

DIRECT SYNTHESIS OF NOBLE METAL NANOSTRUCTURES ON CARBON SUPPORT BY HYDROTHERMAL PROCESS

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Abstract

Nanostructures of noble metals (Pt and Ag) on carbon support were prepared from fructose and solution of the Nobel metal salts ($H_2PtCl_6 \times 6H_2O$ or $AgNO_3$) under hydrothermal conditions. Commercial fructose ($C_6H_{12}O_6$) acts as the carbon source and reducing agent and noble metal salts is a source of the metal to be incorporated in the new formed carbon material structure. The crystalline structure was examined by X-ray diffraction (XRD) and morphology investigated by scanning electron microscopy (SEM). The crystallite size of the deposited particles could be estimated by evaluating the line width of the Bragg peak applying the Scherrer method. All the XRD patterns clearly show the five main characteristic peaks of the face-centered cubic (fcc) crystalline for both Pt and Ag crystallite. The obtained Pt crystallite sizes were below 5.5 nm, while the Ag crystallite sizes were about 32 or 34nm.

Key words: hydrothermal process, platinum, silver, nanostructure, crystallite size

DIREKTNA SINTEZA NANOSTRUKTURNOG PLEMENITOG METALA NA UGLJENIČNOJ OSNOVI POMOĆU HIDROTERMALNOG PROCESA

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Izvod

Nanostrukture plemenitih metala (Pt i Ag) na ugljeničnom materijalu, kao nosaču, su napravljene, polazeći od fruktoze i rastvora soli plemenitih metala ($H_2PtCl_6 \times 6H_2O$ ili $AgNO_3$) pri hidrotermalnim uslovima. Komercijalna fruktoza ($C_6H_{12}O_6$) deluje kao izvor ugljenika i redukujući agens, a soli plemenitih metala, kao izvor metala, koji treba da se inkorporira u novonastalu strukturu ugljeničnog materijala. Kristalita struktura je ispitivana pomoću difrakcije X-zraka (XRD) a morfologija je ispitivana pomoću skanirajuće elektronske mikroskopije (SEM). Veličina kristalita deponovanih čestica se računa iz širine linije Bragg-ovog pika koristeći Scherrer-ov metod. Svi XRD uzorci jasno pokazuju pet karakterističnih pikova površinski centrirane kristalne rešetke (fcc) i za kristalite Pt i za kristalite Ag. Dobijeni kristaliti Pt imaju veličinu manju od 5.5 nm, dok su veličine kristalita Ag oko 32 i 34nm.

Ključne riječi: hidrotermalni proces, platina, srebro, nanostruktura, veličina kristalita

RED MUD AS MATERIAL FOR ROAD CONSTRUCTION

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Abstract

Red mud is a waste material generated during the processing of bauxite ore into alumina by Bayer's proceedings. It is a highly alkaline suspension, a brick red color. As the demand for aluminum has been constantly growing, it is the amount of produced red mud increases daily. Storage of materials costly manufacturing process and requires special facilities and equipment. If the red mud is inadequately disposed of in the environment may give various negative impacts on the environment and human health. Reuse of this material is an acceptable way to reduce its quantity. The construction industry is a sector with great potential for various uses of this material in large quantities. This paper presents the application of red mud, as the structural material for road construction. In the analyzed cases mud is used in non-separation form, after partially drying. The incorporation of materials itself is quite simple, using the usual machinery for road construction. In order to improve its mechanical properties various additives are added to it and are mixed with other materials. Built road sections showed good condition after years of exploitation and weather conditions. The use of red mud as a material for the construction of roads and embankments is an attractive option with high potential for the use of large amounts of red mud. And if the use of red mud in the construction of roads is fairly simple, it is for this purpose underutilized.

Key words: red mud, Bayer's process, industrial waste, disposal, physico-chemical properties, road construction, strength, consistency.

CRVENI MULJ KAO MATERIJAL ZA IZGRADNJU PUTEVA

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Izvod

Crveni mulj je otpadni materijal koji nastaje prilikom prerade boksitne rude u glinicu po Bayer-ovom postupku. To je visokoalkalna suspenzija, cigla crvene boje. Kako potražnja za aluminijumom beleži stalni rast, to se proizvedena količina crvenog mulja svakodnevno uvećava. Skladištenje ovog materijala poskupljuje proizvodni proces i zahteva poseban objekte i opremu. Ukoliko se crveni mulj na neadekvatan način odlaze u životnu sredinu može izazvati različite negativne uticaje na životnu sredinu i zdravlje ljudi. Ponovna upotreba ovog materijala predstavlja prihvatljiv način za smanjenje njegove količine. Građevinska industrija je sektor sa velikim potencijalom za različite upotrebe ovog materijala u velikim količinama. U radu je dat prikaz primene crvenog mulja, kao konstrukcionog materijala za izgradnju puteva. U analiziranim primerima mulj je korišćen u neseparisanom obliku, nakon delimičnog sušenja. Sama ugradnja materijala je prilično jednostavna, uz korišćenje uobičajne mehanizacije za izgradnju puteva. Da bi se poboljšala njegova mehanička svojstva dodaju mu se različiti aditivi ili se meša sa drugim materijalima. Izgrađene deonice su pokazale dobro stanje nakon višegodišnje eksploatacije i atmosferskih uticaja. Korišćenje crvenog mulja kao materijala za izgradnju puteva i nasipa je atraktivna opcija sa visokim potencijalom za upotrebu velike količine crvenog mulja. I ako je primena crvenog mulja pri izgradnji puteva prilično jednostavna, on se u ovu svrhu nedovoljno koristi.

Ključne reči: crveni mulj, Bayer-ov proces, industrijski otpad, odlaganje, fizičko-hemijska svojstva, izgradnja puteva, čvrstoća, nosivost.

RED MUD AS A RAW MATERIAL FOR MAKING IRON

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Abstract

Red mud is highly alkaline suspension which is obtained after processing of bauxite into alumina using the Bayer's process. It is a heterogeneous fine-grained material, composed mainly of oxides and hydroxides of Fe, Al, Si, Ti, Na and Ca, whereat iron oxides are the most frequent. Metallurgy has the potential to use large amounts of red mud, and extract metals from it are promising area of research. In this field, one of the greatest progress has been made in research of allocations iron. This paper provides an overview of procedures for the separation of iron, as well as a more detail view of individual operations. For the separation of iron, studies have mainly focused in four areas: melting, direct reduction, magnetic separation and leaching processes. Each of these methods has advantages and disadvantages. For this reason often applies a combination of individual procedures. The methods of direct reduction, the improved magnetic separation and hydrometallurgical methods have the advantage in comparison to the direct smelting. Announced values for the efficiency of extraction of iron, using these methods or a combination thereof are ranging from 55 % to 90 %. These results are not comparable because are obtained for sludge of different composition. Despite the large number of conducted researches, the use of red mud for this purpose is not satisfactory, and the most appropriate technique allocation has not yet been submitted.

Key words: red mud, Bayer's process, chemical and mineral composition, metallurgical applications, iron recovery, melting, direct reduction, magnetic separation, leaching.

