subject to examination, and investigations to assess the technical condition using ultrasonic test method of wall thickness.

Keywords: ultrasonic technique, cylinder, wall thickness, non-destructive measurement, test piece.

THE LONG TERM CORROSION BEHAVIOR OF A SHAPE MEMORY ALLOY IN SEAWATER SUBJECTED TO VARIOUS PLASTIC DEFORMATION PROCESSES

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ABSTRACT

The influence of the microstructure on the corrosion behavior of a CuAlNi polycrystalline alloy has been studied. The aim of this work was to compare corrosion of shape memory bronze in cast state, after extrusion, rolling, ausforming, marforming and high speed high pressure torsion severe deformation, in Black See water throughout six years. Chloride environment can affected different the alloy, producing dealuminization attack, when lost of aluminum from alloy leave a porous residue of cooper Cu_2O film. The martensitic phase suffers generalized dealuminization on the whole surface and function of the manufacturing process in specific regions appears localized corrosion. The environmental factor affects the formation of the various cooper salts, damaging the compact protective aluminum layer. The seawater provided by coast zone is polluted that leads to form sulfur compounds, hydrogen sulfide and can be contaminated with nitrogen compounds from decomposing algae and plankton. The aluminum bronze are corrosion susceptibility especially at decay of organic matter. Attention was paid to the corrosion process associated with the structural changes from dendritic microstructure to ultrafine martensitic grains. In order to enhance the surface corrosion resistance, shape memory alloy is subjected to accentuated crystalline grain refining. Optical microscopy was performed on the surface of the specimens and also in cross section at different moments during the long time exposure to sea water. The SEM observation was done on the surface of specimens. The EDX analytical examination after conditioning used for the elemental analysis showed formation of Cu and Al oxide layer in case of ausformed samples that suggest improves the corrosion stability.

Keywords: CuAlNi, Shape memory alloy, Corrosion behavior, Dealuminization corrosion, Microstructure, EDX

THE PERCOLATION MODEL OF THE POLIMER NANOCOMPOSITE, CONTAINING FULLERENES

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ABSTRACT

The percolation model of polymer nanocomposite polyethylene–fullerenes was proposed. A dependence of the reinforcement degree of the nanocomposite from the interfacial interaction was obtained. An estimation of the parameter, characterizing the level of the interfacial adhesion, was obtained.

Keywords: polymer nanocomposites, the percolation theory

THE TRIBOLOGICAL PROPERTIES OF EXPANDED GRAPHITE / SILICONE RESIN COMPOSITES

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ABSTRACT

The composites based on expanded graphite (EG) with silicone resin (SR) were consolidated at in range 30-90 MPa for 60 s and then sintered for 30 min at 200±10 °C. The tribological properties of composites was investigated with a pin-on-disk tester under dry conditions. The effects of the SR weight and sliding velocity on the friction and wear properties were explored.

Keywords: expanded graphite, silicone resin, waste products, friction coefficient, wear

THE USE OF MICRO-SYNTETIC FIBERS FOR PREVENTING HIGH STRENGTH CONCRETE SPALLING

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ABSTRACT

This paper presents the behavior of high strength concrete with micro polypropylene fibers under high temperature conditions. Two types of polypropylene fibers percentages were added in the concrete mix. Cubes of 100x100x100 mm were designed with C70 concrete. The concrete specimens were naturally cooled to room temperature after being heated in an electric furnace. No explosive spalling was observed during the heating process. The residual compressive and splitting tensile strength were determined after heating the specimens to 500 °C, 700 °C, respectively 900 °C. After exposing the concrete specimens to 900 °C, the residual compressive and splitting tensile strength reached values near 30% of their strength determined at room temperature.

