PLENARY SESSION

THE FOURTH PHASE OF WATER, BEYOND SOLID, LIQUID, AND VAPOR

G. H. Pollack
University of Washington, Seattle, USA

School children learn that water has three phases, solid, liquid and vapor. But we have recently uncovered a fourth phase. This phase occurs next to water-loving (hydrophilic) surfaces. It is surprisingly extensive, projecting out from the surface by up to millions of molecular layers. And, its features differ substantially from those of bulk water. Of particular significance is the observation that this fourth phase is charged, and, the water just beyond is oppositely charged, creating a battery that can produce current. We found that light charges this battery. Thus, water can receive and process electromagnetic energy drawn from the environment in much the same way as plants. Absorbed electromagnetic (light) energy can then be exploited for performing work, including electrical and mechanical work. Recent experiments confirm the reality of such energy conversion. The energy-conversion framework implied above seems rich with implication. Not only does it provide an understanding of how water processes solar and other energies, but also it may provide a foundation for simpler understanding natural phenomena ranging from weather and green energy all the way to biological issues such as the origin of life, transport, and osmosis. The lecture will present evidence for the presence of this novel phase of water, and will consider the potentially broad implications of this phase for physics, chemistry and biology, as well as some practical applications for engineering and health. The new book dealing with this subject is available, from <www.ebnerandsons.com>

Keywords: fourth phase of water, solid, liquid, vapor.

MATERIALS ISSUES FOR CURRENT AND ADVANCED NUCLEAR REACTOR DESIGNS

P. Hosemann, J. Vujić
University of California, Berkeley, USA

In all engineering applications, design and materials together determine the functionality and reliability of a device. This is particularly important in nuclear systems where the materials are pushed to their limits and phenomena not present anywhere else occur. In nuclear systems there is a combination of high temperature

and pressure, stress, and high radiation environment. Majority of commercial LWRs today are licensed for 40 years of operation, but many of them undergo lifetime extension to 60 or possibly 80 years. Materials degradation has always been a significant issue. However, due to the lifetime plant extension, finding materials that could sustain prolonged exposure to these extreme conditions has become a significant problem. In addition to the materials challenges in current LWRs, advanced reactors usually deal with even more difficult issues due to their operational requirements. Unusual heat transport media, such as liquid metals, liquid salts or other types of coolants, lead to a whole new set of material challenges. While corrosion has been the main issue, much higher operating temperatures create additional difficulties. In this paper, we present an overview of materials issues for current and advanced nuclear reactor designs.

Keywords: nuclear systems, extreme environments, liquid metals, liquid salts, corrosion, radiation effects.

A THREE-PHASE INDUCTIVE SENSOR FOR IN VIVO MEASUREMENT OF ELECTRICAL ANISOTROPY OF BIOLOGICAL TISSUES

Y. Kosugi[1], T. Takemae[2], H. Takeshima[2], A. Kudo[3], K. Kojima[3], N. Tanaka[3]

[1] Tokyo Institute of Technology, Japan
[2] Shizuoka University Japan
[3]Tokyo Medical and Dental University, Japan

Biological tissue will have anisotropy in electrical conductivity, due to the orientation of muscular fibers or neural axons as well as the distribution of large size blood vessels. Thus, the in vivo measurement of electrical conductivity anisotropy can be used to detect deep-seated vessels in large organs such as the liver during surgeries. For the diagnostic applications, decrease of anisotropy may indicate the existence cancer in anisotropic tissues such as the white matter of the brain or the mammary gland in the breast. In this paper, we will introduce a new triphase induction method to drive rotating high-frequency electrical current in the tissue for the measurement of electrical conductivity anisotropy. In the measurement, three electromagnets are symmetrically placed on the tissue surface and driven by high-frequency alternative currents of 50kHz, modulated with 1kHz 3-phase signals. In the center area of the three magnets, magnetic fields are superimposed to produce a rotating induction current. This current produces electrical potentials among circularly arranged electrodes to be used to find the conductivity in each direction determined by the electrode pares. To find the horizontal and vertical signal components, the measured potentials are amplified by a 2ch lock-in amplifier phase-locked with the 1kHz reference signal. The superimposed current in the tissue was typically 45 micro Amperes when we applied 150 micro Tesla of

magnetic field. We showed the validity of our method by conducting in vitro measurements with respect to artificially formed anisotropic materials and preliminary in vivo measurements on the pig's liver. Comparing to diffusion tensor MRI method, our anisotropy sensor is compact and advantageous to be used during surgical operations because our method des not require strong magnetic field that may disturb on-going surgical operations.

Keywords: conductivity anisotropy, biological tissue, three-phase magnetic field, induction current.

GRAPHENE, A MIRACLE MATERIAL

B. Genorio[1], S. Pejovnik[2]

[1] Centre of Excellence for Low-Carbon Technologies, Slovenia

[2] University of Ljubljana, Faculty of Chemistry and Chemical Technology, Slovenia

Graphene-based nanomaterials have attracted wide attention due to their extraordinary electrical, mechanical, and thermal properties. Combination of these extraordinary properties makes graphene one of the "hottest" materials and motivates the scientific community to explore many potential future applications such as energy-related devices, ultracapacitors, Li-ion batteries, solar cells and catalysis. However, two important issues need to be solved to realize the use of graphene and its derivatives in those future applications, a) bulk preparation of high quality graphene-based nanomaterials and b) functionalization and incorporation of these materials into devices. To tackle these two issues we have thoroughly investigated graphene nanoribbons – a high aspect ratio graphene subclass material. We have developed the "one-pot" method that can yield bulk quantities of easily processable final graphene materials. Pristine graphene materials are very difficult to disperse, thus functionalization is generally required. The method enables selective functionalization with various functional groups without disturbing electrical properties of the graphene sheets. The greatest results were obtained with commercially available carbon nanotubes (CNTs) which were converted into a graphene nanoribbon stacks (GNRs). The wet chemistry approach that was developed, yielded polymer-edge functionalized graphene nanoribbon stacks (P-GNRs)1 or alkyl-edge functionalized graphene nanoribbon stacks (A-GNRs).2 Edge alkylation greatly improved solubility in organic solvents without sacrifizing single ribbon conductivity. Although single ribbons are conductive and soluble materials, the bulk conductivity might differ considerably as a percolation network must be formed. To enhance bulk conductivity of A-GNRs, iron was intercalated between graphene nanoribbon stacks.3 Iron intercalated and alkyl-edge-functionalized graphene nanoribbon stacks (Fe@A-GNRs) were then aligned in a magnetic field. We have shown that the aligned dispersions enhanced electrical percolation at given concentrations in

previously non-conductive solvents. Further, this method is a cost-effective and potentially industrially scalable.

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Keywords: graphene, nanomaterials, applications.

X-RAY ANALYSIS AND APPLICATIONS OF SELF-ASSEMBLED NANOPARTICLES LAYERS

P. Siffalovic[1] S. Luby[1], K. Vegso[1], E. Majkova[1], M. Jergel[1], M. Benkovicova[1], K. Nygard[2], O. Konovalov[2], J. Perlich[3], S. V Roth[3], H. Y. Lee[4], C. S. Ku[4]

[1] Institute of Physics SAS, Slovakia
[2] ESRF, BP 220, France
[3] HASYLAB, Germany
[4] NSRRC

In my talk I will review the latest advances in X-ray characterization of self-assembled nanoparticle films. I will illustrate how the small-angle X-ray scattering (SAXS) can be employed to study two- and three-dimensional self-assembly phenomena. Using the intense synchrotron radiation we can follow formation of nanoparticle assemblies in real-time and space. As an example I will show the formation and collapse of two-dimensional nanoparticle Langmuir film at air/water interface. I will also present the real-time analysis of tree-dimensional nanoparticle crystallization directly during the solvent evaporation. The simultaneous analysis of small- and wide-angle X-ray scattering gives an attractive opportunity to track in-situ the surface and bulk chemical reactions along with nanoparticle re-assembly processes. In the end I will present applications of self-assembled nanoparticle films for sensing of low gas concentrations and for strain sensors.

Acknowledgements, The work was supported by project – "Competence center for new materials, advanced technologies and energetics" (ITMS 26240220073)

Keywords: nanoparticle, X-ray scattering, sensor.

CLASSICAL AND QUANTUM APPROACH TO WATER STUDY

E. Del Giudice
Centro Studi Eva Reich, Italia

Classical and quantum approach to water study.

Water has been investigated so far in the conceptual frame of Classical Physics. This approach is able to account for the properties of matter when regarded as a passive object, but is unable to provide a rationale for the properties of self-organization and self movement which are the most fundamental features of living organisms, whose main componenti s just water. Self-organization of living organisms should be a consequence of some peculiar properties of liquid water. Quantum Field Theory appears a suitable theoretical tool to solve this problem since is able to justify the emergence of long lasting coherence among the biocomponents, the spontaneous decrease of entropy with the concentration of energy on a few degrees of freedom, the emergence of a time dependent biochemical scheme where molecules don't meet at random but according to a code governed by a self trapped laser-like electromagnetic (e.m.) field. It is shown that in liquid water a hierarchical structure of nested coherences is present and moreover such structure is a fractal and could be the physical basis of psychic phenomena.

Keywords: water, quantum field theory, coherence, living matter.

ON THE MECHANICAL RESPONSE OF A PRESSURIZED FUNCTIONALLY-GRADED CYLINDER

V. A. Lubarda
Department of NanoEgineering, University of California, San Diego, USA
Montenegrin Academy of Sciences and Arts, Podgorica, Montenegro

A pressurized functionally-graded cylinder is considered made of the material whose elastic moduli vary with the radial distance according to the power-law relation. Some peculiar features of the mechanical response are noted for the incompressible functionally-graded material with the power of the radial inhomogeneity equal to two. In particular, it is shown that the maximum shear stress is constant throughout the cylinder, while the displacement changes proportional to 1/r along the radial distance. No displacement takes place at all under equal pressures applied at both boundaries.

Keywords: elasticity, functionaly-graded material, incompressibility, pressurized cylinder, radial inhomogeneity, stress.

NOVEL MEANS OF CHEMICAL NANOSYNTHESIS VIA USEFUL HARD X-RAY INDUCED CHEMISTRY

M. Pravica[1], D. Sneed[1], Q. Smith[1], L. Bai,[1] C. Park[2]

1 Department of Physics and Astronomy and High Pressure Science and Engineering Center (HiPSEC) University of Nevada, Las Vegas (UNLV)

2. Geophysical Laboratory, Carnegie Institution of Washington

Abstract: Based on the observation of synchrotron x-ray induced decomposition of various materials (e.g. $KClO_3$, NH_3BH_3, N_2H_4, and CCl_4) we are developing novel means to acatalytically initiate highly controllable chemical reactions in isolated or sealed *in situ* by using highly penetrating, highly ionizing, and highly focused x-rays. We have thus far successfully developed chemical reactions that produce H_2, O_2, N_2, Cl_2, and H_2O in a pressurized diamond anvil cell as well as inside a glass capillary subjected to ambient conditions. All x-ray initiated reactions entail little heat input and are highly controllable based upon the application of variable pressure, x-ray energy, and x-ray flux. For mixes of reactants, x-ray induced combustion can also occur. These simple to implement methods will have tremendous future applications in enabling novel routes of the chemical synthesis of nanomaterials at extreme conditions.

Keywords: x-ray, synchrotron, Paris Edinburgh Cell, x-ray induced decomposition, phase- and energy-dependent decomposition, diamond anvil cell, high pressure.