CRVENI MULJ KAO SIROVINA ZA DOBIJANJE GVOŽĐA

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Izvod

Crveni mulj je visokoalkalna suspenzija koja nastaje nakon prerade boksita u glinicu primenom Bayer-ovog postupka. To je heterogen sitnozrni materijal, sastavljen uglavnom od oksida i hidroksida Fe, Al, Si, Ti, Na i Ca, pri čemu su oksidi gvožđa najzastupljeni. Metalurgija ima potencijal za korišćenje velike količine crvenog mulja, a izdvajanje metala iz njega je perspektivno područje istraživanja. Na ovom polju, najveći napredak je ostvaren u istraživanju izdvajanja gvožđa. U ovom radu je dat pregled postupaka za izdvajanje gvožđa, kao i detaljniji prikaz pojedinih postupaka. Pri izdvajanju gvožđa, istraživanja su uglavnom usmerena u 4 pravca: topljenje, direktna redukcija, magnetna separacija i postupci izluživanja. Svaki od ovih postupaka ima i prednosti i mane. Iz tog razloga često se primenjuje kombinacija pojedinih postupaka. Postupci direktne redukcije, unapređene magnetne separacije i hidrometalurški postupci pokazuju prednost u odnosu na direktno topljenje. Saopštene vrednosti za efikasnost izdvajanja gvožđa, primenom ovih postupaka ili njihovom kombinacijom, se kreću od 55 % do 90 %. Ovi rezultati nisu uporedivi jer su dobijeni za muljeve različitog sastava. I pored velikog broja obavljenih istraživanja, primena crvenog mulja u ovu svrhu nije na zadovoljavajućem nivou, a najprihvatljivija tehnika izdvajanja još nije predložena.

Ključne reči: Crveni mulj, Bayer-ov proces, hemijski i mineralni sastav, metalurška primena, izdvajanje gvožđa, topljenje, direktna redukcija, magnetna separacija, izluživanje.

METALLURGICAL PROCESSING OF COPPER SECONDARY RAW MATERIALS

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Abstract

Procedures for copper secondary raw materials processing include two basic stages: pretreatment of the copper waste and its further metallurgical processing. For copper waste pretreatment technology, there are different applied procedures depending on the type of raw material. All operations of pretreatment are influencing the quality of metallurgical processing. For metallurgical processing of raw materials prepared for the purpose of obtaining copper and copper alloys the shaft, flaming and short-drum furnaces, converters and electric furnaces (electric resistant, electric arc and induction furnaces) are used.

Key words: *copper secondary raw materials, metallurgical processing, smelting*

METALURŠKA PRERADA SEKUNDARNIH SIROVINA BAKRA

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Izvod

Postupci prerade sekundarnih sirovina bakra uključuju dva osnovna stupnja: preipremu bakarnih otpadaka i njihovu dalju metaluršku preradu. Za pripremu bakarnih otpadaka koriste se različiti postupci u zavisnosti od vrste i kvaliteta sekundarne sirovine. Sve operacije pripreme utiču na kvalitet metalurške prerade, odnosno na kvalitet proizvoda. Za topljenje pripremljenih sekundarnih sirovina u cilju dobijanja legura na bazi bakra koriste se razni agregati: šahtne peći, konvertori, plamene lončaste i koritaste plamene peći, kratke bubnjaste peći i električne peći (elektrolučne, elektrootporne, indukcione).

Ključne reči: sekundarne sirovine bakra, metalurška prerada, topljenje

THE CREATION AND GROWTH OF A FATIGUE CRACK IN HIGH TENSILE STRENGTH STEEL GRADES FOR SCREWS AND BOLTS

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Abstract

Dynamic characteristics have been tested at three high tensile strength steel grades (41Cr4, 34Cr Mo4, 42CrMo4) suitable for making screws and bolts for internal combustion engine connecting rods which, while in work, are exposed to high fatigue stresses.

The electron microscopy scanning (SEM) have shown that, at high tensile strength steels, the fatigue crack is created around non-metallic inclusions. A stage of fatigue crack growth is characterized by absence of expressed fatigue ruts which prevent from being able to localise an area where fatigue cracks are created. The third stage, a quasistatic fracture, is characterized by presence of a number of big holes created by a dis-cohesion mechanism around non-metallic inclusions and the very small ones, created around cementite. The basic mechanism of fracture in this zone is coalescence of micro holes created by breaking of ligaments.

To increase dynamic strength in high tensile strength steels for screws and bolts, it is necessary to reduce as much as possible creation of fatigue cracks and amount of non-metallic inclusions, respectively.

Key words: *fatigue, crack, inclusion, dis-cohesion, quasistatic fracture, convalescence of micro holes*

STVARANJE I RAST ZAMORNE PRSKOTINE KOD ČELIKA VISOKE ČVRSTOĆE ZA VIJKE

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Izvod

Dinamičke karakteristike ispitivane su na tri kvaliteta čelika (41Cr4, 34CrMo4, 42CrMo4) visoke čvrstoće, koji su namijenjeni za izradu vijaka klipnjače motora sa unutrašnjim sagorijevanjem i koji su pri radu izloženi zamornom opterećenju.

Skening elektronskom mikroskopijom (SEM) je utvrđeno da se kod čelika visoke čvrstoće zamorna prskotina stvara oko nemetalnih uključaka. Stadijum rasta zamorne prskotine se karakteriše odsustvom izraženih brazdica zamaranja što onemogućuje da se lokalizuje mjesto stvaranja zamorne prskotine. Treći stadijum-kvazistatički lom se karakteriše prisustvom mnogobrojnih jamica-kрупnijih, nastalih mehanizmom dekohezije oko nemetalnih uključaka i veoma sitnih, nastalih oko cementita. Osnovni mehanizam loma u ovoj zoni je koalescencija mikro šupljina prekidom ligamenata.

U čelicima visoke čvrstoće za vijke u cilju povećanja dinamičke izdržljivosti neophodno je smanjiti mogućnost stvaranja zamornih prskotina, odnosno smanjiti količinu nemetalnih uključaka.

Ključne riječi: zamor, prskotina, uključak, dekohezija, kvazistatički lom, koalescencija mikrošupljina

IMPROVING THE PROPERTIES OF LOW-ALLOY Cr-Ni-Mo STEEL CASTINGS INTENDED FOR THE MANUFACTURE OF SPARE PARTS OF CONSTRUCTION AND MINING MACHINERY

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Abstract

This paper analyzes the possibility of improving the performance, until now used Cr-Ni-Mo steel castings for making adapters and backhoe loader working under high dynamic loads and intensive wear. Low alloyed Cr-Ni-Mo steel castings, designed and tested at the Institute for Ferrous Metallurgy-Niksic (internal code NK3M). In addition to laboratory metallographic and mechanical tests, analyzed the behavior of castings in operating conditions. The results of these tests are compared with the properties of the product companies: Caterpillar, Liebherr and Hendrix, and NK3M cast steel showed almost the same quality with much lower price.