Keywords: high temperatures, polypropylene fibers, residual strength, spalling

TRENDS IN THE DEVELOPMENT OF MINIATURE OPTICAL ACCELEROMETERS

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ABSTRACT

The paper presents various structures conceived for acceleration detection based on optical principles. In this technological segment the efforts are usually concentrated on the development of fiber optic accelerometers and of fiber Bragg grating accelerometers. Principled, fiber optic accelerometers may encounter in different architectures. One of the most interesting is that the optical sensing element uses the principle of moiré fringes. In other architecture, the acceleration effect is manifested by changing the optical path travelled by a light wave in the free space between two mirrors, one of which is mobile, being rigidly attached to the proof mass of the accelerometer. In fact, the two mirrors form a Fabry-Perot interferometer as a resonant cavity having an optical resonant frequency dependent by the distance between them. It is also shown a fiber-optic accelerometer architecture, in which the light intensity is modulated by the position of the seismic mass. Optical accelerometer structure is similar to a Mach-Zender interferometer, optical path leading to changes in light intensity obtained by detecting the interference wave obtained directly from the light source and the optical path variable wave that propagates along the route: (light source) - (waveguide) - (seismic mass) - (waveguide) - photodetector (photodiode). The second category of optical accelerometers with a strong development is fiber Bragg grating accelerometers. The fiber Bragg transducer is an induced permanent filter in the middle of a piece of single-mode optical fiber, which reflects a narrowband signal. The filter is actually a diffraction grating formed by the periodic modulation of the refractive index of the fiber core. For different architectures the mathematical models and the resulted static characteristics are emphasized. Are also described and mathematically modelled some possible ways to optimize these input-output characteristics.

Keywords: inertial sensors, accelerometers, optical methods, mathematical models

A COMPARISON OF THE STRUCTURE AND PROPERTIES OF HSLA STEEL COLD ROLLED AND SEVERE PLASTIC DEFORMED BY HIGH SPEED HIGH PRESSURE TORSION

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ABSTRACT

A large deformation degree was induced on High Strength Low Alloy steel X60 samples in hot rolled state. The plastic deformation process was conducted on cold rolling mill start to 0.03 up to 3.14 true strain in 43 passes, without intermediate thermal treatments. Also an original severe plastic deformation method – High Speed High Pressure Torsion was applied. The achieved true strain was very similar but had been obtained in one step. Here we report the grain structure evolution from coarse equiaxed grains to fine and ultrafine structure. For cold rolled respectively HSHPT'ed samples was performed a comparison of structures by OM and SEM. However the structure development in each plastic deformation process was strong function of the true strain achieved. Both HS HPT and cold rolling technological parameters were monitored and mechanical properties were determined.

Keywords: Severe plastic deformation, High Speed High Pressure Torsion, High Strength Low Alloy Steel, ultrafine grain structure, OM, SEM, Microhardness

A DAMAGE MODEL FOR FIBER REINFORCED COMPOSITE LAMINATE

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ABSTRACT

In this paper a technique for analyzing mixed mode delamination in laminate plates under in-plane loading conditions is developed. There is used the interface methodology which adopts the first-order shear laminate plate theory. The 2D numerical model of delamination is obtained by using of Finite Element Method in program ANSYS. Displacement, interface reaction and strain energy release rate distribution along the delamination front are illustrated. The results obtained from each mode response analysis are compared.

Keywords: fiber, composite, delamination, displacement, interface reaction, energy release rate

CHARACTERISTICS OF CARBON FOAMS FROM BY-PRODUCTS OF COMMERCIAL POLYETHYLENE PRODUCTION

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ABSTRACT

The aim of this study is to develop methods for obtaining carbon foams of various pore structure and high mechanical strength using polyethylene wax (by-products in polyethylene production) as raw materials. Characteristics of the foams consisted in the determination of the structure, morphology, density, thermal, mechanical and other properties of obtained carbon materials. The relation between physical and chemical properties of obtained carbon materials and conditions of their production was determined.

Keywords: carbon foams, polyethylene by-products, XRD, morphology

COMPARISON OF MECHANICAL PROPERTIES OF STEELS OF THE USUAL METAL POWDERS BASED ON CU AND NI TESTED AT LOW TEMPERATURES

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ABSTRACT

Powder metallurgy industry in Romania is steadily rising on production processes. Producing parts with high mechanical properties and relatively low price led to the analysis of the mechanical properties of common steel and powder metallurgy steels. In this current context, this paper was written.That is why attempts have been made on the behavior of the material at low temperatures of a classical powder metallurgy for the production of masă.Un conventional steel material containing a matrix metal of iron, (0,4 - 0.8)% C, 5 % Ni and Cu (1.5-3)% (whit diffusion alloyed powder plus carbon) shows a wide range of applications due to their static and dynamic mechanical properties and good behavior in sintering. There is generally a good behavior in the cryogenically treated materials to mechanical simple, especially traction. It can be said that there is a higher densification of these materials based on strengthening the bridges between particles.

Keywords: low temperatures, powder metallurgy, matrix metal iron, mechanical properties.