NOBEL PRIZE IN PHYSICS FOR 2012
COHERENT SUPERPOSITION OF ATOMIC LEVELS AND BOUND STATES IN PRECISION METROLOGY AND QUANTUM INFORMATICS

B. Jelenković

Institute of Physics, University of Belgrade, Serbia

Nobel Prize winners in Physics, David Wineland and Serge Haroche, each in his own way investigated the fundamental aspects of light and matter interaction. They are the winners of the most prestigious physical award "for groundbreaking experimental methods that enable measuring and manipulation of individual quantum systems". While with David's experiments, lasers enable control of the condition and the manipulation of electrically charged trapped atoms, in Serge's experiments, the approach is quite opposite, the trapped photons are modified and detected by the atoms (without destruction!). The underlying phenomenon that they both studied is quantum superposition, a non-intuitive aspect of quan-

tum mechanics according to which a quantum particle may occupy two places at the same time. In a way, the Noble Prize has been awarded to this year's winners for the realization of the miniature version of this property of quantum particles, miniature Scrhodinger's cat composed of a few photons (Serge), i.e. of a few atoms (David). The achievement accomplished by David Wineland with his collaborators is a result of extremely precise interaction of laser and ions in a trap which find their application in quantum informatics and quantum simulation. Ions in an ion trap, isolated from the influences and interference of the environment, enabled David and his group to implement the most precise and most stable atomic clocks that exist today. The realization of quantum superpositions of atomic levels and bound atomic states and states of motion due to ion motion state in a harmonic trap, will be described in the presentation, as well as the application of such states in a number of quantum logic circuits. The principles of work of the most precise atomic clock on the basis of Al ions will also be described.

Keywords: Nobel Prize, quantum superposition, quantum computers, quantum clocks.

NOVEL METHOD FOR CHARACTERIZATION OF MATTER, OPTO-MAGNETIC IMAGING FTIR SYSTEM

Đ. Koruga[1], L. Matija[1], J. Munćan[1], I. Mileusnić[1], B. Jeftić[1], I. Đuričić[1], I. Hut[1], I. Koruga[2]

[1] NanoLab, Faculty of Mechanical Engineering, University of Belgrade
[2] DIA Systems LLC, USA

Currently there are two dominant methods for characterizing matter by light, microscopy and spectroscopy. In the past, those two techniques were uncorrelated for the characterization of the same sample. Microscopy image gives structural data about matter (TEM, SEM, etc.), while spectroscopy data (UV/VIS/IR, Raman, etc.) provides for energy properties of matter. In last ten years significant progress has been achieved, (1) Processing two digital images via light microscopy, one made by diffuse perpendicular light, and other with light incident at Brewster angle, gives new method for characterization of matter (named OMI spectroscopy, opto-magnetic imaging spectroscopy) [1,2], and (2) FTIR and light microcopy are combined to provide both structural and spectroscopic data [3]. Based on experience from OMI spectroscopy, we first developed FTIR/opto image spectroscopy method (based on perpendicular light), while now we are developing FTIR/opto-magnetic image spectroscopy [4]. In this paper we present basic concepts of Opto-magnetic Imaging FTIR System and discus experimental results.

Keywords: ppto-magnetic imaging, FTIR system.

APPLICATION OF ADVANCED MATERIALS IN SOLAR POWER ENGINEERING

T. M. Pavlović

Faculty of Natural Sciences and Mathematics, University in Niš, Serbia

Physical characteristics of advanced materials that are used in photo-thermal, photo-voltaic, hybrid and high-temperature conversion of solar radiation are presented in the paper. Special attention was paid to optical and microstructural characteristics of spectrally selective absorbers for low-temperature conversion of solar radiation obtained by electrochemical dyeing of anode-oxidized aluminum. Further, physical characteristics of solar cells are described, which are made of monocrystalline, polycrystalline and amorphous silicon on glass, plastic basis and on anode oxidized aluminum and CdTe solar cells. In relation to hybrid conversion of solar radiation attention is paid to physical characteristics of aluminum as solar radiation reflector. Also, physical characteristics of reflectors and other materials used in high-temperature conversion of solar radiation are described.

Keywords: solar radiation, advanced materials, spectrally selective absorbers, solar cells.

SELECTIVE STIMULATION OF HUMAN NK CELLS PROLIFERATION BY GLYCONECTIN GLYCANS, POTENTIAL THERAPEUTIC TREATMENTS OF CANCER AND VIRAL/RETROVIRAL INFECTIONS

G. Misevic

University of Geneva and University of Brest, Switzerland

Background, Natural Killer (NK) cells are part of the innate immune defense system with the function to eradicate cancer and viral/retroviral infected cells. Selective stimulation of NK cells proliferation should be the first essential step to produce sufficient number of cells targeting selective elimination of the particular type of unwanted transformed and/or infected cells. The nature of molecules responsible for selective stimulation of proliferation of NK cells and particularly of distinct NK cell subsets, if such exist, is not completely established. Consequently tumor specific therapy using targeted NK route cannot be valuably achieved yet. Aims of the presented study were, 1) To find a new class of molecules which can induce selective proliferation of different subsets of NK cell populations in humans. 2) To widen and complement therapeutic methods for treating cancer and viral/retroviral infections using NK cells as the "cellular magic bullet".

Results:

1) Five classes of glyconectins and glyconectin fucosylated acidic glycans were isolated by chromatography and electrophoresis from sponges, sea urchins, humans and rodents. These glyconectins and their glycans were partially characterized and sequenced using battery of monoclonal antibodies, NMR and MS.

2) Ex vivo stimulation of human NK cells proliferation by glyconectins and glyconectin glycans was tested using peripheral blood mononuclear cells (PBMC) cultured in supplemented homologues serum for 1-3 weeks and measured by FACS analyses using antibodies markers for cell identification, CD3, TCR αβ, TCR γδ, CD4, CD8 - T cells, CD 16, CD56 - NK cells, CD20 - B cell, CD 14 monocytes. Treatment of PBMC cultures with these compounds resulted in selective stimulation of proliferation of distinct NK cell subsets from naturally occurring level of 1-5% to 30-80%. Untreated controls remained at level of 1-5 %. No significant stimulation of B or T cells was observed. NK cells of all humans tested, from a variety of ethnic and racial groups could be significantly stimulated.

3) Ex vivo co-cultures of human tumor cells with human NK cells showed massive and continuous killing of target tumor cells during a five weeks period.

4) In vivo studies using C-57 black mice were performed with syngenic B-16 melanoma cells. Mice treated with glyconectins and/or glyconectin glycans exhibited a 20% delay in the time of appearance and 50% reduction in melanoma growth, a 12% increase in the total time of survival ($p = 0.0044$), and complete inhibition of metastasis when compared to control untreated mice. NK cells number increased two fold after glyconectin glycans injection and correlated with anti-tumorogenic effect, however, in vivo mechanisms remain unknown.

Conclusion, In vitro results with human NK cells and in vivo mice experiments suggested that tumor-selective subsets of human NK cells, obtained from in vitro selective stimulation of proliferation by the particular type of glyconectin glycans, may ha.

Key words: selective stimulation, human cells, therapeutic treatments of cancer.

XYLITOL AND OTHER POLYOLS IN THE PREVNTION AND TRETMENT OF DENTAL CARIES

J. Vojinović

University of Banja Luka, Faculty of Medicine – Department of Dentistry, B&H

Complex sugars, polyalcohols, divided into alditole (real sugar alcohol) and cyclic polyols. According to the number of oxygen atoms alditoli can be hexitols (sorbitol), pentitols (xylitol) and tetritols (eritrol). They are showing a series chemical and biochemical characteristics that influence their interaction with microor-

ganisms and enamel surface versus glucose, fructose and their di and polymers (sucrose, starch, etc.). They have also inhibitory effect on acid production processes and promote remineralization of tooth enamel. Most experimental and clinical examination was performed with xylitol and sorbitol, especially concerning scientifically proven prevention effects. Xylitol is a natural sugar isolated even in the 19th century from the birch tree. It is also part of another hard trees, some cereals (oats, etc.), and different fruits and vegetables. Sweetness is the same as white sugar (sucrose), contains only 9 calories per teaspoon, but can (albeit minimally) that raises the level of glucose in the blood. It occurs as a natural intermediate in the intracellular processing of glucose in some animals and man. Xylitol affects cryogenic bacteria in terms of inhibition of the glycolytic process, mutual aggregation and bonding to the tooth pellicle, which prevents the formation and maturation of dental plaque. This may be reflected on the prevention of periodontal disease, and there is also evidence of the successful counteracting of the streptococcal infection of the middle ear. Several mechanisms described that can stimulate remineralization of enamel, which will be presented in more detail in the paper. Clinical and epidemiological studies from 70\'s of the last century confirmed significant cariesinhibiting effects both in children and pregnant women. Extensive studies conducted in Finland and Marshal Islands suggest that early treatment of xylitol significantly improve health of baby teeth in later ages. The application of xylitol in the form of syrup had proven effect on reducing the risk of developing aggressive forms of ECC. Therefore, the use of xylitol has been introduced in the regular protocols for prevention and treatment of early caries in children and high-risk populations compensating hazardous of usage of highly concentrated fluorides. In recent years are examining the effect of new carriers such as xylitol teeth wipes, pacifiers as xylitol reservoirs. Other alditols have not a significant number of studies to back up their effectiveness. Eritrol shows promising results.

Keywords: xylitol, polyols, prevention of dental caries.

ORAL PRESENTATIONS

ANALYSIS OF THE PRODUCTION OF ELECTRIC ENERGY FROM GRID CONNECTED PHOTOVOLTAIC SYSTEM AT TECHNICAL UNIVERSITY OF GABROVO

P. Tsankov, D. Markova, S. Platikanov

Technical University of Gabrovo, Faculty of Electrical Engineering and Electronics, Bulgaria

The paper presents the analysis of the production of electric energy from 10 kWp grid connected photovoltaic system at Technical University of Gabrovo. The photovoltaic system is connected to low voltage electricity grid and consists of three subsystems. The first and second subsystems with single installed power of 3.42 kWp are identical, each containing 12 polycrystalline silicon PV modules. The third subsystem with power of 3.22 kWp is built from a field of 100 amorphous silicon PV modules. Measurement of electrical energy generated by PV system is done with three-phase four-quadrant digital electricity meter. It measures active and reactive power exchanged in both directions between the grid and photovoltaic system. Three single-phase energy meters measure separately the energy produced by each of the three subsystems. Meters are connected through specialized communication devices to the PC. Remote monitoring and reporting of the energy meters is realized, which records produced electric energy by time tariffs – daily, peak and night. Tabular and graphical visualization and analysis of results for several years of operation of the photovoltaic system are shown.

Keywords: analysis, production, grid, photovoltaic system.

THE ADSORPTION OF AG-NP ONTO CELLULOSE INFLUENCED BY PLASMA AND DIFFERENT GAS USED FOR DYEING AND AG-NP SYNTHESIS

M. Gorjanc[1], M. Mozetič[2], F. Kovač[3], M. Gorenšek[1]

[1] University of Ljubljana, Faculty of Natural Sciences and Engineering, Slovenia
[2] Jozef Stefan Institute, Slovenia
[3] University of Ljubljana, Faculty of Chemistry and Chemical Technology, Slovenia

For a research low-pressure inductively coupled plasma, using water vapor as process gas, was used for a treatment of cellulose to increase the adhesion of synthetized silver nanoparticles (Ag-NP). Bleached and mercerized cotton fabric was used as the representative cellulose material. The synthesis of Ag-NP took under gaseous con-

ditions, using N2 and Ar. Additionally vat dyeing of the untreated and plasma treated Ag-NP functionalized cotton was performed under air, N2 and Ar. The amount of adsorbed An-NP was determined using inductively coupled plasma mass spectroscopy (ICP-MS). The influence of all treatments on color change of cotton fabric was studied using Datacolor Spectrophotometer. The results show which of the conditions is the most appropriate for a higher Ag-NP adhesion onto cellulose and the importance of plasma treatment and used gas for Ag-NP synthesis and dyeing.

Keywords: plasma, silver nanoparticles, adhesion, dyeing.