Key words: *improving, adapter, wear, steel casting, comparison*

POBOLJŠANJE OSOBINA NISKOLEGIRANOG Cr-Ni-Mo ČELIČNOG LIVA NAMIJENJENOG ZA IZRADU REZERVNIH DIJELOVA GRAĐEVINSKIH I RUDARSKIH MAŠINA

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Izvod

U ovom radu je analizirana mogućnost poboljšanja osobina, do sada korišćenog Cr-Ni-Mo čeličnog liva za izradu navlaka rovokopača i utovarivača koji rade u uslovima velikih dinamičkih opterećenja i intenzivnog habanja. Niskolegirani Cr-Ni-Mo čelični liv, osmišljen i testiran u Institutu za crnu metalurgiju-Nikšić (interne oznake NK3M). Osim laboratorijskih metalografskih i mehaničkih ispitivanja, analizirano je ponašanje odlivaka u eksploatacionim uslovima. Rezultati navedenih ispitivanja su upoređeni sa osobinama proizvoda firmi: Caterpillar, Hendrix i Liebherr, i NK3M čelični liv je pokazao približno isti kvalitet, uz znatno nižu cijenu.

Ključne reči: *unapređenje osobina, čelične navlake, habanje, livenje čelika*

NANOMATERIALS AND NANOTECHNOLOGY FOR SUSTAINABLE ENERGY

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Abstract

The use of nanotechnology to develop a suite of sustainable energy production schemes is one of the most important scientific challenges of the 21st century. The challenge is to design, to synthesize, and to characterize new functional nanomaterials with controllable sizes, shapes, and/or structures.

Nanotechnology is generating a lot of attention these days and therefore building great expectations not only in the academic community but also among investors, the governments, and industry. This paper, explores some of the possible implementations of nanotechnology for new and improved methods of energy conversion, considering a need for this to be done without compromising our environment. Its unique capability to fabricate new structures at atomic scale has already produced novel materials and devices with great potential applications in a wide number of fields. Focus is given to important role of nanomaterials, preparation and characterization some of nanomaterials important for sustainable energy, dye sensitized solar cells and hydrogen production technology.

Key words: solar energy, energy conversion, dye sensitized solar cells, hydrogen

NANOMATERIJALI I NANOTEHNOLOGIJE ZA PROIZVODNJU ODRŽIVE ENERGIJE

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Izvod

Upotreba nanotehnologija u cilju razvijanja načina proizvodnje održive energije je jedan od najznačajnijih izazova 21 vijeka. Izazov je dizajnirati, sintetizovati i izvršiti karakterizaciju novih funkcionalnih nanomaterijala kontrolisanih veličina, oblika i/ili struktura. Nanotehnologija danas privlači punu pažnju ne samo akademske zajednice, već i investitora, vlada i privrede a radi izgradnje i ostvarivanja velikih očekivanja.

Ovaj rad istražuje moguću primjenu nanotehnologija za nove i unaprijeđene metode pretvaranja energije, uvažavajući potrebe naše sredine. Njihova je jedinstvenost u tome što imaju mogućnost da fabrikuju nove structure na atomskom nivou, kao što su već proizvedeni novi materijali i uređaji sa mogućnošću visoko potencijalne primjene u mnogo oblasti. Fokus je na bitnoj ulozi nanomaterijala, pripremi i karakterizaciji nekih nanomaterijala za proizvodnju održive energije, tankoslojnih solarnih ćelija u tehnologija proizvodnje energije vodonikom.

Ključne riječi: solarna energija, konverzija energije, tankoslojne solarne ćelije, vodonik

QUANTIFYING THE SHAPE OF NANOPARTICLES USING CIRCULARITY

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Abstract

Shape is an important characteristic of a particle and strongly related to its physical characteristics, whereas shape descriptors are a powerful tool in digital image analysis tasks. As an example we may mention the relation between shape's circularity and coercivity. In that regard it is important to have a method to characterize particles. In this article we present the use of circularity measure as a means to qualitatively describe nanoparticles. Circularity measure provides an answer to the question how circular a given shape is. When the measure returns a value close to 1 it indicates the shape is very close to a circle. The value is precisely 1 only in the case of a perfectly circular shape. We propose the circularity measure based on an area of a shape, which, unlike the standard measures, is more robust with respect to image noise and narrow protrusions. This measure is convenient when dealing with lower quality images or the ones with low resolution.

Key words: computer vision, shape analysis, coercivity, nanoparticles, circularity, shape descriptors, classification.

KVANTIFIKOVANJE OBLIKA NANOČESTICA POMOĆU CIRKULARNOSTI

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Izvod

Oblik je važna osobina čestica koja je čvrsto povezana sa njihovim fizičkim osobinama, dok su deskriptori oblika moćno sredstvo u mnogim zadacima obrade slike. Kao primer možemo navesti odnos cirkularnosti oblika i koercitivnosti. U tom smislu važno je imati metod koji karakteriše čestice. U ovom radu predlažemo korišćenje cirkularnosti kao mere koja može pomoći prilikom kvantitativnog opisivanja nanočestica. Cirkularnost daje odgovor na pitanje koliko je kružan oblik. Metrika bliža broju 1 je indikator da je čestica aproksimativno bliža krugu. Predlažemo upotrebu mere cirkularnosti zasnovane na površini koja je, za razliku od standardne mere, robusna (na primer u pogledu šuma ili u vezi sa uskim prodorima u objekat). Ona je veoma pogodna kada se radi sa slikama niskog kvaliteta ili sa slikama male rezolucije.

Ključne reči: *Computer vision, analiza oblika, koercitivnost, nanočestice, cirkularnost, deskriptori oblika, klasifikacija.*

CHARGE CARRIERS STATES IN SUPERCONDUCTING CERAMICS

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Abstract

This paper analyzes what happens to the elementary charge carriers in anisotropic perovskite structures, such as modern superconducting ceramics. Translational symmetry of the atom (ion) distribution of the electron (or hole) system is broken by the sputtering and due to existence of two boundary surfaces. This is a charge carrier's model of high-temperature superconductors in which the observed symmetry breaking orthogonal to CuO planes was treated as a perturbation. The single-particle fermion's wave functions and the possible energies of charge carriers were determined.

Key words: Charge carriers, boundaries, anisotropy, energy states and spectra, one-particle wave functions

STANJA NOSILACA NAELEKTRISANJA U SUPERPROVODNIM KERAMIKAMA

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Izvod

U radu je analizirano šta se dešava sa elementarnim nosiocima naelektrisanja u anizotropnim perovskitnim strukturama, kakve su savremene superprovodne keramike. Translaciona simetrija atomskih (jonskih) rasporeda sistema elektrona (ili šupljina) je naprušena rasprašivanjem (spateringom) i postojanjem dveju graničnih površi. Ovo je model nosilaca naelektrisanja kod visoko-temperaturskih superprovodnika u kojem se posmatrano narušenje simetrije normalno na CuO ravni tretira kao perturbacija. Određene su jedno-čestične fermionske talasne funkcije i moguće energije nosilaca naelektrisanja.