CONSIDERATIONS ON COATINGS OBTAINED BY ELECTROLYTE DEPOSITION MECHANISM

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ABSTRACT

Electrolytic deposition is achieved by electrolysis of aqueous solutions of simple or complex salts containing metal ions to be deposited. Piece is coated cathode and anode current source can be an unassailable metal inert (insoluble anode in electrolysis) or metal coating, which dissolves as ions in solution (soluble anode in electrolysis), moving and discharged (submitted) at the cathode, forming protective metal layer. Electrolyte (electrolytic bath) includes: a metal compound which decomposes and is deposited in well-defined concentration, buffering agents to maintain constant acidity (pH) solution, inorganic substances to increase the electrical conductivity and special additives to improve porosity, adhesion, gloss coating or structure. Because of quality-price-performance ratio and outstanding qualities they possess, composites allow multifunctional pieces, shape simplification mechanisms and improve performances. Layers of composite materials made by deposits fall into the category of advanced materials. Metal matrix composites studied in this paper have the particularity that the matrix is an electrodeposited metal or alloy.

Keywords: electrodeposition, cathode, anode, layer, metal, alloy, conditions.

CONSIDERATIONS ON SURFACE FATIGUE BEHAVIOR OF PM STEEL

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ABSTRACT

Latest research in the field of powder metallurgy show concern over attempts fatigue. Have been made to predict the the endurance limit to fatigue for predicting the effect of residual porosiy an the tensil strenght. It was found that the surface finish of the samples has a great influence on the fatigue strength. The sample containing pores - those caused by transient liquid phase by the Mo particle - the adverse effect of such flaws on the fatigue strength, which was also found by testing the fatigue PushPull was prepared perceptible only to the surface as is customary metallographic sections, that is, while if the influence of surface defects of the conventional polishing was masked by the closure of the pores. It highlighted the negative effect of secondary pores generated by Mo transition. They are the results of fatigue test of a high-strength sintered steel based material containing iron (0.6-0.8)% C, (1,5-2%)Mo, and 0,6% Cu. Fatigue response of the samples depends on the shape and nature of the pore is tension concentrators.

Keywords: pores, fatigue strength, powder metallurgy, sintered steels, microhardness.

CONTROL TUNING IN A CLOSED LOOP CAPACITIVE MEMS ACCELEROMETER

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ABSTRACT

This paper presents the mechanism used to close the loop for a MEMS capacity accelerometer, not only in terms of mathematical modeling, but also in terms of numerical simulation. By using the linear model of the mathematical model, some analysis related to the system quality is performed in frequencies. Because of the great nonlinearities present in the system at the level of the capacitive transducer, to extend the utility of the accelerometer, we need to close its loop. In the case of the micro-accelerometers, an electrostatic force is usually used as feedback. To improve the dynamic characteristics of the accelerometer, the feedback voltage is taken from a controller mounted on the direct way of the accelerometer, after the phase sensitive demodulator. The controller type is established using the transfer function of the linearized system and is tuned by using various integral criteria, as the minimum error surface criteria Ziegler-Nichols, and Kaya-Scheib method. Finally, the dynamic performances of the closed loop accelerometer are tested and discussed for all criteria used in tuning.

Keywords: inertial sensors, MEMS, closed loop, control tuning

DOXYCYCLINE ENCAPSULATION STUDIES INTO MESOPOROUS SBA-15 SILICA TYPE CARRIERS AND *IN VITRO* RELEASE

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ABSTRACT

The doxycycline encapsulation procedure on mesoporous SBA-15 silica has been studied and optimized. The supports (SBA-15 and aminopropyl-modified SBA-15) and hybrid materials containing doxycycline were synthesized and characterized by small and wide angle powder X-ray diffraction, N_2 adsorption-desorption isotherms, FT-IR spectroscopy, scanning electron microscopy and thermal analysis. Doxycycline uptake and its release profiles in phosphate buffer solution at pH 5.5 and 37 ^{o}C were determined by UV-VIS spectroscopy. The doxycycline encapsulation protocol onto the mesoporous supports was established.

Keywords: mesoporous silica, doxycycline, drug delivery systems, SBA-15

EFFECT OF SEVERE AUSFORMING ON THE SHAPE MEMORY MICROSTRUCTURE OF A COPPER BASED ALLOY

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ABSTRACT

Thermomechanical treatments provide requirements of good mechanical properties withal better and precise shape memory properties. The present work has been studied morphology, chemical structure and elemental mapping of Cu-based shape memory alloys after ausforming applied at high temperature range. Ausforming implies plastic deformation of austenite, introduced lattice defects which modify structure of martensite and increase strength of the alloys. Thus, ausformed alloys have great potential for novel actuators in commercially valuable applications, at certain transformation temperatures. The samples plastic deformed with different deformation degree were systematically investigated by scanning electron microscope (SEM) and energy dispersive X-ray analysis (EDX). Subtle changes in composition have been studied for ausformed samples in different conditions (temperature of deformation between 1000˚C and 800˚C, deformation degree from 8 to 40%) to determine the properties of CuAlNi shape alloys and become workable in the production. Transformation temperatures of specimens determined by DSC were correlated with changing the structure of martensite.