INFLUENCE OF COOLING RATE AND ALLOYING ELEMENTS ON THE MICROSTRUCTURE OF THE Al-Mn-BASED ALLOY

B. Markoli[1], K. Delijić[2], N. Štrekelj[1], I. Naglič[1]

[1] Faculty of Natural Sciences and Engineering, University of Ljubljana
[2] Faculty of Metallurgy and Technology, University of Montenegro

Aluminum based alloys can contain a lot of different phases, mostly crystalline intermetallics, but also quasicrystalline (QC) ones. These QC phases can be used as a strengthening phases in these alloys. A series of Al-Mn alloys were produced by melting and chill casting into round molds of diameters of 2, 4, 6, 10 and 15 mm. This allowed us to establish the influence of the cooling rate in the first place and after that we studied also the influence of chemical composition on the formation, fraction and morphology of phases in synthesized alloys. The influence of alloying elements was studied through additions of B, Be, C, Ca, Cu, Fe, Mg, Si, Sr and Ti. Elements were added individually or as combination of two or more. Only a handful of chemical compositions and casting diameters were selected for this presentation. For our analyses LM (light microscopy), SEM (scanning electron microscopy) and EDS (energy-dispersive x-ray spectroscopy) were used. For determining the volume fraction of QC phases computer software was used. Cooling rates were estimated by heat calculations and measurement of DAS (dendrite arm spacing). It was found that at cooling rates between 500 and 1350 K•s-1 the preferred phase formed in alloy system Al-Mn-Cu-Be was an icosahedral QC phase or iQC. Icosahedral QC phase formed as the primary phase and in some cases also in the form of the quasicrystalline eutectic (αAl + iQC). The presence of the primary iQC was in other alloy systems confirmed by morphology of these phases. Due to characteristic symmetry of these QC phases, morphology which develops in the process of growth also retain (represent) this characteristic symmetry. Microstructures of all alloys revealed, that iQC appeared more often at higher cooling rates. In the case of cooling rates lower than needed for the formation of iQC, the competitive, so-called approximants appeared, such as the H-phase. Our results also suggest that the cooling rate, necessary for formation of iQC phase, depends on the alloying elements present in the alloy and their quantity. Morphology of iQC phase depends on

cooling rate and also on alloying elements. Morphology changes from polygonal into heavily branched dendritic form. With the distance from the edge of the samples and decreasing cooling rate the dendrites grow in size. The primary branches were thicker and the secondary branches appeared as well.

Keywords: Al-Mn alloys, cooling rate, chemical composition, quasicrystals.

NATURAL CRUSHED STONE AS AGGREGATE FOR ULTRA HIGH HARDNESS CEMENT CONCRETES

M. Kekanović, N. Đurić
Technical Institute in Bijeljina, B&H

Due to fierce competition and the new trends of construction using concrete, the cement industry has started offering high class cements (62,5; 72,5; 82,5) in the world market. Such cements enable the production of concretes of ultra high hardness ranging from 100 to 250 MPa. The production of these concretes, apart from high class cement, requires the stone aggregate of at least 30% higher hardness compared to the given hardness of concrete. A technological solution for this type of concrete will be jointly sought by the cement industry, construction industry and mineral materials exploitation industry. The production of these crushed aggregates that will find the application in the production of ultra high hardness concretes will open up new markets for construction of safer buildings, especially in seismically active areas. This paper gives an overview of laboratory tests on the samples of andesite and black marble, as an initial stage of research. Later stages will include bigger number of these rocks from various deposit sites, with a special emphasis on the deposit sites in the areas of former Yugoslavia. The reserves of rock aggregate of compressive strength from 150 to 300 MPa are expected to be located in these areas, opening up a possibility for production of ultra high hardness concretes.

Keywords: concretes, hardness, cement; stone, aggregate, construction.

MARKING OF PRODUCTS OF STRUCTURAL STEEL WITH COATINGS

L. Lazov, N. Angelov
Technical University of Gabrovo, Bulgaria

Two ways of marking are examined, by removing layer and by melting the layer and substrate. Experiments were performed with two types of lasers (in the visible $\lambda 1 = 578$ nm and near infrared $\lambda 2 = 1, 06$ μm) areas. The change of contrast in dependence from two technology parameters - power density and speed of marking were analyzed. The physical mechanism for marking to both methods was discussed. The

intervals of power density and speed of marking are certain in order to obtaining optimum contrast.

Keywords: laser marking, structural steel, coating, fiber laser, CuBr laser.

APPLICATION OF LOW TEMPERATURE ALUMINIZING ON HOT WORK TOOL STEELS

D. Ješić
Institute Tribotehnika, Rijeka, Croatia

During die-casting of aluminium components, tool parts are exposed to a complex combination of different wear mechanisms, such as thermal fatigue, erosion and reactive soldering of the die surfaces. As a result, this causes damage and severely reduces the durability of tools, thus increasing tools maintenance costs. For increased resistance to reaction soldering, different methods of thermo-mechanical surface modification techniques (such as nitriding or vanadising) or different processes of coatings may be applied. In this paper, the possibility of using low-temperature, low-potential aluminizing with subsequent oxidation of aluminized hot work tool steel surface has been explored. In this case, formation of stable and compact aluminium oxide (Al2O3) layer is what prevents direct contact of molten metal with the base die alloy, making it resistant (to some extent) to reaction soldering.

Keywords: aluminizing, reactive soldeing, erosion, die-casting.

FULLERENE THIN FILMS CHARACTERIZATION BY SPIN MAGNETOMETER

I. Đuričić, L. Matija, I. Mileusnić, J. Munćan, A. Debeljković, Lj. Petrov, Đ. Koruga
NanoLab, Faculty of Mechanical Engineering, Serbia

Is carbon a magnetic material? According to textbook data the answer to that question is a definite no. This answer is based on well-known data that carbon atom is diamagnetic element with magnetic susceptibility χ=- 5 ×10-7 emu/g. Graphite susceptibility parallel to the planes is about equal to the free atom, while in the c-axis direction is χ= - 30 ×10-6 emu/g. Diamond, as bulk structure of carbon atoms, is also a diamagnetic material with χ= - 4.9 ×10-7 emu/g. Nevertheless carbon nanomaterials such as C60 has magnetic susceptibility of χ= -3.5 ×10-7 emu/g, C70 has χ= - 5.9 ×10-7 emu/g. while nanotube is in a range from χ= -1.6 ×10-5 to χ= -2.2 ×10-5 emu/g, depends on magnetic field applying and temperature. All these data indicate that carbon materials are not magnetic. However, it is time to reconsider this dogma, because recently experiments have strongly indicated that, in certain forms, carbon can show not

only paramagnetic, but also ferromagnetic characteristics. To investigate these phenomena we use spin magnetometer to measure remanent magnetism of fullerene thin films, with accuracy of ± 3pT.

Keywords: fullerene, remanent magnetisation, spin magnetometer.

MRI-COMPATIBLE MANIPULATOR FOR SURGICAL INTERVENTIONS – PRELIMINARY INVESTIGATIONS

I. Buzurovic[1], D. Debeljkovic[2], L. Matija[2], I. Koruga[3]

[1] Harvard Medical School, USA
[2] University of Belgrade, Serbia
[3] DIA Systems LLC, USA

The contemporary development of robotic systems and their application in medicine require both novel methodologies and materials. Recently, magnetic resonance imaging (MRI) has become a widely used modality for diagnostic purposes. It was proven that MRI could visualize internal structures of the body better than X-rays, without using ionizing radiation. The latest research efforts have been made to extend the usage of this modality to the real-time monitoring and guidance of surgical interventions. In this paper, the preliminary investigations have been made to analyze the feasibility of developing an MRI compatible robotic manipulator for interstitial medical interventions. Due to the strong magnetic field in the working environment, the classical approach and materials cannot be used. Notably, the robotic device needs to be made of non-conductive, non-metallic and non-magnetic materials, and it still has to maintain its integrity and desired dynamical behavior during the working regime. Moreover, the robotic device should not produce any image distortion that can affect the image quality. This study outlines the preliminary mechanical design and the list of major parts and materials for the MRI compatible robotic system for interstitial surgical interventions. The usage of the adequate actuators, such as ultrasonic and piezoelectric motors, has been analyzed. Furthermore, the extensive simulation of system dynamics and system stability characteristics over a finite time interval was performed to investigate the possible control methodologies and global dynamical features of such a system.

Keywords: magnetic resonance, robotic interventions, system dynamics, MRI compatible materials, finite time stability.

FTIR MICROSPECTROSCOPY AND OPTOMAGNETIC IMAGING SPECTROSCOPY – IMPORTANT TOOLS FOR DISCOVERING SECRETS OF WATER

J. Munćan, L. Matija, Đ. Koruga

NanoLab, Faculty of Mechanical Engineering, Serbia

The method of Opto-magnetic image spectroscopy introduced by Koruga et. al [1, 2] showed us that water has specific paramagnetic/diamagnetic properties, and that this fact is a result of complex water dynamics – constant making and breaking of water clusters [3]. This method was shown to be a valuable tool having great potential in various biomedical and other applications [4–6]. Application of this method brought to our attention some interesting properties of water in interaction with sunlight, skin water in interaction with anesthetics, water in healthy and cancerous colon tissues and other. On other hand introduction of Aquaphotomics [7], a scientific method, which gives insight into water organization through specific "water-mirror" approach, based on near infrared spectroscopy. This novel method gives possibilites to analyze water molecular vibrations in relation to other molecular vibrations and function of the whole analyzed system under various perturbations. Application of aquaphotomics allowed studing interaction of nanomaterials and water [8, 9] or some contaminants in water, which gave rise to very stable water formations [10] and opened new possibilities in explaining antioxidant properties of some nanomaterials and some underlaying processes related to hydration of biomolecules if water is contaminated, it even shed some light on homeopathy[11]. Using these two spectroscopy methods assured us that interaction of light and water is of special importance in studying water and aqueous systems that we decided to include other types of spectroscopy and image based spectroscopy methods such as FTIR microspectroscopy and hyperspectral imaging in our analysis. This presentation will show our new findings about properties of water in interaction with metals, water exposed to sun irradation and plants exposed to sun irraditation as opposed to plants in dark ambient. The findings will be related to exclusion zone water [12] and possible consequences will be disscussed.

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Keywords: spectroscopy, water, imaging.

POSTER PRESENTATIONS

SYMPOSIUM A

Science of matter, condensed matter and solid state physics

PREDICTION OF THERMAL TRANSPORT PROPERTIES OF HELICALLY COILED CARBON NANOTUBES

Z. Popović, M. Damnjanović, I. Milošević
Faculty of Physics, Serbia

Thermal conductivity is one of the most interesting physical properties of carbon nanotubes. This quantity has been extensively explored experimentally and theoretically using different approaches like, molecular dynamics simulation, Boltzmann-Peierls phonon transport equation, modified wave-vector model etc. Results of these investigations are of great interest and they show that carbon based materials, graphene and nanotubes in particular, possess high values of thermal conductivity. Thus, carbon nanotubes are good candidate for the future applications as thermal interface materials. We investigate thermal conduction of a model of helically coiled carbon nanotubes (HCCNTs), obtained by topological coordinate method and relaxed by optimization of Brenner interatomic potential. Thermal conductance of HCCNTs is calculated taking into account phonon spectra and phonon relaxation rate.

Keywords: helically coiled carbon nanotubes, thermal conduction.

STUDY OF OPERATING MODES OF STAND-ALONE PHOTOVOLTAIC SYSTEM FOR OUTDOOR LIGHTING

S. Platikanov, M. Yovchev
Technical University of Gabrovo,
Faculty of Electrical Engineering and Electronics, Bulgaria

Photovoltaic power supply of the street lighting is developing rapidly during the last years. Stand-alone photovoltaic (PV) system supplying light-emitting diode (LED) outdoor luminaires is constructed in Technical University of Gabrovo. The PV-LED system consists of PV module, accumulator, solar controller, LED lamp and system for remote visualization on operating modes. Working processes for

optimization of night operating mode of the LED luminaire are studied. Data for electric energy stored by and consumed for lighting from the accumulator are presented.

Keywords: stand-alone, photovoltaic, system, outdoor lighting.