Ključne riječi: *Nosioci naelektrisanja, granice, anizotropija, energetska stanja i spektri, jedno-čestične talasne funkcije*

EVALUATION OF THE CORROSION STABILITY OF CARBON STEEL IN ACID ENVIRONMENT (HCl) IN PRESENCE OF ROSMARINUS OFFICINALIS

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Abstract

The economic and environmental damage in industry that come as a result of corrosion are strongly dependent not only on the materials used and on the corrosion products, but also on the inhibitor selection. Green inhibitors not only increase the corrosion resistance of metals in aggressive environments, but also avoid the use of synthetic organic or inorganic substances. The aim of this paper is to study the protection efficiency of rosmarinus officinalis in the corrosion of 36CrMo steel in HCl solution. The inhibition ability of this oil has been tested for different concentrations of HCl acid and inhibitor using the potentiodynamic polarisation method. The results show that the corrosion stability of the carbon steel increases when increasing the concentration of the rosmarinus officinalis oil and decreases with acid concentration.

Key words: corrosion protection, 36CrMo steel, green inhibitor, rosmarinus officinalis

EVALUATION OF THE PROTECTION EFFICIENCY OF FOENICULUM VULGAR IN THE CORROSION OF CARBON STEEL IN ACID ENVIRONMENT (HCl)

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Abstract

Corrosion is a widely spread phenomena not just in everyday life, but especially in industry. The economic cost coming from loss of efficiency, damage or failure of the equipment can be considerable. The addition of inhibitors in the corrosion environment is one of the most used methods in corrosion protection. The focus of the research has always been in finding low cost and environmental friendly substances to be used as inhibitors. This paper present result on the inhibition ability of foeniculum vulgar in the corrosion of 36CrMo steel in HCl solution. The protection efficiency of these extracts has been tested for different concentrations of HCl acid and inhibitor using the potentiodynamic polarisation method. The results show that the corrosion rate decreases with increasing the concentration of the foeniculum vulgar oil.

Key words: corrosion protection, 36CrMo steel, green inhibitor, foeniculum vulgar

LASER INFLUENCE TO MATERIALS AND RESPECTIVE QUANTIFICATIONS OF RESULTS

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Abstract

The influence of electromagnetic radiation in optical spectra is a topic studied multidisciplinary for a long time. Although interaction with different intensities is vastly used in applications, a number of facts exist, which demand detailed study in order to acquire reliable results, based on precisely defined parameters. In this paper needed material and irradiation sources, regarding experimental conditions, parameters are looked for and analyzed, which guarantee repeatability of results. For conditionally speaking weak intensities these processes are biostimulation-biomodulation in biosystems. For strong intensities certain technological operations are being developed for modification of organic and inorganic materials. Author's experiments and acquired results served for analysis for setting up of needed condition realization procedure, which for specific sample lead to same final changes. Accent is on the biological origin material and on materials, exposed to various ecological conditions. Certain program packages are being chosen and analyzed, which partially involved analytical approaches with restrictions. Interfaces are being suggested, to be used in specific applications with existing packages, to get closer to different profile users.

Key words: laser, interaction, biomodulation, plants

UTICAJ LASERA NA MATERIJALE I KVANTIFIKACIJA REZULTATA

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Izvod

Uticaj koherentnog elektromagnetnog zračenja u optičkom diapazonu je predmet, koji se multidisciplinarno proučava dugo. Iako se interakcija sa različitim intenzitetima mnogo koristi u primenama, postoji veliki broj činjenica, koje traže detaljno istraživanje u cilju dobijanja pouzdanih rezultata zasnovanih na precizno definisanim parametrima. U ovom radu se traže i analiziraju potrebni parametri materijala i izvora zračenja, odnosno eksperimentalnih uslova, koji garantuju ponovljivost rezultata. Za uslovno slabe intenzitete radi se o procesima tipa biostimulacije-biomodulacije na biosistemima. Za velike intenzitete radi se na ostvarenju određenih tehnoloških operacija kojima se modifikuju materijali organske i neorganske prirode. Eksperimenti autora i dobijeni rezultati poslužili su za analizu postavljanja procedure ostvarenja potrebnih uslova, koji na specifičnom uzorku dovode do istih finalnih promena. Akcenat je na materijalu biološkog porekla i na materijalima, koji su izloženi raznim ekološkim uslovima. Analizirani su i odabrani razvijeni paketi programa, koji su delimično uključili analitičke pristupe sa ograničenim prilazom. Predlažu se interfejsi, koji se mogu za specifične primene uključiti uz postojeće programe, kojima bi se približili korisnicima različitih profila.

Ključne reči: laser, interakcija, biomodulacija, biljke

ELECTROCHEMICAL DEPOSITION TERNARY ALLOY ZnNiCo CHLORIDE BATH DIRECT CURRENT

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Abstract

It was performed deposition ternary alloy Zn Ni Co on the base material. We used different concentrations of Zn, Ni and Co ions in the electrolyte, the current density of deposition and deposition time. Electrochemical deposition ternary alloy was performed using the chloride bath on steel.

Key words: *Electrochemical deposition alloy, ZnNiCo alloy, chloride bath, direct current*

ELEKTROHEMIJSKO TALOŽENJE TROJNE LEGURE ZnNiCo IZ HLORIDNOG KUPATILA U REŽIMU KONSTANTNE STRUJE

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Izvod

Vršeno je taložene trojne legure ZnNiCo na osnovnom materijalu. Korištene su različite koncentracije Zn, Ni i Co jona u elektrolitu, gustine struje depozicije kao i vrijeme taloženja. Elektrohemijско taloženje trojne legure je vršeno korištenjem hloridnog kupatila na čeliku.

Ključne reči: Elektrohemijско taloženje legura, ZnNiCo legura, hloridni elektrolit, konstantna struja

ELECTROCHEMICAL DEPOSITION TERNARY ALLOY ZnNiCo CHLORIDE BATH PULSE CURRENT

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Abstract

The coating ternary alloy ZnNiCo is electrochemically precipitated onto the steel sheet as protected material from chloride electrolyte using pulse of current patterns of deposition. Used as electrolytes with different ratios of metal ions, different current densities and different times deposition.

Key words: *Electrochemical deposition of alloys, ZnNiCo alloy, chloride electrolyte, pulse current*

ELEKTROHEMIJSKO TALOŽENJE TROJNE LEGURE ZnNiCo IZ HLORIDNOG KUPATILA U REŽIMU PULSNE STRUJE

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Izvod

Prevlaka trojne legure ZnNiCo je elektrohemijski istaložena na čelični lim kao štice materijal iz hloridnog elektrolita korištenjem pulsnog strujnog režima taloženja. Korišteni su elektroliti sa različitim odnosom metalnih jona, različitim gustinama struje taloženja kao i vrijeme taloženja.