Keywords: Shape memory alloy, Martensitic transformation, Ausforming, Scanning Electron Microscopy, Energy Dispersive X-ray Analysis

EPOXY/CARBON COMPOSITES. THE CURING BEHAVIOUR AND MORPHOLOGY DEPENDED ON THE DEGREE OF STRUCTURE ORDER

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ABSTRACT

The aim of this work was to study the influence of the degree of the structure ordering for a series of carbon fillers, which includes, on one hand, anthracite consisting of graphene planes with various degree of organization, and, on the other hand, graphite that is composed of well-ordered graphene sheets, on the curing behavior and morphology of epoxy composites containing these fillers. The systematic studies was performed for composites based on low molecular weight diglycidyl ether of bisphenol A cross-linked with aliphatic amines. Raw Svierdlovski anthracite (Donbas, Ukraine) of turbostratic structure, and the anthracite thermally treated at 950, 1400, 1700 and 2000 °C, with the structure changing gradually as a result of increasing calcination temperature toward the graphite-like structure, were used as carbon fillers. The anthracite fillers were compared to natural graphite that is composed of well-ordered graphene sheets. Epoxy composites with thermally modified anthracites, as well as natural graphite were prepared according to procedure including the breakdown of the filler agglomerates by use of an ultrasonic disintegrator and shear mixing.

Keywords: anthracite fillers, graphene sheets, epoxy composites, curing reactions, morphology

EVALUATION THE EFFECTIVENESS SOLUTION OF LOWER STRUCTURE FOR ENERGY EFFICIENT BUILDINGS

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ABSTRACT

Do you think that passive houses are the inventions of recent years? That is not exactly true. Even if they use more advanced technology, some of the basic principles goes back several hundreds years. The History of passive houses have their roots in the 19th century, where the first building was not a building, but research ship of polar explorer Fridtjof Nansen called fram in 1883. The walls and the sandwich construction deck had a thickness of 400 mm, which fulfill the function of a thermal insulation layer of felt and the linoleum fulfill the function of a vapour barrier. The glass treated windows were triple and worked with controlled ventilation with electric ventilators. [4,7]
The building, which is directly on the ground is in direct interaction with the subsoil and its thermal state. Some amount of heat is primarily destined for the creation of thermal comfort in the interior spaces from the foundational construction and the floor on the ground to the cooler sub grade. The outgoing heat represents heat losses, which unfavorably affect the overall energetic effectiveness of the building. The heat loss represents approximately 15 to 20 % of the overall heat loss of the building. This number is a clear antecedent of need of isolation and minimizes the flow of heat from the building to the sub grade. [3,5,6]

Keywords: history of passive houses, building construction, thermal insulation, building on the terrain, energy efficient buildings

EXPLOSIVE CONSOLIDATION OF NANOCRYSTALLINE Si POWDERS

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ABSTRACT

Nanoscale and coarse Si powders (average particle size, 40nm) was object of the investigations. The large grained coarse Si particles preliminary were treated in vibration and planetary ball mill for transformation of powder in nanoscale. The nanopowder was placed in a steel container and compacted by explosively induced shock waves of cylindrical symmetry. Industrial explosives were used for the generation of shock waves. Explosive compaction experiments were performed in range of pressure impulses of 3-20 GPa. This densification process performed in two stages: a) static and b) dynamic loadings. The relationships between the nanopowder preparation, compacting conditions, the precursor particle sizes and properties of the consolidated bulk nanostructured material are discussed in the paper.

Keywords: Nanocrystalline Powder, Si, Shock Wave, Explosive, Compaction

HIGH SPEED HIGH PRESSURE TORSION EFFECTS ON A DIFFICULT DEFORMABLE SHAPE MEMORY ALLOY

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ABSTRACT

High pressure torsion (HPT) is a severe plastic deformation process, able to reduce grain size, down to nanostructure or amorphous level, in bulk materials. In the experiments a modified high speed HPT (HS-HPT) technique was used. It was ideally suited for products about 50 mm in diameter, contributing to a meaningful increase of mechanical properties. This type of severe plastic deformation generates large plastic deformation in entire volume of sample under the effect of high pressure cumulated with high rotation. On the strength of friction and pressure the sample was heated, took place grain fragmentation up to (ultra)fine grains, nanocrystalline or amorphous areas, without recrystallization. The effect of severe plastic deformation via High Pressure Torsion (HPT) on microstructure of the Cu-Al-Ni shape memory alloys was investigated by optical (OM). The reversible martensitic transformation temperatures were investigated using differential scanning calorimetry (DSC) as effect of microstructure refinement appropriate to different deformation degrees. The hardness tests demonstrate that creating ultrafine grain with high strength can produce reliable lightweight metallic parts. The presence of monoclinic and orthorhombic martensite, together with nanocrystalline areas were confirmed by X-ray diffraction (XRD).