STUDY OF THE TEMPERATURE COEFFICIENTS OF AMORPHOUS AND POLYCRYSTALLINE SILICON PHOTOVOLTAIC MODULES UNDER REAL OPERATING CONDITIONS

P. Tsankov

Technical University of Gabrovo,
Faculty of Electrical Engineering and Electronics, Bulgaria

The paper presents the results of study of the temperature coefficients of amorphous and polycrystalline silicon photovoltaic modules under real operating conditions in 10 kWp grid connected photovoltaic system at Technical University of Gabrovo, Bulgaria. The photovoltaic system consists of three subsystems. The first and second subsystems are identical, each containing 12 polycrystalline silicon PV modules type ASE-250 DG-FT/MC. The third subsystem is built from a field of 100 amorphous silicon PV modules type ASE-F 32/12. Computer based monitoring system measures and stores operational data for global solar radiation, solar radiation in the plane of PV modules, temperature of the two types PV modules, ambient temperature, current, voltage and power of the DC side of three subsystems, DC and AC energy produced by the three subsystems, etc. Computer processing and rearranging the data are carried out to separate the measurements into groups of approximately equal amounts of radiation in the plane of the modules from 100 to 1100 W/m2 with an interval 100 W/m2. Graphical representation of the power, voltage and current as a function of the temperature at same level of solar radiation for the two types of modules are given. Using linear regression functions the changes of power, voltage and current as functions of the temperature are obtained. Based on analytic functions the operating temperature coefficients of amorphous and polycrystalline photovoltaic modules are determined. An analysis of the results is carried out.

Keywords: temperature coefficients, amorphous, polycrystalline, silicon, photovoltaic modules, operating conditions.

EFFECT OF THERMAL HISTORY ON MELTING BEHAVIOR OF MELT MIXED ISOTACTIC POLYPROPYLENE/PARAFFIN/NANO SILVER COMPOSITE

M. P Molaba[1], D. D Dudić[2], A. S Luyt[1]

[1] Department of Chemistry, University of the Free State (Qwaqwa Campus), South Africa
[2] Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia

The composite containing isotactic polypropylene (iPP), paraffin (WAX) and Ag nanoparticles, with mass ratio 90/9/1 respectively, was melt mixed. The samples were obtained cooling from the melt in three different ways, slowly cooling in the press, quenching at 35 °C and 0 °C. Additionally, the samples were annealed at 110 °C for 15 min. Methods of differential scanning calorimetry and optical microscopy were used to establish effect of thermal history of the composites on their melting behavior and morphology.

Keywords: melt mixed isotactic, polypropylene,paraffin,nano silver composite.

ELECTRICAL PROPERTIES OF THERMALLY TREATED POLYETHYLENE/PARAFFIN/NANO SILVER COMPOSITES

M. P Molaba[1], D, D Dudić[2], A. S Luyt[1]

[1] Department of Chemistry, University of the Free State (Qwaqwa Campus), South Africa
[2] Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia

High density (HDPE), low density (LDPE) and linear low density (LLDPE) polyethylene were melt mixed with paraffin (WAX) and Ag nanoparticles (mass ratio 90/9/1 respectively). The neat samples were annealed for 15 min at next temperatures, 50, 65, 80 and 95 °C. Differential scanning calorimetry and optical microscopy were used to show effects of annealing on neat morphologies. DC and AC electrical measurements suggest an existence of redistribution processes of Ag nanoparticles during annealing. Depending on initial morphology, electrical ageing of the samples in DC electrical field may contribute to the redistribution of Ag particles in composite.

Keywords: polyethylene, paraffin, nano silver composites.

SILVER NANOPARTICLES WITHIN FUNCTIONALIZED HYDROGELS FOR PLASMONIC BIO(CHEMICAL) SENSORS

F. Radovanović[1], T. Tomković[2], A. Nastasović[2], Z. Jakšić[1]

[1] IHTM – Centre of Microelectronic Technologies and Single Crystals, Serbia
[2] IHTM – Centre of Microelectronic Technologies and Single Crystals, Division for Chemistry, Serbia

Plasmonics is the basis for a novel generation of adsorption-based ultra-sensitive (bio) chemical sensors. In nanoplasmonic sensors one utilizes nanocomposites typically in the form of thin films, comprising metal nanoparticles or ordered metal-dielectrics (plasmonic crystals). In this work we investigated thin functionalized hydrogel films with embedded silver nanoparticles. These films were prepared by copolymerizing glycidyl methacrylate with mono and multifunctional methacrylates using UV irradiation. The epoxy group in glycidyl methacrylate can then be converted by chemical means into a desired functionality to capture the targeted analyte. Silver nanoparticles were either photochemically generated in situ, or were introduced into hydrogels by chemical reduction. Differences in morphology and performance of these nanocomposites were investigated and will be discussed

Keywords: plasmon, sensor, hydrogel, silver, nanoparticle.

EQUILIBRIUM MODE DISTRIBUTION IN W-TYPE GLASS OPTICAL FIBERS

S. Savovic[1], A. Simovic[1], A. Djordjevich[2]

[1] Faculty of Natural Sciences and Mathematics, Serbia
[2] City University of Hong Kong, China

Power flow equation is used to calculate equilibrium mode distribution in W-type glass optical fibers. It has been shown how the coupling length for achieving the equilibrium mode distribution in W-type glass optical fibers varies with the depth and width of the intermediate layer and coupling strength for different widths of launch beam distribution. W-type optical fibers have shown effectiveness in reducing modal dispersion and bending loss.

Keywords: W-type glass optical fiber, mode coupling.

THE STUDY OF THE ENERGY EFFICIENCY OF MONOCRYSTALLINE SILICON MODULES

D. Mirjanić[1], S. Maksimović[2], D. Divnić[1]

[1] Academy of Sciences and Arts of Republic of Srpska, B&H
[2] Elektroprenos B&H Operational area of Banja Luka, B&H

This paper presents a system with eight solar panels with monocrystalline silicon and equipment for the monitoring and measurement of solar power plants, that are placed on the roof of the Academy of Sciences and Arts of the Republic of Srpska in Banja Luka. The measurement of the solar modules were carried out with UI analyzer for photovoltaic PV-KLA and Mini PV-KLA. Meteorological parameters (temperature, wind speed, humidity, intensity of solar radiation) were measured using an automatic meteorological station Davis Vantage Pro-USA. The compared results between the theoretical and experimentally obtained energy efficiency of the above mentioned panels in relation to their characteristics have been shown in this paper.

Keywords: photovoltaic, solar energy, efficiency, Monocrystalline Silicon Modules.

ELECTRIC DRIVE OF TWO-AXES TRACKING SYSTEM FOR PHOTO-VOLTAIC MODULES

S. Rachev, L. Dimitrov

Technical University of Gabrovo, Bulgaria

Paper deals with implementation of two-axes tracking system for photo-voltaic modules in order to demonstrate in education the advantages of these systems. According to the main components – the system includes electronic module for control and two DC motors for each of the axes, respectively.

Keywords: drive of two-axes tracking system, for Photo-voltaic modules.

KINETICS OF SUCROSE INVERSION IN MIXED SOLUTIONS

B. Škundrić[1], A. Gužvić[2], S. Sladojević[3], Lj. Vasiljević[4], S. Zeljković[2], M. Dragoljić[5], J. Penavin Skundrić[3]

[1] Academy of Sciences and Arts of Republic of Srpska, B&H
[2] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H
[3] University of Banja Luka, Faculty of Technology, B&H
[4] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[5] Ministry of Interior of Republic of Srpska, Crime-Technical Centre

Inversion of sucrose was the first reaction examined from the kinetic standpoint. The presence of hydrogen ions catalyzes this reaction whose course can be easily ob-

served from the change of sucrose solution optical rotation. Solvolysis of sucrose was observed as a reaction of the pseudo first rank with different concentrations of acid as a catalyst in two mixed solutions, aqueous ethanol and aqueous dimethyl sulfoxide at 298K. Constants of spontaneous reaction speed and catalytic constants were determined, Bronsted-Bjerrum equation was applied, and kinetic results were discussed in accordance with Hughes-Ingold theory of effects of solvent on the reaction speed.

Keywords: solvolysis of sucrose, solvent effect, salt effect.

LOW-TEMPERATURE ADSORPTION OF NITROGEN ON CLINOPTILOLITE

B. Škundrić[1], J. Penavin Škundrić[2], D. Lazić[3], N. Čegar[2]

[1] Academy of Sciences and Arts of Republic of Srpska, B&H
[2] University of Banja Luka, Faculty of Technology
[3] University of East Sarajevo, Faculty of Technology Zvornik, B&H

A significant characteristic of a solid adsorbent is the size of its specific surface, which includes both the outer and inner surface (referring to the surface of pores, channels and cavities of small dimensions). In addition to Langmuir equation, Dubinin-Radushkevich adsorption model was also used for examining characteristics of clinoptilolite and modified forms of clinoptilolite as adsorbents in adsorption of nitrogen from the gas phase. This relation also includes filling the pores of inner surface at the same time as creating the mono-layer. The useful information was obtained for cation-modified clinoptilolite samples on their specific surfaces and volume of sample micropores.

Keywords: clinoptilolite, adsorption of nitrogen, adsorption isotherms.

CONVERSION OF DIETHYL ETHER ON Fe(II)-MORDENITE

R. Petrovic[1], B. Škundrić[2], N. Čegar[1], J. Penavin Škundrić[1]

[1] University of Banja Luka, Faculty of Technology
[2] Academy of Sciences and Arts of Republic of Srpska, B&H

The rate of diethyl ether dehydration reaction was examined on mordenite (NaM) and Fe(II)-mordenite (Fe(II)M) as catalysts. Diethyl ether dehydration reaction was observed in a gas phase and in the temperature interval of 427 K to 653 K. Products of the reaction are ethene and water and on NaM a small quantity of butene. It was determined that the reaction is not the first order reaction, that it has an initial period and that it gets sped up in time. With the increase of temperature the initial period on NaM gradually disappears and at the temperature of 653 K the reaction becomes the first order reaction, while on Fe(II)M at all observed temperatures the initial period remains. By introducing Fe2+ ion in the mordenite structure, its catalytic activity in-

creases and the reaction is carried out at a significantly lower temperature, with the bigger rate. The increased catalytic activity of Fe(II)M is linked with the increase of the total number and also acidity of the active centers on the zeolite surface. The increase of the total number, as well as acidity of the active centers on the zeolite surface, is a consequence of the presence of Fe2+ ions in the mordenite structure.

Keywords: mordenite, dehydration, diethyl ether.

ADSORPTION OF LAURIC ACID ON ZEOLITE 13X MODIFIED BY SURFACE-ACTIVE SUBSTANCE

J. Penavin Škundrić[1], B. Škundrić[2], Z. Levi[1], Lj. Vasiljević[3], B. Vasić[4], I. Samelak[4], S. Zeljković[4], S. Sladojević[1]

[1] University of Banja Luka, Faculty of Technology, B&H
[2] Academy of Sciences and Arts of Republic of Srpska, B&H
[3] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[4] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H

The study observed adsorption of lauric acid from alcohol solution on zeolite 13X with genapol laid down on it (surface-anion-active supstance, PAM /surface-active substance/, sodium chloride – alkyl diglycol ether sulfonate). Adsorption of lauric acid on 13X zeolite and on PAM-modified 13X zeolite was observed at three temperatures. It proved that PAM-modified zeolite was characterized with some new characteristics significant for adsorption. The obtained results were explained in accordance with Langmuir, Temkin and Dubinin Astakhov adsorption model for the same system and same experimental conditions.

Keywords: lauric acid, surfactants, zeolite 13X.

LANGMUIR ADSORPTION ISOTHERM OF CRYSTAL VIOLET ON ZEOLITE 13X

J. Penavin Škundrić[1], B. Škundrić[2], S. Kečа[1], G. Latinović[1], T. Kondić[1], T. Dobrilović[1], A. Vlajnić[1], M. Marmat[1]

[1] University of Banja Luka, Faculty of Technology, B&H
[2] Academy of Sciences and Arts of Republic of Srpska, B&H

Adsorption of crystal violet on 13X zeolite was performed from the aqueous solution at three temperatures. The relation used for adsorption analysis was the one conducted by Langmuir for an idealized process occurring at a uniform surface and under the assumption that the energy of adsorbed particles is not affected by their mutual distance (there is no reaction among the particles). The results of measuring proved that the isotherms of crystal violet on zeolite 13X, according to Giles classification, came under S4 group of isotherms and that two significantly distinct "plateaus" could be reg-

istered. The first plateau, at least approximately, corresponds to filling the mono-layer of organic dye at the zeolite surface and is the result of physical adsorption, while the structure of the other plateau is much more complex. The results of adsorption studies, at least approximately, provide information on the character of active centers at the surface of adsorbates, as well as on the size of specific surface.