Ključne reči: *Elektrohemijsko taloženje legura, ZnNiCo legura, hloridni elektrolit, pulsna struja*

DIELECTRIC AND OPTICAL PROPERTIES OF SYMMETRICALLY PERTURBED MOLECULAR CRYSTALLINE NANOFILMS

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Abstract

The changes of optical properties under boundary presence in molecular crystal nanofilm were theoretically investigated in this work. The dispersion law and states of excitons as well as their space distribution along boundary direction have been determined using adjusted Green's function method and also by combined analytical and numerical calculations. We study the basic micro and macroscopic physical characteristics of symmetric ultrathin molecular crystalline films and one can see that essential optical properties of these systems arise with perturbation conditions, which appear at their surface layers. On the basis of real and imaginary part of relative permittivity, the absorption, refraction, reflection and transparency indices were determined, and the influences of boundary parameters on occurrence of a very selective and strictly discrete absorption, refraction and transparency were analyzed. What we have found particularly interesting is the significant percentage of reflected and transparent electromagnetic IR radiation in the nanofilm, although bulk samples of the same crystallographic structure are complete absorbers of this spectrum.

Key words: Thin film, excitons, permittivity, absorption, refraction, reflection, transparency

DIELEKTRIČNE I OPTIČKE OSOBINE SIMETRIČNO PERTURBOVANIH MOLEKULSKIH KRISTALNIH NANOFILMOVA

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Izvod

Promene optičkih svojstava zbog prisutnosti granica u molekularnom kristalnom nanofilmu teoretski su istraženi u ovom radu. Zakon disperzije i stanja eksitona, kao i njihova prostorna raspodela duž graničnog pravca određeni su prilagođenim metodom Grinovich funkcija u kombinaciji sa analitičkim i numeričkim proračunima. Mi smo istražili osnovne mikro i makroskopske fizičke karakteristike simetričnih ultratankih molekulskih kristalnih filmova i može se videti da bitna optička svojstva tih sistema zavise od perturbacionih uslova, koji se pojavljuju na njihovim površinskim slojevima. Na osnovu realnog i imaginarnog dela relativne permitivnosti, indeksi apsorpcije, prelamanja, odbijanja i transparentcije su određeni, a analizirani su utjecaji graničnih parametara na pojavu vrlo selektivne i strogo diskretne apsorpcije, odbijanja i transparentcije. Posebno zanimljiv je značajan udeo odbojnog i transparentnog elektromagnetskog IC zračenja u/nanofilmu, iako su balk uzorci iste kristalne strukture potpuni apsorberi ovog spektra.

Ključne riječi: Tanki film, eksitoni, permitivnost, apsorpcija, prelamanje, odbijanje, transparentcija

SOME CONSIDERATIONS RELATED TO QUANTUM ELECTRONICS, ACOUSTICS AND, SCIENCE OF MATERIAL BASED ON EXPERIMENT AND THEORY

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Abstract

The coupling of some fundamental sciences and issues arising from it are considered in this paper. Nowadays problems of material science connected to the transport and optical characteristics. So-me measurements and their interpretations for chosen condensed materials are considered. Various processes, which include directly optical and acoustic processes, are measured for solid and liquid materials. After obtained principal issues of measurement, coupling with them is performed. Princi-pal links include dielectric, resistive, optical and acoustical performances. Nonlinear optical contri-bution up to optical-laser breakdown can be evaluated from linear data. Micellar laser scattering cover transient effects and is one of the topics in many sciences (including biology and ecology)

Key words: *laser, scattering, micelle, sound, ecology, transport performances, diffusion*

NEKA RAZMATRANJA ODNOSA KVANTNE ELEKTRONIKE, AKUSTIKE I NAUKE O MATERIJALU BAZIRANE NA EKSPERIMENTU I TEORIJI

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Izvod

Spoj nekih osnovnih nauka i pitanja koja iz njega nastaju se razmatraju u ovom radu. Sadašnji problemi nauke o materijalima je povezan sa karakteristikama transporta i optičkih. Neka merenja i njihove interpretacije za odabrane kondenzovane materijale su tumačena. Razni procesi, koji uključuju direktne optičke i akustične procese, mere se na čvrstim materijalima. Nakon dobijenih osnovnih načela merenja, vrše se njihovo povezivanje. Glavne veze uključuju dielektrične, otporne, optičke i akustične uslove. Nelinearni optički doprinos optičko - laserskom prekidu može se oceniti iz linearnih podataka . Micelarno lasersko rasejanje povezuju prolazni efekti i jedna je od tema u mnogim naukama (uključujući biologiju i ekologiju)

Ključne riječi: rasejanje, laser, micle, brzina zvuka, ekologija, transportne osobine, difuzija

ROLLER COMPACTED CONCRETE FOR PAVEMENTS

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Abstract

Roller compacted concrete pavement has a wide range of uses – from the pedestrian pathways to the infrastructural buildings. This type of concrete is primarily intended for the roundabouts and industrial pavements bearing heavy loads, but not high speeds. It can be used for construction of pedestrian and bicycle lanes, parking lots etc. Concrete pavement is more durable than the other types of pavements, it is more resistant to wear and its maintenance is simpler, not requiring frequent closures for traffic in order to maintain it. Its durability, longevity, noninflammability is accompanied by the low cost. It has a light color, so less lighting is required at night. The construction process of roller compacted concrete is simple: the concrete is produced in the concrete factory, transported to the construction site in a mixer-truck and placed with the available technology – pavers and if needed, by vibrating rollers. The pavement can be used very shortly after construction. Owing to the raw materials used in fabrication, the roller compacted concrete pavement has considerably lower cost of construction in comparison to asphalt-concrete.

Key words: *roller compacted concrete, fast construction, longevity*

VALJANI BETON ZA KOLOVOZ

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Izvod

Kolovoz od valjanog betona ima široko polje primene - od pešačkih staza pa sve do infrastrukturnih objekata. Ova vrsta betona je prevashodno namenjena izgradnji kružnih tokova i industrijskih kolovoza koji podnose velike terete, ali ne i velike brzine. Može se primeniti i za izgradnju pešačkih staza, biciklističkih staza, parkirališta i drugo. Betonski kolovoz je dugotrajniji od ostalih kolovoza, otporniji je na habanje, a njegovo je održavanje jednostavnije tako da ne zahteva česta zatvaranja za sobraćaj. Uz otpornost, dugotrajnost i nezapaljivost, odlikuje se i povoljnom cenom.. Ima svetlu boju te je noću potrebno manje rasvete. Valjani beton je moguće ugraditi i na podlogu bez posebne pripreme. Proces izrade betonskog kolovoza od valjanog betona je jednostavan: beton se proizvodi u fabrici betona, kamionom-kiperom se prevozi na gradilište i ugrađuje postojećom tehnologijom – finišerima a, po potrebi, i vibrovaljcima. Kolovoz je moguće koristiti vrlo brzo nakon ugradnje. Zahvaljujući sirovinama koje se koriste u proizvodnji, kolovoz od valjanog betona ima znatno niže troškove ugradnje u odnosu na asfalt beton.