Keywords: Severe Plastic Deformation, High Pressure Torsion, Shape Memory Alloys, Structure, Transformation Temperature, Martensite, Cu-Al-Ni shape memory alloy, grain size

INVESTIGATION OF THE ACTIVITY OF RUTHENIUM CARBOXYLATE COMPLEXE IN HYDROGENATION REACTION

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ABSTRACT

This study examined investigation of the catalytic activity of ruthenium carboxylates with triphenylphosphine and tributylphosphine ligands in hydrogenation reaction. The hydrogenation reaction is one of the most important reactions in the ground and fine organic synthesis, in the desulfurization of hydrocarbons and in the production of intermediates. To analyze the conversion ethyl trans-cinnamate the ^{1}H NMR spectroscopy was used. To stabilize the ruthenium complexes were used sterically demanding triphenylphosphine and tributylphosphine and to increase the solubility of organic solvents was specifically synthesized carboxylates with methoxy, methoxyethoxy and metoxydietoxy groups. All used catalysts were tested by the pressure of hydrogen 40-100 bar. Increasing the pressure increases the catalytic conversion according to Le Chatelier's principle.

Keywords: catalytic activity, ruthenium catalysts, hydrogenation reactions, ruthenium carboxylats, homogeneous catalyses, nanoparticle, homogeneous catalyses.

MECHANICAL PROPERTIES OF EXPANDED GRAPHITE / SILICONE RESIN COMPOSITES

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ABSTRACT

In this study mechanical properties of silicone resin polymer composites filled with different amounts expanded graphite (EG) were studied. An equipment is designed and manufactured for testing at elevated temperatures. A method is developed for determining the mechanical properties under compression of composite materials based on expanded graphite in the range of operating temperatures. Mechanical tests at 20 and 400 °C.

Keywords: composites, expanded graphite, waste products, silicone resin, mechanical testing

MESOSTRUCTURED ALUMINOSILICATES AS CARRIERS FOR DOXYCYCLINE-BASED DRUG DELIVERY SYSTEMS

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ABSTRACT

A mesostructured AlSBA-15 material has been obtained by direct "acid-free" sol-gel method using aluminum sulfate and tetraethyl orthosilicate as precursors and triblock copolymer Pluronic P123 as structure-directing agent. 3-aminopropyl moieties have been introduced by a post-synthesis grafting procedure and the resulting mesoporous materials have been applied as carriers for doxycycline delivery systems. The mesostructured supports and doxycycline-loaded materials have been characterized by small and wide angle powder X-ray diffraction, N_2 adsorption-desorption isotherms, FT-IR spectroscopy, scanning electron microscopy coupled with energy dispersive X-ray analysis, as well as thermal analysis. The drug release behavior is discussed in light of the doxycycline-aluminosilicate interactions.

Keywords: mesoporous aluminosilicate, AlSBA-15, acid-free medium, doxycycline, drug release

MORPHOLOGY AND THERMO–MECHANICAL PROPERTIES OF EPOXY COMPOSITES WITH GLASSY CARBON

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ABSTRACT

The application of carbon fillers to polymer matrices requires basic knowledge about characteristics of both phases. Interactions between a filler and polymer matrix affecting the morphology and dynamics of polymer's chains molecular motion in such mixtures should be also taken into considerations. The novel filler used in this study was glassy carbon having specific layered structure.

Glassy carbon is an advanced material combining glassy and ceramic properties with those of graphite. However, unlike graphite, glassy carbon has a fullerene-like microstructure, which leads to a great variety of unique material properties, i.e. high temperature resistance, corrosion resistance, high hardness and strength, low density, and isotropy of physical and chemical properties. It is expected that the epoxy composites with glassy carbon as a filler should have interesting properties from point of view of possible applications.