Keywords: adsorption of organic dyes, faujasites, adsorption isotherms.

SURFACE ACTIVE AGENT IN STRUCTURE OF NATURAL AND SYNTHETIC ALUMOSILICATE

J. Penavin Škundrić[1], Z. Levi[1], S. Sladojević[1], S. Zeljković[2], D. Bodroža[1]

[1] University of Banja Luka, Faculty of Technology, B&H

[2] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H

The study examines adsorption of ammonia, acetic acid and oleic acid on alumosilicates before and after applying surface active agents (PAM). Since chemical similarity between the adsorbate and the adsorbent is significant for adsorption, it was interesting to observe reaction of the mentioned adsorbates in contact with the natural sample of bentonite and synthetic sample of mordenite. Reaction of zeolite and bentonite primarily depends on their functional characteristics (surface electric charge, capacity of cation exchange and type of exchanged cations, swelling capacity), which are directly connected to the active centers located at the crystal lattice vertexes, at the basal planes or within the pores. The process of modification with the organic PAM results in a partial neutralization of negative electric charge, and the obtained organominerals have a bigger efficiency of adsorption of harmful components from water and air.

Keywords: adsorption, surface active agents, organominerals, mordenite, bentonite.

THERMAL STABILITY AND DAMPING PROPERTIES OF POLYURETHANE HYBRID MATERIAL BASED ON CASTOR OIL

J. Budinski Simendić[1], Z. Bjelović[1], S. Samaržija Jovanović[2], V. Aleksić[3], H. Valentova[4], K. Meszaros Szecseny[5], I. Krakovsky[4]

[1] Faculty of Technology, University of Novi Sad, Serbia

[2] Faculty of Natural Sciences and Mathematics, Kosovska Mitrovica, University of Priština

[3] Faculty of Technology, Zvornik, University of East Sarajevo, B&H

[4] Faculty of Natural Science and Mathematics, Charles University, Prague, Czech Republic

[5] Faculty of Natural Sciences and Mathematics, University of Novi Sad, Serbia

This study reports the fabrication of polyurethane materials using castor oil, diifferent diisocyanates and titanium (IV) oxide nanoparticles. Dynamic viscoelastic properties of prepared samples was studied at five frequencies at a temperature range

from -50 to 100°C. The loss tangent, tan δ, was used as a measure of the materials damping properties (dissipation of vibration energy). The glass transition temperatures were determined as a large maximum in the tan δ curves, and the temperature range with tan $\delta > 0.2$ was used to evaluate damping capacity synthesized materials. Thermal stability of prepared samples was assessed using TG-DSC measurements. The obtained results show a good guidance to select a kind of polyurethane hybrid materials for specific application

Keywords: castor oil, polyurethanes, DMA, nanocomposites.

OPTIMIZATION OF THE SYNTHESIS PARAMETERS OF NaA ZEOLITE

A. Tanasijević[1], M. Perušić[2], R. Filipović[3], M. Radić[2], D. Kešelj[2], D. Lazić[2]

[1] Faculty of Technology Zvornik, B&H
[2] University of East Sarajevo, Faculty of Technology, B&H
[3] Factory "Birač" Zvornik, B&H

Generally, zeolites possess a number of advantages over other structural materials in the production of detergents. In accordance with the purpose, there are different requirements in terms of the characteristics of these products. For this reason, the development of model synthesis is a useful tool in the production facilities where the produce more types of zeolites for various industrial applications. There is a general opinion that the obtained results may improve control, operation and management of the production process detergent zeolite. During the research it was found that the temperature affects the structure of the adsorption characteristics of zeolites. Also, time of instillation has influence to the structure and adsorption properties of zeolites as well as it is possible to obtain an optimum zeolite surface characteristics and IEK. It is appropriate by controlled process parameters produce projected characteristics of zeolites, in industrial conditions.

Keywords: optimization, process, zeolite.

REDUCTION KINTICS OF Ag-W POWDERS SYNTHESIZED BY A HOMOGENEOUS PRECIPITATION ROUTE

D. Jelić[1], S. Mentus[2], S. Zeljković[3]

[1] Faculty of Medicine, Republic of Srpska, B&H
[2] Faculty of Physical Chemistry; SANU; Serbia
[3] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H

Silver tungstate (Ag2WO4) was synthesized by homogeneous precipitation route. The obtained silver tungstate powder was characterized by SEM and X-ray diffraction methods. Its reduction was examined therogravimetrically in Ar + 25% H2

atmosphere at the following heating rates 2.5, 5, 10 and 20 °C/min. It was found that the reduction occurs through the three steps. By transforming TG data into the conversion degree parameter α, and using the isoconversional expended Friedman (F) and modified Coast-Redfern (CR) methods, the following results were obtained for activation energies of various steps, Ag2WO4 → Ag + WO3-x [EF=92.4 kJ/mol i ECR= 85.8 kJ/mol], Ag + WO3-x→WO2-x [EF=179.5 kJ/mol and ECR=181.2] and finally Ag + WO2-x→W [EF=175.9 kJ/mol i ECR= 195.6 kJ/mol]. Also the preexponetial factors were determined. The data were confirmed by using the Discrete activation energy distribution model.

Keywords: tungstates, precipitation, nonisothermal kinetics, isoconversional method.

AMMONIUM ION ADSORPTION ON NATURAL ZEOLITE TUFF AND ON FAUJASITE, DESCRIBED BY DUBININ THEORY

J. Penavin Škundrić[1], R. Petrović[1], B. Škundrić[2], Z. Levi[1], B. Vasić[3], D. Bodroža[1]

[1] University of Banja Luka, Faculty of Technology, B&H
[2] Academy of Sciences and Arts of Republic of Srpska, B&H
[3] University of Banja Luka, Faculty of Natural Science and Mathematics, B&H

Thanks to negative electrical charge and the porosity of structure, natural mineral materials (clay and zeolites) have a wide application as cation exchangers and molecular sieves. The researches conducted so far have shown high adsorption efficiency of pollutants present in contaminated waters on zeolites. By modification of their properties, adsorbents of better characteristics may be obtained. The subject of research in the paper included the adsorption characteristics of tuffs (mineral samples with high content of Klinoptilolith) from the area of the Republic of Srpska and 13X zeolite modified by genapol surfactant for the adsorption of ammonium from water environment at 293K, by using Langmuir and Dubininov theoretical approach.

Keywords: ammonium adsorption, klinoptilolith, 13X zeolite, superficially active matters.

THE COMPOSITION, STRUCTURE AND TEXTURAL CHARACTERISTICS DOMESTIC ACID ACTIVATED BENTONITE

Z. Petrović[1], P. Dugić[2], V. Aleksić[1], S. Begić[3], J. Sadadinović[3], V. Mićić[1]

[1] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[2] Refinery oil Modriča, B&H
[3] University of Tuzla, Faculty of Technology, B&H

Bentonite are aluminosilicate minerals which due to its porosity, layered structure and composition have widely application. In the production of mineral

and edible oils, bentonite as adsorbent is used in the process of refining and bleaching. Structural and textural characteristics of bentonite may be improved by different modification procedures. The aim of this study was to investigate the composition, structure and texture characteristics of domestic bentonite in place Gerzovo, before and after activation with sulfuric acid. These characteristics were investigated by analytical methods, X-ray diffraction (XRD) and the method of low-temperature nitrogen adsorption (BET). Characteristics of acid-activated bentonite were compared with the characteristics of commercial active clay. The obtained results showed that the activation of bentonite with sulfuric acid leads to a significant improvement in the structural and textural characteristics. Using these results it can be assumed that this bentonite will have good adsorption characteristics and can serve as an alternative in comparision with imported commercial adsorbents based on aluminosilicate.

Keywords: bentonite, acid activation, composition, structural and textural characteristics.

INFLUENCE OF TEMPERATURE ON THE ZEOLITE A TO ABSORPTION DIBUTYL PHTHALATE

Lj. Vasiljević[1], B. Škundrić[2], D. Lazić[1], M. Gligorić[1], V. Mićić[1]

[1] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[2] Academy of Sciences and Arts of Republic of Srpska, B&H

In order to determine the effect of temperature on the absorption properties of particles and zeolite A, is accompanied by changes in absorption dibutyl phthalate (DBF), the share of crystalline phase, specific surface area, particle size (DS50%) and scanning electron microscopy (SEM) synthesized of zeolite powders. Samples were prepared from raw materials (sodium aluminate and sodium silicate) with a temperature of 90°C, which were crystallized at temperatures of 70, 75, 80, 85 and 90°C. The particle size of the final products are similar in most of the studied systems at all temperatures of crystallization, which is in line with the principles of autocatalytic nucleation and the \"memory effect\" of gel. Increasing the surface area of crystals with increasing crystallization temperature, it was observed in all systems studied (3.25 to 35.31 m2/g). It was observed that as the crystallization temperature increases absorption of dibutyl phthalate (0.90 to 1.20 cm3/g), but at the same time the share of zeolite A decreases in the same samples, as confirmed by SEM analysis.

Keywords: zeolite A, absorption of dibutyl phthalate, temperature.

CHEMICAL-MINEROLOGICAL CHARACTERISATION OF BAUXITES FROM DIFFERENT DEPOSITS

G. Ostojić[1], D. Lazić[2], B. Škundrić[3], J. Penavin Škundrić[2], S. Sladojević[4], D. Kešelj[2], D. Blagojević[4]

[1] Factory "Birač"AD Zvornik, B&H
[2] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[3] Academy of Sciences and Arts of Republic of Srpska, B&H
[4] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H

From the position of the chemical and mineralogical composition, bauxites are complex multi-component materials. In this work characterization several bauxite deposits, Brazil, Milici, Citluk and Kosovo is performed. Chemical characteristics are determined by a combination of several analytical methods, gravimetric, potentiometric titration, atomic absorption spectroscopy (AAS) and UV-VIS spectrophotometry. For determination of mineralogical compositions, X-ray structural analysis (XRD) and thermal analysis methods (DTA, TG, DTG) were used. Additions to the chemical and structural characterization are giving results from scanning electron microscopy (SEM) with EDX analysis. Obtained information were used to assess the quality of investigated bauxites in terms of their application in the alumina production.

Keywords: bauxite, characterization of bauxite, X-ray diffraction, thermal analysis, AA spectrophotometry, UV-VIS spectrophotometry.

APPLICATION OF NANOMATERIALS IN THE FUTURE

D. Mirjanić

Academy of Sciences and Arts of Republic of Srpska, B&H

Interest in nanomaterials has increased enormously in the last years, due to to the fact that nanomaterials, biomaterials, eco-materials, materials for ICT and renewable energy sources has been recognized by European Union, USA, Japan, Chine, India as a holders of future industry development. They are widely used in many areas, energy, transport, constructions&buildings, medicine&pharma, ICT, textile and sport sectors, consumer goods, packacking. For example, Framework Programme 7th, as well as future Horizon, defines nanosciences, nanotechnology, materials and new production technologies (NMP) as one of the most priority research topic that have been or shall be financed inside European Union. The strategic orientation of development of nanomaterials should be reached by the main goal to improve and strengthen scientific resources and to make them an integral part of European, rather worlds, research, that shall finally resulted in new products

and technology to the benefit of societies. Besides that, policy of development in the field of nanomaterials and nanotechnologies has important role to encourage industry, specially medium and small enterprises, to become a part of industry research. It is excpected that development and application of nanotechnology improve the competetiveness and quality of life in the future. Therefore, the examples of impacts of new, advanced nanotechnology materials in different fields, will be shown in this paper.

Keywords: nanomaterials, nanotechnolgy, nano-enabled products.