Ključne reči: valjani beton, kolovoz, brza izrada, dugotrajnost

INFLUENCE OF PRESSURE ON ELECTRICAL CONDUCTIVITY OF LIGNOCELLULOSE COMPOSITES FILLED WITH ELECTROLYTIC COPPER POWDER

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Abstract

This article is concerned with synthesis and characterization of electroconductive composite materials prepared by the compression molding of mixtures of lignocellulose and electrochemically deposited copper powder under different pressures, and investigation of the influence of particle size on conductivity and percolation threshold of obtained composites. Electrodeposited copper powder content was varied from 2.0-29.8 vol%. Analysis of the most significant properties of individual components and prepared composites included structural analysis and measurements of electrical conductivity. The significant increase of the electrical conductivity can be observed as the copper powder content reaches the percolation threshold. The packaging effect and more pronounced interparticulate contact with smaller, highly porous, highly dendritic particles with high values of specific area lead to "movement" of percolation threshold towards lower filler content, which for the particles <45 μm and highest processing pressure of 27 MPa was 11.4% (v/v). In the investigated range of electrodeposited copper powder concentrations and applied pressures the increase of the electrical conductivity of composites is as much as fourteen orders of magnitude. It was found that this transition occurs at lower volume fractions than stated in the literature which can be due to the filler with high specific area.

Key words: *Conducting polymer composites, electrolytic copper powder, lignocellulose, particle size, electrical conductivity, percolation threshold*

UTICAJ PRITISKA NA ELEKTRIČNU PROVODLJIVOST LIGNOCELULOZNIH KOMPOZITA PUNJENIH ELEKTROHEMIJSKI DOBIJENIM BAKARNIM PRAHOM

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Izvod

Ovaj članak se bavi sintezom i karakterizacijom elektroprovodnih kompozitnih materijala pripremljenih hladnim presovanjem mešavina lignoceluloze i elektrohemijski dobijenog bakarnog praha pri različitim pritiscima, kao i ispitivanje uticaja veličine čestica na provodljivost i perkolacioni prag dobijenih kompozita. Udeo elektrohemijski dobijenog bakarnog praha je variran od 2.0 – 29.8 vol%. Analiza najznačajnijih osobina kako pojedinačnih komponenti tako i dobijenih kompozita je uključivala strukturnu analizu i merenja električne provodljivosti. Značajan porast električne provodljivosti može se primetiti kad sadržaj bakarnog praha u kompozitima dostigne perkolacioni prag. Efekat pakovanja i izraženiji međučestični kontakt sa manjim, izrazito poroznim i dendritičnim česticama sa velikim vrednostima specifične površine dovodi do "pomeranja" perkolacionog praga ka manjim vrednostima udela punioca, koji za čestice <45 μm i najveći pritisak prerade kompozita od 27 MPa iznosi 11.4% (v/v). U ispitivanom opsegu koncentracija elektrohemijski dobijenog bakarnog praha u kompozitima i pritiscima prerade porast električne provodljivosti je iznosio čak četrnaest redova veličine. Primećeno je da se ovaj prelaz javlja pri nižim vrednostima udela punioca nego što je navedeno u literaturi, što može biti posledica upotrebe punioca sa velikim vrednostima specifične površine.

Ključne reči: provodni polimerni kompoziti, elektrolitički bakarni prag, lignoceluloza, veličina čestica, električna provodljivost, perkolacioni prag

SCANNING ELECTRON MICROSCOPY OF Au585Ag90Cu264Zn61 GOLD ALLOY FOR JEWEL PRODUCTION

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Abstract

Gold alloys "585" that are used for production of jewelry can be three-, four-, five- and more component alloys. All these alloys are with Au-Ag-Cu base, with constant amount of gold, according to applicable legislation, of 58.5 mass.% Au, while the other components depends on other needs: hardness, plasticity, color, special effects, etc. The investigation was conducted with alloys of yellow color (Au-Ag-Cu-Zn) and of white color (Au-Ag-Cu-Zn-Pd), according to needs and demands of market environment, where the investigation took place, and that is in The Republic of Serbia.

With age-hardening in alloys of noble metals, especially in alloys of noble metals with components that crystallize with f.c.c. lattice in certain conditions of previous treatment, as well as temperature and period of ageing, a thermodynamic stable state of alloy appears, and also a phenomena of hardness and strength of product.

The examination of structure of the product, as well as of changes inside the structure of material itself is performed by different mechanic and metallographic methods. One of better methods of overview of changes inside the material structure is examination by scanning electronic microscope – SEM. Beside the structure of material, chemical analysis obtained using the device – detector for energy dispersive spectroscopy – EDS, by which distribution and disposition of elements in one chrismal grain can be determined.

Key words: gold alloy 585/1000, age-hardening, SEM, EDS, microstructure, distribution of elements, crystallization;

SKENIRAJUĆA ELEKTRONSKA MIKROSKOPIJA LEGURE ZLATA Au585Ag90Cu264Zn61 ZA PROIZVODNJU NAKITA

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Izvod

Legure zlata „585“, koje se koriste za proizvodnju nakita mogu da budu tro-, četvo-, peto-, i više komponentne legure. Sve ove legure su u osnovi Au-Ag-Cu, sa konstantnom količinom zlata, shodno važećim zakonskim propisima, od 58,5 mas.%Au, dok ostale komponente zavise od drugih potreba: čvrstoća, plastičnost, boja, specijalni efekti, itd. Ispitivanje je rađeno sa legurama žute boje (Au-Ag-Cu-Zn) i bele boje (Au-Ag-Cu-Zn-Pd), shodno potrebama i zahtevima tržišta u okruženju, gde je i rađeno ispitivanje, tj. u Republici Srbiji. Starenjem kod legura plemenitih metala, posebno kod legura plemenitih metala sa komponentama koje kristališu po površ. c.k. rešetki, u određenim uslovima predhodne obrade, kao i temperature i vremena starenja, dolazi do termodinamički stabilnog stanja legure, a pritom i do pojave fenomena povećanja tvrdoće i čvrstoće proizvoda.

Ispitivanje strukture proizvoda, kao i promene nastale unutar strukture samog materijala obavlja se različitim mehaničkim i metalografskim metodama. Jedna od najboljih metoda sagledavanja promena u strukturi materijala je ispitivanje skenirajućim elektronskim mikroskopom.

U radu će biti prikazani rezultati ispitivanja legure Au585Ag90Cu264Zn61 – „žuto zlato“, skenirajućim elektronskim mikroskopom - SEM. Pored strukture materijala, biće prikazana i hemijska mikroanaliza, dobijena pomoću uređaja – detektora za energo disperzionu spektroskopiju – EDS, pomoću koje se može odrediti distribucija i raspored elementa u jednom kristalnom zrnu.

Ključne reči: legura zlata 585/1000, otvrdnjavanje starenjem, SEM, EDS, mikrostruktura, distribucija elemenata, kristalizacija;

CHARACTERISTICS AND QUALITY OF COAL IN DEPOSIT "DELIĆI AND PELJAVE – TOBUT", NEAR UGLJEVIK

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Abstract

The first intensive exploration within the exploration area "Delici and Peljave – Tobut" in the northeastern part of the Republic of Srpska, took place in the period 1957 – 1963. Although the results of performed drilling was positive, they were not sufficient for making reliable conclusions on coal bearing deposit, and therefore additional detailed geological explorations were done in 2011 and 2012. During these exploration works, several methods of research and testing were applied, and short presentation of research results is in this paper.

Key words: coal, deposit, geological exploration, mineral reserves, quality.