The aim of this work was to study the influence of glassy carbon structure on morphology and thermo-mechanical properties of resultant composites. The composites based on low molecular weight diglycidyl ether of bisphenol A cross-linked with aliphatic amines with 10 wt. % of the filler were prepared for the study. The following methods were used for characterization of composite materials: optical microscopy, scanning electron microscopy, dynamic mechanical analysis and termogravimetry. The degree of dispersion of filler's particles in the epoxy matrix as well as the character of inter-phase zone between the polymer and the filler were determined in this way. The improvement of thermal stability, stiffness and elastic modulus of composites obtained was observed. The properties of glassy carbon and its epoxy composites were compared with those of anthracite-derived fillers of turbostratic and graphite-like structure and their composites respectively.

Keywords: glassy carbon, carbon fillers, epoxy matrix, SEM, DMA

NEW METHOD FOR SUSTAINABLE POLYMER COMPOSITES PROCESSING

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ABSTRACT

Polymer blends and composites have been obtained in a newly designed multifunctional mixing twin screw extruder. It is assembled as a module that allows for obtaining of two independent polymer streams with separate control. This unit can fulfill as well:

- Longer mixing process so that during polymer melt passing the chemical reactions can be performed more successfully and completely;
- Effective pressure and temperature control in the conditional 'reactive zone' that is a part of the extruder barrel;
- Good homogenizing action, distributive and dispersive mixing. Because of the precise construction the best friction ratio can be obtained that in turn ensures as well the best possible intermeshing in the polymer melt.

The application of newly developed design can turn the processing machine into speedy technological stirred reactor triggering some innovative processes as stable and successful green chemical methods.

Keywords: polymer composites, multifunctional mixing twin-screw, new design

OXIDATION HEAT EFFECTS OF METAL NANOPOWDERS AFTER ELECTRON IRRADIATION

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ABSTRACT

The nanopowders of iron, nickel, molybdenum and copper received by electric explosion of wire were irradiated by an electron current on the liner electron accelerator with the radiation doses of 1, 5, 10 Mrad. Four parameters of activity of nanopowders were evaluated according to the differential thermal analysis: the initial temperature of oxidation, the completeness of oxidation, the maximum speed of metal oxidation and the thermal effect of oxidation. It was ascertained that the thermal effect of combustion increased after irradiation by 1.5-2.5 times. It was shown that the significant increase of the heat of combustion of nanopowders was caused by the increase of the internal stored energy as a result of the ionizing effect of electrons. The electrostatic model of surface charged structures of nanoparticles generated by the ionizing effect of electrons was offered, and its analogue is a spherical capacitor. This model makes it possible to estimate the increase of the surface energy of nanopowders by charging the spherical nanocapacitor with 110-1 100 kJ/mol. It was shown that the lattice parameters of the initial and irradiated metal nanopowders are greater than those of the standard samples of massive metals. Irradiation of nanopowders by accelerated electrons furthers stabilization of interplanar spacings of crystal lattices and brings them closer the standard of massive metals.

Keywords: nanopowders, electron irradiation, the thermal effect, the crystal lattice, energy condensed systems, nanocapacitor

PHYSICAL AND CHEMICAL PROPERTIES AND CRYSTAL STRUCTURE TRANSFORMATION OF BEESWAX DURING HEAT TREATMENT

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ABSTRACT

The object of research is the wax as a waste product of bees in the steppe and mountain areas of Almaty region of Kazakhstan.
Purpose - to study the structure parameters and the homologous phase composition, morphology waxes of alpine and mountain areas of Kazakhstan and the establishment temperature - dependent patterns of their atomic-crystalline state.
Methods: radiography, gas chromatography, scanning electron microscopy and chemical methods of separation of multicomponent systems.
The results obtained in the atomic crystal and molecular structures of beeswax depending on the districts collect materials.
The technique of obtaining radiographs after dissolving beeswax in benzene, hexane and xylene. Submitted thermo-radiographic study samples obtained.
Batch analysis thermo-radiographs waxes after treatment with benzene, hexane and xylene showed that their structure is essentially different from the source and closer to the spectra of the crystallized wax melted and due to annihilation of stacking faults waxes native atoms after their dissolution in hexane, benzene and xylene and subsequent their recrystallization.
The results obtained allow to expand the amount of information on the physico-chemical processes and structural transformations in beeswax as a composite of different genesis biomaterial.
Scope: beekeeping, plant, structural and analytical chemistry, biotechnology and biocomposites.