COMPARATIVE ANALYSIS OF DIELECTRIC AND STRUCTURAL CHARACTERISTICS OF THE SAMPLES BASED ON POLYETHYLENETEREPHTALATE

D. Cerović, J. Dojčilović, I. Petronijević, D. Popović
University of Belgrade, Faculty of Physics, Serbia

Widespread use of polymeric materials from items of daily use to the electrical engineering, electronics and medical applications causes the need for their detailed examination at various outer influences. Dielectric spectroscopy allows tracking changes in the structure of polymers at various external influences. In this work we analyzed β relaxation recorded in polymer woven structures and meshes based on polyethyleneterephtalate. Through the obtain results, comperative analysis of dielectric parameters and structural characteristics of the samples was done.

Keywords: dielectric spectroscopy, polymeric woven structure, polyethyleneterephtalate.

USING PERMUTATION ENTROPY FOR AFM DATA ANALYSIS

D. Malivuk[1], S. Nježić[2], S. Lekić[1], E. Škrgić[3], Z. Rajilić[1]
[1] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H
[2] University of Banja Luka, Faculty of Medicine, B&H
[3] Gymnasium, Federation of B&H

We consider driven oscillations of the AFM cantilever in computational experiments. Complexity of motion is described by permutation entropy H(3), we compute for data obtained during scanning. Our aim is to find out the optimal values of the scanning velocity, initial position of the tip, and the driving force amplitude and frequency for the imaging a nanostructure, in a specific dynamic mode of the AFM operation.

Keywords: AFM, permutation entropy, nanostructure.

NEW DIELECTRIC NANOFILMS FOR OPTICAL APPLICATION

B. Škipina,[1] S. Pelemiš,[2] S. Vučenović[3]

[1]University of Banja Luka, Faculty of Technology, Republic of Srpska, B&H
[2]University of East Sarajevo, Faculty of Technology, Republic of Srpska, B&H
[3]University of Banja Luka, Faculty of Science, Republic of Srpska, B&H

In this work we present a various procedure for fabricating dielectric nanofilms, and discust wich of them have greatest adventage. We foud out that sol-gel technique is desirable option due to low equipment cost and a simple preparation high quality nanofilms. In order to optain optical properties and film thickness we present various techniques such are Ellipsometry, Dielectric spectroscopy, X-Ray reflectivity, SEM micrograph, Atomic Forse Microscopy and so on. Dielectric nanofilms are suitable for several optical and electro applications and there are good candidate for dielectric mirrors.

Keywords: dielectric nanofilm, optical properties, sol-gel technique, ellipsometry, dielectric spectroscopy.

MODE COUPLING IN LARGE CORE STEP-INDEX SILICA OPTICAL FIBERS

S. Savovic[1], A. Djordjevich[2], A. Simovic[1], B. Drljaca[3], A. Janicijevic[4]

[1] Faculty of Natural Sciences and Mathematics, University of Kragujevac, Serbia
[2] City University of Hong Kong, China
[3] Faculty of Natural Sciences and Mathematics, University of Pristina, Serbia
[4] Faculty of Technology and Metallurgy, University of Belgrade, Serbia

Using the power flow equation, investigated in this article is the state of mode coupling in large core step-index silica optical fibers. Results show the coupling length at which the equilibrium mode distribution is achieved and the length of the fiber required for achieving the steady-state mode distribution. Since large core silica optical fibers are used at short distances (usually at lengths of up to ten meters), the light they transmit is at the stage of coupling that is far from the equilibrium and steady-state mode distributions.

Keywords: silica optical fibers, mode coupling.

EVALUATION OF MATERIAL DISPERSION IN GLASS OPTICAL FIBRES

M. S. Kovačević[1], A. Djordjevich[2], A. Janićijević[3]

[1] Faculty of Natural Sciences and Mathematics, Department of Physics, Serbia
[2] City University of Hong Kong, China
[3] Faculty of Technology and Metallurgy, University of Belgrade, Serbia

An estimation of material dispersion is presented in some typos of glass fibers. Using broadly applicable principles for group velocity, a simple expression is derived for material dispersion that includes the third derivative of the index of refraction with respect to the wavelength, d^3n/dl^3. It is shown that for fused silica and fluoride based fibers, even d^2n/dl^2, the material dispersion still occurs caused by effects of the third derivative of refractive index with respect to the wavelength.

Keywords: material dispersion, fused silica, fluoride glass, optical fiber.

INTERACTION OF RADON PROGENY WITH SOLID TRACK DETECTORS AND ROOM GLASS SURFACES IN A FUNCTION OF RETROSPECTIVE DOSIMETRY

A. Janićijević[1], M. Srećković[2], M. Davidović[3]

[1] University of Belgrade, Faculty of Technology and Metallurgy Serbia
[2] University of Belgrade, Faculty of Electrical Engineering, Serbia
[3] Institute Gosa, Serbia

This paper reviews some aspects of solid-state nuclear track detectors (SSNTDs) and their applikation in the radon in residential buildings. Several geometrical models for the track growth given in the literature are described and compared. Applications of SSNTDs for radon and progeny measurements are discussed. Particular attention has been given to methods of long term passive measurements of radon progeny with SSNTDs. Long-term passive methods based on track detectors can give radon concentrations in dwellings for periods usually from 1 month to 1 year. The obtained radon concentrations prezent the contemporary values. However, to assess the total radon exposure of a person, such measurements might not be satisfactory. For examle, a person could heve taken some actions that have significantly changed the radon levels, such as home renovation. Radon measurements performed at a particular time might not be able to represent the exposure of a person in the past. However , reconstruction of irradiation history for an individual is usualy very dificult, if not impossible. To solve this problem, the so-called retrospective radon measurement was pro-

posed, wich are based on measurements of implanted radon progeny α – emitters (210Po) in glas surfaces or volumens of some detectors.

Keywords: solid-state nuclear track detectors (SSNTD), Nuclear tracks, LR 115, Retrospective radon dosimetry.

SOLVING SOME PROBLEMS IN FIELD OF HEAT CAPACITY BY USING OF NEW CORRELATION

B. Pejović, M. Perušić, V. Mićić, G. Tadić, S. Pavlović

University of East Sarajevo, Faculty of Technology in Zvornik, B&H

In the thermodynamics practice, both for semi – ideal and for real gases, the dependence of the middle specific heat capacity of temperature, is usually determined by experimentally as linear function, mainly, for the relatively short temperature range. In addition to this, for the purpose of various analyzes, both in theory and in practice, is necessary to know the dependence of the real specific heat capacity of temperature also. Due to this, in this paper was the definition of the middle specific heat capacity for certain, selected a suitable temperature range, by using differential and integral calculus, analytical dependence is derived from the real specific heat capacity and the middle specific heat capacity. The relation which is given in the differential form for defined temperature range, allows direct troubleshooting without special restriction on its use. By using the resulting dependence, the general model is derived in the form of polynomial of arbitrary degree by depending of temperature, which is faster and more convenient for practical application of the current model, which has not a general character. Also the existing model is not the most appropriate because it solves the problem given indirectly, considering it requires analytical dependence of the amount of exchanged heat. Correlation which has derived in this paper, can be effectively applied to obtain of depending on the amount of exchanged heat between the temperature and also for the observed temperature range. Derived analytical relation was used to obtain another relation to the amount of exchanged heat which have a more complex form of the existing two, which can be applied for various thermodynamic analysis. Verification of the present model and the possibility of its application is given to a few characteristic examples of semi – ideal and real gas and CO2 gas as semi – ideal based on the experimental results, the diatomic semi – ideal gases starting from Einstein relation, water as real fluid starting from the Dieteritium relation, and at the and characteristic group of real gases. Therefore, it is seen wider temperature range.

Keywords: specific heat capacity, semi – ideal and real gas, the temperature of gas, differential and integral calculus, analytic correlation.

USE OF CFD ANALYSIS TO ACHIEVE ENERGY EFFICIENT DATA CENTER

S. Stavreva[1], M. Serafimov[2], I. Andreevski[1], C. Dimitrieska[1]
[1] Technical Faculty, Macedonia
[2] Faculty of Mechanical Engineering, Macedonia

Several parameters impacting airflow and the achievement of defined work conditions of datacom equipment have been analyzed in an existing data center. First, the necessary measurements were carried out in order to establish the features of the center, as well to use them to create the basis of the numerical model of the data center, via the program package PHOENISC. Simulating the numerical model of the data center, the temperature field, pressure field and velocities within the data center were being achieved. The results obtained by the simulations were compared with the measurements done, showing quite a high concurrence, and thereby confirming the model and becoming available for further data center analyses. The model includes several factors influencing the airflow. Analyzing the obtained results from the model simulations, hints were obtained how to implement changes in the data center, in order to comply with the recommended work conditions for the datacom equipment, and at the same time to achieve reduced energy costs.

Keywords: data center, datacom equipment, airflow, field, numerical model, simulation, heat load.

EFFECTS OF TIME AND AGITATION SPEED ON THE EFFICIENCY OF ACIDIC WASTE WATER NEUTRALIZATION PROCESS USING LIME SLUDGE

S. Begić[1], Z. Petrović[2], V. Mičić[2], A. Avdić[1], S. Tuzlak[1]
[1] University of Tuzla, Faculty of Technology, B&H
[2] University of East Sarajevo, Faculty of Technology, B&H

Lime sludge generated as a byproduct of industrial processes of water softening represent significant economic and ecological burden, if they dispose as waste material in lagoons, or directly discharge into natural recipients. Alkaline character and a high content of calcium carbonate in sludges opens the possibility for their consideration as a secondary raw material for various purposes. Results of previous feasibility studies indicate the effectiveness of the application of lime sludge for neutralization of industrial wastewater. In this paper, the influence of process parameters (time and mixing speed) on the efficiency of acidic water neu-

tralization, using three different lime sludge, was studied. The results obtained indicate that the mixing time has a greater effect on the rate of change of pH of acidic water in comparison with the speed of agitation. The research results represent a prelude to solving environmental problems generated by the process industries (acidic industrial waste water, lime sludge).

Keywords: lime sludge, neutralization, acidic waste water, time and agitation speed.

VITAMINES B1 AND C AS COPPER CORROSION INHIBITORS IN HYDROCHLORIC ACID

M. Pavlović[1], M Tomić[1], R. Fuch Godec[2]

[1] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[2] University of Maribor, Faculty of Chemistry and Chemical Engineering, Maribor, Slovenia

In this work the protection of copper by processing the corrosion environment using vitamins B1 and C in a 4% solution of hydrochloric acid as a corrosion inhibitor was investigated. Vitamin C (ascorbic acid) and vitamin B1 (thiamine) were used in concentrations of 0.5 g/dm3, 1g/dm3, 1.5 g/dm3, 2g/dm3 and 3g/dm3. Inhibitiory effect of vitamins B1 and C in the corrosion process of copper were investigated by gravimetric and electrochemical methods, electrochemical impedance spectroscopy (EIS), cyclic voltammetry and polarization curves. It was found that the degree of protection of vitamin C in 4% HCl solution varies both with the concentration of inhibitor and time. The highest level of protection in 4% HCl solution was achieved at the concentration of vitamin C of 1.5 g/dm3 in period of about 4h (z = 71,6233%). Studies suggest that vitamin B1 as a corrosion inhibitor in 4% HCl solution shows weaker protective properties than vitamin C. Vitamin B1 shows the best protective properties for all concentrations for a period of 6h (z = 30,3905 to 41,4837). These results do not recommend vitamin B1 as a possible inhibitor in HCl solutions.

Keywords: copper, corrosion, inhibitor, corrosion indicators, protective factor z.