KARAKTERISTIKE I KVALITET UGLJA NA LEŽIŠTU "DELIĆI I PELJAVE-TOBUT" KOD UGLJEVIKA

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Izvod

Prva intenzivna istraživanja u okviru istražnog prostora "Delići i Peljave - Tobut" u sjeveroistočnom dijelu Republike Srpske (BiH), odvijala su se u periodu 1957-1963. godine. Iako su rezultati izvedenih istraživanja pozitivni, oni nisu bili dovoljni za donošenje pouzdanih zaključaka o ugljonosnom basenu, te su tokom 2011. i 2012. godine izvedena dopunska detaljna geološka istraživanja. U okviru ovih istraživanja primijenjeno je više metoda istraživanja i ispitivanja, a sažet prikaz rezultata je dat u ovom radu.

Ključne reči: ugalj, ležište uglja, geološka istraživanja, Ugljevik.

PHISICO-CHEMICAL CHARACTERIZATION OF THE HYBRID IRON/CARBON NANOMATERIALS

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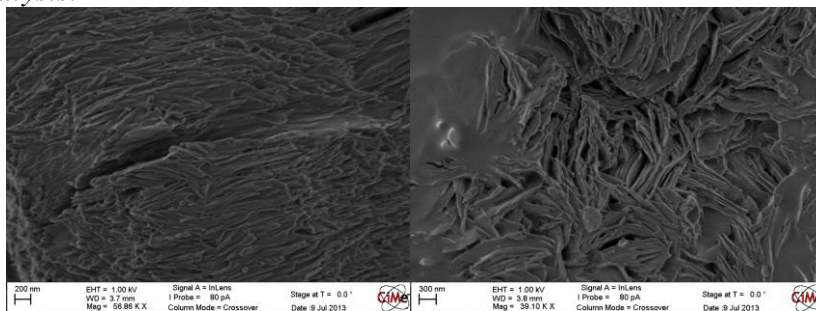
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Abstract

Iron nanoparticles were synthesized by microemulsion method using surfactants as occluding agents under basic conditions. A unique approach is used where a source of iron was the digested sludge from the iron mine dump site-the accumulation lake. Methylene blue was added in surplus to replace the surfactant molecules after the nanomaterials' microemulsion synthesis and it was strongly adsorbed. In the after-treatments at elevated temperatures, methylene blue was transformed into a nanocarbon material within the pores of the iron nanomaterial forming a hybrid nanomaterial. Phisico-chemical characterisation of this material was performed by means of electron microscopy, x-ray diffractometry and x-ray photoelectron spectroscopy in order to distinguish the high quality material with potential in industrial adsorption and catalysis.



Picture 1. Scanning electron microscope images of the samples obtained

COMPUTATIONALLY GENERATED MOLECULAR DESCRIPTORS AS PROXIES FOR THE MODELLING OF THE MATERIALS AND THEIR ENVIRONMENTAL IMPACT

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Abstract

For the prediction of material's properties and of interaction of molecules with the surroundings, one needs to know their properties. Usually, the molecular properties are revealed through experimental measurements. It can be a tedious, time-consuming, and costly work. On the other hand, computational chemistry readily generates a huge number of data which can provide various molecular descriptors. These can be various observable properties (bond lengths and angles, dipole moments, etc...), but also the unobservable properties (partial atomic charges, electronegativity, various latent variables).

There is an urgent need to develop accurate and economical screening tools that predict potential toxicity and environmental burden of various chemicals. Equally important is the design of safer alternatives.

Molecular modelling methods offer one of several complementary approaches to evaluate the risk to human health and the environment as a result of exposure to environmental chemicals. These tools can streamline the hazard assessment process by simulating possible modes of action and providing virtual screening tools that can help prioritize bioassay requirements. Tailoring these strategies to the particular challenges presented by environmental chemical interactions make them even more effective.

Advances in the fields of computational chemistry and molecular toxicology in recent decades allow the development of predictive models that inform the design of molecules with reduced potential to be toxic to humans or to the environment.

As an example we present the novel methodology for the computational evaluation of pK_a values of various organic bases, based on calculation of partial atomic charges by a simple semiempirical QM method.

RAČUNARSKI GENERISANI MOLEKULSKI DESKRIPTORI KAO PROXI-JI ZA MODELOVANJE MATERIJALA I NJIHOVOG UTICAJA NA OKOLINU

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Izvod

Za predviđanje osobina materijala i njihove interakcije sa okolinom, treba poznavati njihove osobine. Obično se osobine molekula otkrivaju eksperimentalnim merenjima. To može biti mukotrpan dugotrajan i skup posao. Sa druge strane, računarska hemija lako daje veliki broj podataka koji mogu da obezbede različite deskriptore molekula. To mogu biti razne merljive veličine (dužine i uglovi veza, dipolni momenti, i sl...), ali i nemerljive osobine (parcijalna atomska naelektrisanja, elektronegativnost, razne latentne varijable).

Postoji velika potreba za razvijanjem pouzdanih i ekonomičnih načina za skrining kojima se predskazuje potencijalna otrovnost opterećenje životne okoline raznim hemikalijama. Jednako važan je i dizajn bezbednijih alternativa. Metode molekulskog modelovanja nude jedan od nekoliko komplementarnih pristupa za procenu rizikaza zdravlje ljudi i životne sredine kao posledicu izlaganja hemikalijama u okolišu. Ovim postupcima se može neprekidno vršiti procena opasnosti simuliranjem mogućih načina delovanja, a obezbeđivanje virtualnog skrininga može pomoći u određivanju prioriteta kod bio-eseja. Ukrajanjem ovih strategija u određene izazove interakcija hemikalija i životne sredine može iste učiniti efikasnijima.

Napredak u računarskoj hemiji i molekulskoj toksikologiji postignut poslednjih decenija dozvoljava razvoj prediktivnih modelaza racionalni dizajn molekula sa umanjenim potencijalom otrovnosti za ljude i životnu sredinu.

Kao primer predstavljamo novu metodologiju za računarsko procenjivanje pK_a vrednosti različitih organskih baza na osnovu izračunavanja parcijalnih atomskih naelektrisanja prostim semiempirijskim QM metodom.

THE INFLUENCE OF THE METAL/CERAMIC INTERFACE TYPE ON THE WETTING PROCESS

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Abstract

Metal/ceramic joining enables the use of the favourable characteristics of both materials in many technological applications, but liquid metal/ceramic substrate wetting process still demands answers. Wetting process is the initial and very important step in metal/ceramic joining. Besides the composition of the solid and liquid components, the wetting properties of the liquid metal/ceramic interface are affected by surface pattern of the ceramic substrate.

The change in the type of liquid metal/ceramic substrate interface, due to new reaction layer formation, in the same liquid metal/ceramic system, leads to a significant change in wetting – so that macroscopically measured contact angles can be lowered up to one third of its original value. It is found that the liquid metal spreads over a specific structure of the substrate, reflecting its 3-dimensional shape on wetting properties at nano level.

Taking into account the crystal lattice, substrate planes orientation and grain boundary grooves phenomena, the wetting process is defined here to contribute the better understanding of the complex interface wetting phenomena and predicting the wetting modification at nano-scale.