Keywords: Wax; Composite biomaterial; Radiography; Defect structure

PREPARATION AND THERMAL STABILITY EVALUATION OF SOLID LIPID PARTICLES LOADED WITH ALENDRONATE

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ABSTRACT

Sodium alendronate (AL) is a therapeutical agent in the bisphosphonate (BFs) class. The main biomedical applications of BFs are the inhibition of bone resorption, its use as carrier and bone targeted delivery agent of other drugs, and restenosis inhibition and osteogenesis stimulation near bone implants. Currently, AL is used in conventional release tablets. Its low oral bioavailability (1-3%) is caused by several factors such as low permeability determined by the negatively charged molecules, the short plasma half-time ($T_{½}$ = 0.5 – 2 h) and its chelatation by Ca^{2+} ions resulting in non-absorbable complexes. Aiming at increasing AL bioavailability both on oral and on other routes of administration (e.g. nasal and rectal mucosa), we have decided to load AL in solid lipid particles (SLPs). This research intends to assess AL stability when associated with lipidic excipients and during lyophilization. We prepared 8 self-emulsifying lipidic mixtures based on Compritol 888 (glyceryl behenate), Gelucire 44/14 (a mixture of glycerol and PEG1500 esters of long fatty acids) and Cremophor A 25 (the 25 mole ethoxylate of a blend of cetyl and stearyl alcohols). The hydrophilic-lipophilic balance of those mixtures ranges from 10.4 to 11.4. The aqueous AL solution was dispersed by ultrasonication in these mixtures. The obtained emulsions were lyophilized at – 57 °C and 0.016 mbar for 15 hours. The stability of AL was evaluated by 3 specific methods: differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and FTIR spectroscopy (FTIR). *DSC* was carried out with a Perkin Elmer device under the following conditions: the samples (4-4.5 mg) sealed in an aluminum pan and placed in inert atmosphere were dynamically analyzed at a temperature ranging between 50 and 300°C. *TGA* was performed on 3-6 mg samples using a derivatograph Mettler Toledo in a nitrogen atmosphere with a flow rate of 20 mL/min, a heating speed of 10°C/min (25-600°C). *FTIR* spectra were obtained with a Vertex 70 equipment using KBr pellets technique, and obtained spectra were compared with those available in literature. The results have confirmed the stability of AL in association with the selected lipidic excipients. All three thermal analysis methods have shown identical characteristics for AL both in its raw and in its SLPs loaded state.

Keywords: alendronate, solid lipid particles, Cremophor

RESEARCH ON BENZENE VAPOR DETECTION USING POROUS SILICON

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ABSTRACT

Porous silicon (PS) has been an attractive material for enhancing the optical properties of silicon. Its large surface area for sensor applications and compatibility with silicon-based technologies has been the driving force for this technology development. In this study, benzene vapor detection properties of porous silicon have been investigated at room temperature. Electrical (DC) and photoluminescence (PL) spectra measurements in a controlled atmosphere (Nitrogen gas and the benzene vapor mix) were performed to test the sensor response towards the benzene vapor. It was find that PS surface very sensitive against to the vapor and electrical/optical properties changes with exposure the vapor. The experimental results suggested that PS surface is candidate a promising material for sensing the benzene vapor.

Keywords: Porous silicon, benzene vapor sensing, luminescence, DC measurement

RESEARCH ON TECHNICAL INSPECTION OF CYLINDERS FILLED WITH COMPRESSED GASES, LIQUEFIED OR DISSOLVED UNDER PRESSURE USING ULTRASONIC TECHNOLOGY

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ABSTRACT

The technology for measuring thickness is an ultrasonic non-destructive measurement technique widely used to measure the thickness for various materials. It is fast, reliable, versatile and unlike a micrometer requires access to only one side of the test piece.

Using the ultrasonic technique, almost any material can be measured: metal, plastic, composite, fiberglass, ceramics, rubber and glass. Ultrasonic measurement is completely non-destructive and does not require cutting or sectioning the material.

To extend the lifetime of the cylinders, they will be subject to examination, and investigations to assess the technical condition using ultrasonic test method of wall thickness.

Keywords: ultrasonic technique, cylinder, wall thickness, non-destructive measurement, test piece.