INFLUENCE OF PARTICLE MORPHOLOGY ON ELECTRICAL CONDUCTIVITY IN LIGNOCELLULOSE AND COPPER POWDER COMPOSITES

V. Bojanić[1], M. Pavlović[2], M. Pavlović[3]

[1] University of Banja Luka, Faculty of Agriculture B&H
[2] Institute for Chemistry, Technology and Metallurgy, Center for Materials and Metallurgy, University of Belgrade, Serbia
[3] University of East Sarajevo, Faculty of Technology Zvornik, B&H

The electrical conductivity of the system based on lignocellulose (LC) biopolymer matrix filled with electrodeposited copper powder has been studied. Galvanostatically produced copper powder, having highly porous, highly dendritic particles with high values of specific area was used as filler. Volume fraction of the electrodeposited copper powder was varied from 2.0 – 29.8 vol%. Analysis of the most significant properties of prepared composites and its components included measurements of electrical conductivity, impedance spectroscopy (IS) behavior and structural analysis. The significant increase of the electrical conductivity can be observed as the copper powder content reaches the percolation threshold (PT). It was shown that PT depends on both particle shape and type of spatial distribution. IS measurements have shown that particle morphology having pronounced grain boundaries has great effect on appearance of electric conductive layers. The packaging effect and more pronounced interpartical contact with copper powder particles lead to "movement" of PT, which for the particles.

Keywords: electrolytic copper powder, impedance spectroscopy, lignocellulose, composite.

HEAT TRANSFER IN THE MELT-SPINNING PROCESS

B. Karpe[1], B. Kosec[1], M. Gojić[2], M. Soković[3], M. Bizjak[1]

[1] University of Ljubljana, Faculty of Natural Sciences and Engineering, Slovenia
[2] University of Zagreb, Faculty of Metallurgy, Croatia
[3] University of Ljubljana, Faculty of Mechanical Engineering, Slovenia

In the case of continuous casting of metal ribbons with the melt-spinning process on the industrial scale, larger quantity of melt could lead to a slow excessive warming of the chilling wheel, which would further lead to solidification of a ribbon at non-uniform conditions and increased wearing of the wheel. Primary goal of our work was to determine to what extent the release of heat during contact of the melt/ribbon on the circumferential surface of the chilling wheel affect its surface temperature rise, and inversely how much elevated temperature of the chill wheel surface affects on metal ribbon cooling rate and its solidification velocity. On the basis of developed mathematical model, a computer program was made and used for analyses of heat transfer in the

melt-spinning process. The calculations show that contact resistance between metal melt and chilling wheel has a great influence on melt/ribbon cooling and chill wheel heating rate, and must not be neglected in numerical calculations, even if its value is very low. In the case of continuous casting, significant long term surface temperature increase may take place, if the wheel is not internally cooled. But inner cooling is effective only if wheel casing thickness is properly chosen. New method for determining contact resistance through variable heat transfer coefficient is introduced which takes into account physical properties of the casting material, process parameters and contact time/length between metal melt/ribbon and substrate and enables cooling rate prediction before the experiment execution. In the case of continuous casting, heat balance of the melt-spinning process is calculated and influence of the chill wheel cooling mode on cooling rate of metallic ribbon is analyzed. In the frame of the practical part of our investigation work the ribbons from the aluminium and copper, and following copper base shape memory alloys, CuAl12Ni4, CuAl13Ni4, CuAl14Ni4 and CuAl15Ni4 were produced.

Keywords: melt-spining process, heat transfer, continuous casting, cooling, shape memory alloys.

MICROSTRUCTURAL ANALYSIS OF NITRONIC 60 STAINLESS STEEL AFTER TEMPERING AT 750 ˚C

M. Gojić[1], A. Gigović Gekić[2], S. Kožuh[1], M. Soković[3], B. Kosec[4], L. Kosec[4]

[1] University of Zagreb, Faculty of Metallurgy Sisak, Croatia
[2] University of Zenica, Faculty for Metallurgy and Materials, B&H
[3] University of Ljubljana, Faculty of Mechanical Engineering
[4] University of Ljubljana, Faculty of Natural Sciences and Engineering

It is known that Nitronic 60 stainless steel has good mechanical properties, corrosion resistance and resistance to adhesive wear. It this work results of microstructural analysis of Nitronic stainless steel are shown. This steel is a highly austenitic stainless steel for applications at elevated temperatures. In this investigation the Nitronic 60 steel composed from 16-18 % chromium, 8-9 % nickel, 7-9 % manganese, 3.5-4.5 % silicon and 0.08-0.18 nitrogen (wt. %). Before microstructural testing the samples are solution annealed (1020 oC/1 hour, followed cooling in water) and tempered at temperature of 750 °C in duration from 24 to 72 hours. Microstructural analysis was carried out by means of optical microscopy (OM), scanning electron microscopy (SEM) and energy dispersive spectrometry (EDS) mehods. Microstructural analysis showed that the secundary particles are observed, expecially sigma phase. It was found that the formation of sigma phase is on grain boundaries and into grains. Content of chromium in sigma phase is in range from 21.2 to 56.9 % (wt. %).

Keywords: Nitronic 60 stainless steel, microstuctural analysis, tempering, sigma phase.

KINETIC INVESTIGATION OF THE MOLYBDENUM SULFIDE OXIDATION PROCESS

N. Štrbac[1], D. Živković[1], A. Mitovski[1], V. Andrić[2], M. Sokić[3], Lj. Balanović[1]

[1] Technical Faculty of Bor, Serbia
[2] Vinca Institute of Nuclear Sciences, Serbia
[3] ITNMS, Serbia

Molybdenum is widely used in modern technology in the pure metal form and especially in the form of various alloys, primarily as alloy steel (molybdenum steel). It is used in the various parts in the automotive and aerospace industry. As a pure metal, molybdenum is used for development of anti-cathode and cathode X-ray tube, various parts of high-vacuum amplifiers, etc. Molybdenum can also be used as structural material in nuclear power reactors. In nature, molybdenum can be found in about twenty different minerals. The most important of them, which is the main carrier of molybdenum in the ores that are being processed nowadays, is molybdenite. Molybdenite rarely occurs alone as a valuable mineral, but more often with wolframite and scheelite in wolframite based ores, or as a companion of copper sulphide ores. MoS2 is an excellent lubricant that can be used in a wide temperature range. Molybdenum sulfides, and other its compounds thereof, are characterized by high catalytic activity and selectivity, where MoS2 represents a semiconductor material with excellent photostability and low toxicity. Molybdenum ore processing technology is based on the molybdenite characteristics. Oxide ores in total production haven't got important economical significance. Technological procedures for the sulphide ore processing are based on the following fundamental stages, ore crushing, flotation and obtaining of the molybdenum concentrate, processing and obtaining molybdenum oxide from molybdenum sulphide concentrates and the pure metal molybdenum production and its components. In this paper, the results of experimental investigations of the molybdenum sulfide oxidation with oxygen from the air are presented. Kinetic studies of the oxidation were carried out using isothermal kinetics in the temperature range 300-700ºC. DTA, XRD, and EDXRF spectroscopy confirmed the mechanism of the process, which is determined by the previous thermodynamic and kinetic analysis.

Keywords: molybdenum sulphide, oxidation, kinetics and mechanism.

SUSTAINABLE PRODUCTION OF LACTIC ACID ON DISTILLERY STILLAGE

V. Mićić[1], Lj. Mojović[2], Z. Petrović[1], B. Pejović[1], A. Đukić Vuković[3]
[1] University of East Sarajevo, Faculty of Technology, B&H
[2] University of Belgrade, Technology and Metallurgy Faculty, Serbia
[3] University of Belgrade, Faculty of Technology, Serbia

Lactic acid is a versatile chemical with a wide range of applications in chemical, food, pharmaceutical, cosmetic and polymer industries. Emerging technologies for sustainable production of lactic acid include utilization of by-products and wastes as substrates. In this study, lactic acid production on an industrial stillage from the bioethanol production on waste bread (from plant Reahem, Srbobran, Serbia) with different lactic acid bacteria was studied. The highest lactic acid yield was achieved by Lactobacillus rhamnosus ATCC 7469. Under the selected conditions (t=41 °C, 5% of inoculum and 55 g l-1 of initial sugar concentration) a lactic acid yield of 92.3 %, volumetric productivity of 1.49 g l-1 h-1 and almost complete utilization of the present sugar was noticed until the 34 h of fermentation. Further improvement of the productivity was attained in fed-batch fermentation. In this way, the lactic acid concentration and productivity were increased for 47.6 % and 17.2 %, respectively, while high viable cell number above 109 CFU ml-1 was reached at the end of the fermentation. It is important to note that the production was achieved on the stillage without supplementation with mineral or nitrogen sources. The spent fermentation media with biomass could be utilized as animal feed and thus further enhance the economy of the process.

Keywords: distillery stillage, lactic acid fermentation, lactobacillus rhamnosus.

SYNTHESIS AND CHARACTERISATION OF POLYMER THIN FILMS AND THEIR NANOCOMPOSITES

A. Miletić, N. Martić, Đ. Tripković, I. Ristić, B. Pilić, N. Vukić, S. Cakić
University of Novi Sad, Faculty of Technology, Serbia

In the past decade, polymeric materials have generated a great interest in academy and industrial research due to its potential to solve a wide variety of industry problem in nanotechnology. Recently greater focus has been placed upon polymer thin films which become increasingly important in many technological applications. Nanomodifications allow fine tuning of mechanical and morphological properties of polymer thin films. In this work was investigated the influence of silica nanofiller on the morphology and mechanical properties of polymer thin films based on modified styrene-butadiene copolymer. The addition of filler dramatically influences the morpholo-

gy of films, making them highly porous. Addition of nanoparticles improves the mechanical properties of films, increasing the tensile strength by 40% and elongation by 65%, although the nanocomposites films have porous structures.

Keywords: elastomers, polymer thin films, nanocomposite materials.

STRUCTURE AND MORPHOLOGY OF MACROPOROUS POLYMER-BASED COMPOSITE MATERIAL

Z. Vuković[1], T. Novaković[1], A. Nastasović[2], M. Mitrić[3], M. Čomor[3], M. Marinović Cincović[3]

[1] University of Belgrade, NU IHTM-Center for Catalysis and Chemical Engineering, Serbia
[2]University of Belgrade, NU IHTM-Center of Chemistry,Department for Polymers, Serbia
[3] University of Belgrade, Vinca Institute of Nuclear Sciences, Serbia

Composite of macroporous monolithic copolymers of glycidyl methacrylate and ethylene glycol dimethacrylate [abbreviated PGME] and boehmite sol (in content of 5, 25 and 50 mass% with respect to monomer mixture) were synthesized by in situ radical copolymerization in a cast of cylindrical shape. Composite samples were caracterized by XRD, SEM and FTIR techniques. Observation revealed that the obtained composites completely crystallize in amorphous structure, without the presence of the crystalline boehmite phase. Also, there is slight change in the size and morphology composite particles compared to starting copolymers. Polymeric material with such structural and morphologycal characteristics could be applied as a suitable support in solid phase reactors.

Keywords: composite, boehmite sol, structure, morphology.

STRUCTURAL, THERMAL AND MORPHOLOGICAL CHARACTERIZATION OF FUNCTIONALIZED MACROPOROUS COPOLYMERS

B. Ekmeščić[1], M. Pergal[1], I. Stefanović[1], D. Maksin[2], S. Ostojić[3], Z. Vuković[1], A. Nastasović[1]

[1] IHTM, Serbia
[2] Vinca Institute of Nuclear Sciences, Serbia
[3] Institute of General and Physical Chemistry, Serbia

Macroporous copolymers of glycidyl methacrylate and ethylene glycol dimethacrylate were functionalized with hexamethylene diamine, 1,3-bis (3-aminopropyl) tetramethyldisiloxane and α,ω-diamino propyl poly(dimethylsiloxane). The samples were characterized by Fourier transform infrared spectroscopy (ATR-FTIR), mercury porosimetry, scanning electron microscopy (SEM) with energy

dispersive X-ray analysis (EDX), thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). Fuctionalization significantly alters porosity parameters, mechanism of thermal degradation and increases thermal stability. The sample functionalized with disiloxane exhibited better thermal stability comparing with the initial and other functionalized samples. Acknowledgements. This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Projects III43009, ON 172062 and III45001).

Keywords: functionalization, hexamethylene diamine, siloxanes, thermal degradation.