Key words: *wetting, metal/ceramic interface, grain boundary groove*

UTICAJ VRSTE GRANIČNE POVRŠINE METAL/KERAMIKA NA PROCES KVAŠENJA

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Izvod

Spoj metala i keramike omogućava korišćenje poželjnih osobina oba ova materijala u mnogim primenjenim tehnološkim rešenjima, ali proces kvašenja keramičke podloge tečnim metalom još uvek zahteva neke odgovore. Kvašenje je prvi i veoma važan korak kod spajanja metala i keramike. Osim sastava čvrste i tečne komponente, na osobine kvašljivosti granične površine tečni metal/keramika utiče površinska tekstura keramičke podloge.

Promena vrste granične površine tečni metal/keramika, usled nastanka novog reakcionog sloja, u istom sistemu tečni metal/keramika može dovesti do značajnih promena kvašljivosti, tako da se makroskopski izmeren ugao kvašenja može smanjiti na trećinu svoje prvobitne vrednosti. Utvrđeno je da se tečni metal razliva po površini podloge, pri čemu se njena trodimenzionalna strukutra odražava na kvašljivost na nano nivou.

Uzimajući u obzir strukturu kristalne rešetke, orijentaciju ravni i usekline na granicama zrna, ovde je kvašljivost definisana tako da doprinese boljem shvatanju složenih fenomena na graničnoj površini i predviđanju modifikacija kvašljivosti na nano nivou.

Ključne reči: kvašenje, međupovršina metal/keramika, usekline na granici zrna

EFFECTS OF WINDING ANGLES ON MECHANICAL PROPERTIES OF FILAMENT WOUND PIPES

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Abstract

The aim of this study is to investigate the mechanical properties of continuous glass fiber reinforced composite tubes produced by filament winding technique with three different winding angles. With help of split-disk tests hoop tensile properties of selected specimens were determined, where reliable results were obtained with low standard deviations. It was observed that bigger winding angle lead to higher hoop tensile properties of filament-wound tubular samples. Also, the effect of reinforcement direction on the mechanical performances of these composites has been presented. Fiber fracture and fiber-matrix debonding is observed to be the dominant failure mechanisms by samples winded with bigger winding angles, whereas delamination in addition to these mechanisms is detected by samples with smaller winding angles. From received results it is concluded that, mechanical properties of composite specimens are depended from winding angles in filament winding technology. With help of conducted SEM analysis good merger between glass fibers and the epoxy matrix was seen, but cracks within plies and broken fiber were noticed, due to the high fiber branching.

Key words: filament winding, NOL ring test, composite pipes.

DETERMINATION OF FLEXURAL PROPERTIES OF HYBRID COMPOSITE PARTS

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Abstract

The aim of this work was to determine the flexural properties of hybrid composites parts cut from trapezoidal core made of carbon/glass fibers impregnated with epoxy resin with help of play lay-up and filament winding technology. Values for stress, strain and module of elasticity were calculated using the three point bending test. The tests were performed according to American Society for Testing and Materials (ASTM) standards. GFRP laminates exhibit progressive failure consisting of fiber failure, debonding, and delamination.

Further, the paper investigates the content of voids inside the structure and the interface fiber/epoxy resin using scanning electron microscope.

The paper presents the procedures involved in the laminate design, fabrication, experiments and analysis of composite part for deck.

Key words: *hybrid composites, three point bending test, tensile test.*

TREATMENT OF SPENT VANADIUM BASED CATALYSTS

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Abstract

During the production processes of surfactants in convertors with V_2O_5 based catalysts the sulfur-three-oxide is obtained by oxidation of sulfur-di-oxide. The aim of this study was to obtain ferrovandium from such spent catalysts.

In this work a two-stage leaching hydrometallurgical process of the catalyst by solution of sulfuric acid and pyrometallurgical process are used for obtaining the ferrovandium. For the characterization of spent catalysts, intermediate products and final products method of atomic absorption spectrophotometry and method of X ray diffraction analysis are used.

Vanadium is the most commonly used alloying element in the production of structural and tool steels. As alloying element in the steel, it is introduced in the form of ferrovandium. For the experiments, the spent catalysts with vanadium contents up to 5% on the basis of SiO_2 with content of 55-75% are used. The paper presents the effect of particle size, temperature and leaching time on the degree of leaching of vanadium. Maximal leaching yield of vanadium up to 95% was obtained with the following parameters: particle size - $75\mu m$, temperature - $80\text{ }^\circ C$ and the time - 180 min. Leaching was done in the two stages. The precipitate was rinsed after two-stage leaching and safely deposited without any environmental hazard. Vanadium from the solution was precipitated in the form of calcium-vanadate. After drying and annealing, it was used for alloying the steel in order to obtain ferrovandium. The content of vanadium in ferro-alloy was about 10%. Thus obtained ferroalloy is suitable for alloying in the production of structural and tool steels.

Key words: *spent catalysts, leaching, alloying, ferrovandium*

PRERADA ISTROŠENIH KATALIZATORA NA BAZI VANADIJUMA

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Izvod

U procesu proizvodnje površinski aktivnih materija koristi se sumpor-trioksid koji se dobija oksidacijom sumpor-dioksida u konvertorima sa katalizatorom na bazi V_2O_5 . Cilj istraživanja ovog rada bio je dobijanje ferovanadijuma iz ovakvih istrošenih katalizatora.

Pri radu je korišćen hidrometalurški postupak dvostepenog luženja katalizatora rastvorom sumporne kiseline i pirometalurški postupak dobijanja ferovanadijuma. Za karakterizaciju istrošenih katalizatora, međuprodukata i gotovog proizvoda korišćena je metoda atomske apsorpcione spektrofotometrije i metoda rendgeno difrakcione analize.

Vanadijum se najčešće koristi kao legirajući element u proizvodnji konstrukcionih i alatnih čelika. Kao legirajući element unosi se u čelik kao ferovanadijum. Za eksperimente su korišćeni istrošeni katalizatori sa sadržajem vanadijuma do 5%, pri čemu osnovu katalizatora čini SiO_2 sa sadržajem 55-75%. U radu su prikazani rezultati uticaja veličine čestice, temperature i vremena luženja na stepen izluženja vanadijuma. Pri veličini čestica $-75\mu m$, temperaturi $80^\circ C$ i vremenu 180 min dobijeno je maksimalno izluženje vanadijuma od 95%. Luženje je vršeno u dva stupnja. Talog je nakon dvostepenog luženja ispiran, bezbedno deponovan i ne predstavlja problem za okolinu. Vanadijum je iz rastvora taložen u obliku kalcijum-vanadata. Nakon sušenja i žarenja, isti je korišćen za legiranje čelika radi dobijanja ferovanadijuma. Sadržaj vanadijuma u fero-leguri je iznosio oko 10%. Ovako dobijena ferolegura je pogodna za legiranje u proizvodnji konstrukcionih i alatnih čelika.

Ključne reči: *istrošeni katalizatori, luženje, legiranje, fero-vanadijum*