THE LONG TERM CORROSION BEHAVIOR OF A SHAPE MEMORY ALLOY IN SEAWATER SUBJECTED TO VARIOUS PLASTIC DEFORMATION PROCESSES

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ABSTRACT

The influence of the microstructure on the corrosion behavior of a CuAlNi polycrystalline alloy has been studied. The aim of this work was to compare corrosion of shape memory bronze in cast state, after extrusion, rolling, ausforming, marforming and high speed high pressure torsion severe deformation, in Black See water throughout six years. Chloride environment can affected different the alloy, producing dealuminization attack, when lost of aluminum from alloy leave a porous residue of cooper Cu_2O film. The martensitic phase suffers generalized dealuminization on the whole surface and function of the manufacturing process in specific regions appears localized corrosion. The environmental factor affects the formation of the various cooper salts, damaging the compact protective aluminum layer. The seawater provided by coast zone is polluted that leads to form sulfur compounds, hydrogen sulfide and can be contaminated with nitrogen compounds from decomposing algae and plankton. The aluminum bronze are corrosion susceptibility especially at decay of organic matter. Attention was paid to the corrosion process associated with the structural changes from dendritic microstructure to ultrafine martensitic grains. In order to enhance the surface corrosion resistance, shape memory alloy is subjected to accentuated crystalline grain refining. Optical microscopy was performed on the surface of the specimens and also in cross section at different moments during the long time exposure to sea water. The SEM observation was done on the surface of specimens. The EDX analytical examination after conditioning used for the elemental analysis showed formation of Cu and Al oxide layer in case of ausformed samples that suggest improves the corrosion stability.

Keywords: CuAlNi, Shape memory alloy, Corrosion behavior, Dealuminization corrosion, Microstructure, EDX

THE PERCOLATION MODEL OF THE POLIMER NANOCOMPOSITE, CONTAINING FULLERENES

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ABSTRACT

The percolation model of polymer nanocomposite polyethylene–fullerenes was proposed. A dependence of the reinforcement degree of the nanocomposite from the interfacial interaction was obtained. An estimation of the parameter, characterizing the level of the interfacial adhesion, was obtained.

Keywords: polymer nanocomposites, the percolation theory

THE TRIBOLOGICAL PROPERTIES OF EXPANDED GRAPHITE / SILICONE RESIN COMPOSITES

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ABSTRACT

The composites based on expanded graphite (EG) with silicone resin (SR) were consolidated at in range 30-90 MPa for 60 s and then sintered for 30 min at 200±10 °C. The tribological properties of composites was investigated with a pin-on-disk tester under dry conditions. The effects of the SR weight and sliding velocity on the friction and wear properties were explored.

Keywords: expanded graphite, silicone resin, waste products, friction coefficient, wear

THE USE OF MICRO-SYNTETIC FIBERS FOR PREVENTING HIGH STRENGTH CONCRETE SPALLING

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ABSTRACT

This paper presents the behavior of high strength concrete with micro polypropylene fibers under high temperature conditions. Two types of polypropylene fibers percentages were added in the concrete mix. Cubes of 100x100x100 mm were designed with C70 concrete. The concrete specimens were naturally cooled to room temperature after being heated in an electric furnace. No explosive spalling was observed during the heating process. The residual compressive and splitting tensile strength were determined after heating the specimens to 500 °C, 700 °C, respectively 900 °C. After exposing the concrete specimens to 900 °C, the residual compressive and splitting tensile strength reached values near 30% of their strength determined at room temperature.

Keywords: high temperatures, polypropylene fibers, residual strength, spalling

TRENDS IN THE DEVELOPMENT OF MINIATURE OPTICAL ACCELEROMETERS

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ABSTRACT

The paper presents various structures conceived for acceleration detection based on optical principles. In this technological segment the efforts are usually concentrated on the development of fiber optic accelerometers and of fiber Bragg grating accelerometers. Principled, fiber optic accelerometers may encounter in different architectures. One of the most interesting is that the optical sensing element uses the principle of moiré fringes. In other architecture, the acceleration effect is manifested by changing the optical path travelled by a light wave in the free space between two mirrors, one of which is mobile, being rigidly attached to the proof mass of the accelerometer. In fact, the two mirrors form a Fabry-Perot interferometer as a resonant cavity having an optical resonant frequency dependent by the distance between them. It is also shown a fiber-optic accelerometer architecture, in which the light intensity is modulated by the position of the seismic mass. Optical accelerometer structure is similar to a Mach-Zender interferometer, optical path leading to changes in light intensity obtained by detecting the interference wave obtained directly from the light source and the optical path variable wave that propagates along the route: (light source) - (waveguide) - (seismic mass) - (waveguide) - photodetector (photodiode). The second category of optical accelerometers with a strong development is fiber Bragg grating accelerometers. The fiber Bragg transducer is an induced permanent filter in the middle of a piece of single-mode optical fiber, which reflects a narrowband signal. The filter is actually a diffraction grating formed by the periodic modulation of the refractive index of the fiber core. For different architectures the mathematical models and the resulted static characteristics are emphasized. Are also described and mathematically modelled some possible ways to optimize these input-output characteristics.

Keywords: inertial sensors, accelerometers, optical methods, mathematical models