THE INFLUENCE OF SILICA NANOPARTICLES ON PRINTABILITY OF POLYLACTIDE FILMS

N. Vukić[1], I. Ristić[1], T. Radusin[2], V. Simendić[1], B. Simendić[3]

[1] Faculty of Technology Novi Sad, Serbia
[2] Institute of Food Technology, Serbia
[3] High Technical School, Serbia

Over the past decade polylactide (PLA) based materials, due to its biodegradability and biorenewability, has been the subject of numerous researches in order to solve the problem of solid wastes, and to reduce the consumption of fossil raw materials and emission of carbon dioxide into the atmosphere. Polylactide is a thermoplastic aliphatic polyester made from renewable resources like corn, sugar beets or rice. Physical and mechanical properties of PLA films can be improved by incorporation of only small amounts of nanoparticles into polymer matrix. The aim of this work was to determine the influence of addition of silica nanoparticles on the printing properties of PLA films, and to research the influence of printing on mechanical properties of samples. Pure PLA and PLA films with different nanosilica content were prepared on laboratory extruder. A lab printability tester was used to print on polylactide films. Ink transfer on film substrates was observed and surface energy of biodegradable films was measured. It was found that the low content of silica nanoparticles improved a printing properties of PLA films.

Keywords: polylactide, printing properties, mechanical properties.

TEXTURAL AND THERMAL PROPERTIES OF MACROPOROUS POLYMER-BASED COMPOSITE MATERIAL

T. Novaković[1], A. Nastasović[2], Z. Vuković[1], M. Čomor[3], M. Marinović Cincović[3]

[1] University of Belgrade, NU IHTM-Department of Catalysis and Chemical Engineering, Serbia

[2] University of Belgrade, NU IHTM-Deaprtment of Chemistry and Polymers, Serbia

[3] Institute of Nuclear Sciences Vinča, University of Belgrade, Serbia

In this work composite of macroporous monolithic copolymers of glycidyl methacrylate and ethylene glycol dimethacrylate [abbreviated PGME] and boehmite (in content of 5, 25 and 50 mass% with respect to monomer mixture) were synthesized by in situ radical copolymerization in a cast of cylindrical shape. The influence of boehmite content in the reaction mixture on the textural properties and thermostability of composite samples was investigated. Results of Hg porosymetry and thermal analysys showed increasing of specific surface area (SBET), pore volume (Vp) and pore diameter (d) and improvement in the thermal stabylity of obtained composite samples. Polymeric material with such characteristics could be applied in different separation techniques, like capillary chromatography, electrochromatography, ion exchange chromatography, etc.

Keywords: composite, boehmite sol, porous structure, thermostability.

BIOCOMPATIBILITY EVALUATION OF Cu-Al-Ni SHAPE MEMORY ALLOYS

V. Lazić[1], R. Rudolf[2], M. Čolić[3], A. Todorović[1], I. Đorđević[1], N. Romčević[4], B. Trifković[1], N. Milošević[1]

[1] Faculty of Dentistry, Belgrade, Department of Protetics in Stomatology, Serbia

[2] Faculty of Mechanical Engineering Univerzitet u Mariboru, Slovenia

[3] Institute for Research in Medicine, Military Academy, Serbia

[4] Institute of Physics, University of Belgrade, Serbia

Shape memory alloys belong to a group of smart, functional materials with a unique ability to "remember" the shape that they had before the pseudo-elastic deformation. Cu-Al-Ni shape memory alloys are today the only available high-temperature SMA, showing good resistance to a functional load, but their biomedical application is still limited. Using melt spinning technique, thin Cu-Al-Ni ribbons can be produced directly from the melt. The aim of our study was to evaluate the biocompatibility of Cu-Al-Ni alloys in vitro. Thin Cu-Al-Ni ribbons were produced by the technique of melt spinning and used for the tests. The base alloy for casting of the same composition, but without shape memory effect, was used as control. To test the cytotoxicity,

mouse L929 fibroblasts, rat thymocites and splenocytes were used. The results show that Cu-Al-Ni ribbons were not cytotoxic to mouse L929 fibroblasts and rat thymocites. Furthermore, the rapidly solidified ribbons conditioning medium inhibited cell proliferation and production of IL-2 by activation of rat splenocytes to a much lesser extent. The inhibitory effects were almost completely avoided by conditioning rapidly solidified thin ribbons in culture medium for 4 weeks.

Keywords: alloys, shape memory effect, biocompatibility.

DETERMINATION OF TERNARY INTERACTION COEFFICIENT IN Ga-Sn-Zn SYSTEM

Lj. Balanović, D. Živković, D. Manasijević, N. Štrbac, I. Mihajlović, A. Mitovski
University of Belgrade, Technical Faculty in Bor, Serbia

Addition of the third element, such as Ag, Bi, Sb or Ga, significantly improves the characteristics of the Sn-Zn-based alloys considered as advanced environmentally adequate materials. Therefore, Ga-Sn-Zn ternary system is one of newly investigated electronic material, recently considered as possible lead-free substitute for traditional lead-tin solders. The results of ternary interaction coefficient determination of liquid Ga-Sn-Zn alloys are presented in this paper. Based on available ternary thermodynamic properties obtained by general solution model, ternary interaction parameter for the liquid phase of investigated ternary system was determined using MLAB in selected temperature range.

Keywords: thermodynamics, ternary interaction coefficient, Ga-Sn-Zn alloys.

FABRICATION AND PROPERTIES OF OIL-EXTENDED ELASTOMERIC NANOCOMPOSITES BASED ON DIFFERENT RUBBERS

D. Manjenčić[1], V. Jovanović[2], J. Budinski Simendić[3], N. Vukić[3], V. Simendić[3], Z. Miljković[4], V. Aleksić[5]
[1] Novohem DOO Šabac Serbia
[2] PMF Kosovska Mitrovica Serbia
[3] Faculty of Technology University of Novi Sad Serbia
[4] Gumins Novi Sad, Serbia
[5] University of East Sarajevo, Faculty of Technology, B&H

For elastomeric materials application is is very important to have apropriate network precursors for material design. The present work explored the effect of oil type on the properties of reinforced elastomers. For sample preparation different

network precursors was used, ethylene-propylene-diene rubber (EPDM), acrylonitrile-butadiene rubber (NBR), natural rubber (NR), and polyether-urthane rubber (EU). The curing characteristics was studied by Monsanto rheometer. The tensile test of the produced materials was carried out using a universal testing machine. The thermal stability of samples was assessed in nitrogen by thermogravimetry (TGA). It was estimated that the oil type significantly influenced the properties of obtained materials.

Keywords: elastomeric materials, rubber, plastification, polymer network.

BIOBASED POLYMER MATERIALS FOR SUSTAINABLE DEVELOPMENT

I. Ristić, R. Radičević, B. Pilić, J. Budinski Simendić,
University of Novi Sad, Faculty of Technology, Serbia

In recent decade biobased polymers have been the subject of many scientific and industrial researches. Growing global environmental and ecological problems and the high rate of depletion of oil resources have forced the search for new "green" polymers, compatible with the environment. In this article is present a brief review of the advantages and sustainability of biodegradable polymer, with special focus on poly(lactide) (PLA) based materials. Some applications of PLA in medicine, phar¬macy and food packaging industry were presented.

Keywords: biobased polymers, poly(lactide), sustainability.

ISSUES OF PIPE MATERIAL IN STEAM REFORMING FACILITY FOR HYDROGEN PRODUCTION

M. Plavšić[1], Z. Božičković[2], B. Marić[2]
[1] Automobile Association Derventa, B&H
[2] University of East Sarajevo, Faculty of Mechanical Engineering, B&H

Summary, There are numerous problems present in exploitation of catalytic units such as steam reforming units. In this paper is described technological unit for hydrogen generation, main streams of operating fluid and reactions which take place in catalytic tubes. Special problems represent materials of tubes in which appear various mechanisms of damages due to effects of high operating temperatures and corrosion aggressive gases. In these tubes take place very complex, thermo chemical, endothermic, catalytic reactions under conditions of corrosion \"aggression\", corrosion and thermal fatigue and large operating loads. Because of

that in this paper is put special accent on problems of materials of catalytic tubes which, beside good ductility, must be resistant to creep and corrosion.

Keywords: materials, catalytic tubes, mechanisms of damages, corrosion.

INFLUENCE OF THE VANADIUM CONTENT ON THE TOUGHNESS AND HARDNESS OF HIGH-ALLOYED Cr-Mo STEEL

A. Todić[1], D. Čikara[1], B. Pejović[1], T. Todić[1], V. Mićić[2]

[1] Faculty of Technical Sciences, University of Priština, Serbia
[2] University of East Sarajevo, Faculty of Technology, B&H

Characteristics of air hardening steel are high hardness and low impact toughness. In order to increase the impact toughness while retaining replace with the high hardness value numerous research added. One of the ways to achieve this is the alloying of specified steel with vanadium and application of appropriate heat treatment. Vanadium affects the solidification process of these alloys by narrowing of the temperature interval of crystallization. In addition, vanadium formed V6C5 carbides that block the growth of austenitic dendrites and structure makes fine-grained. Vanadium which forms V6C5 carbides is partly distributed between present phases in the steel, carbide (Cr, Fe)7C3 and austenite. Also, the presence of vanadium can enable the formation of (Cr, Fe)23C6 carbide and its precipitation in austenite during the cooling process. In local areas around fine carbide particles, austenite is transformed into martensite. In other words vanadium reduces the amount of remained austenite and so improves hardenbility of the steel. In this way, better technical characteristics of these steels are obtained.

Keywords: vanadium, impact toughness, hardness, microstructure.

TECHNOLOGICAL PROCESSES AND OPERATIONS IN LOGISTICS

P. Dakić[1], V. Gajić[2], B. Dakić[2]

[1] Academy of Sciences and Arts of the Republic of Srpska, B&H
[2] ŽRS, a.d. Banjaluka, B&H

From the scientific position the logistics researches and uses multidisciplinary and interdisciplinary knowledge and skills to implement generated principles in planning, organization, control, modeling and simulation of material flow, energy and information in the supply chain logistics. With the synthesis of the objective function applied are various optimization methods in relation to set criteria (usually temporal, spatial, and financial). If the flow of materials, energy and information and their transformations that are not set i.e., rationalized from the beginning (in-

source) to the end (confluence), then the individual (partial) optimizations do not ensure their general rationalization. This work pays attention to logistics centers as transport links of the distribution chains, treating and monitoring them as a composition of functions. For logistics centers as logistical links (nodes) the most important function of composition are studied by the direction of motion of material (energy, information), where the various transformations lead to target balancing and tuning the system. During operation of the logistics center at its entrances different items appear (shipments with different levels of concentration and classification, vehicles, integrated and intermodal units, etc...), which performs various processes and operations functionally organized and planned combinations, with the aim of generating more composition of units of different events at the output of decomposition and diversification.

Keywords: technological processes, operations, logistics.

BALANCING PROCESSES AND OPERATIONS IN LOGISTICS

P. Dakić[1], *B. Dakić*[2]

[1] Academy of Sciences and Arts of the Republic of Srpska
[2] ŽRS a.d. Doboj, B&H

Logistics explores and utilizes multidisciplinary and interdisciplinary knowledge and skills to implement the generated principles in the planning, organization, control, modeling and simulation of material flow, energy and information in the supply chain logistics. Objectives Partial objectives are to improve or the rationalization of energy efficiency, environmental protection, more humane operation, utilization and protection of infra and supra-structure, the savings in human resources and others. During the implementation of the processes and operations in logistics we meet with the logistical problems of balancing units and blocks with one hand and with the other hand balancing selection criteria for optimal function goals. Therefore the paper focuses on balancing the units and blocks which implementation reduces logistics costs, adjusts the system in terms of the maximum utilization of space in a static sense, the high reliability of flows in a dynamic sense, a careful selection of criteria in the example of the railway and other transport increases the overall efficiency of the logistics. It is assumed that the processes and operations have features such as interconnectivity, interoperability and intermodularity as the basic conditions of work in logistics systems.

Keywords: processes, operations, balancing, criteria.

BY MEASUREMENTS OF TENSILE STRENGTH OF RECYCLED THERMOPLASTICS

Z. Janjuš[1], A. Petrović[2], A. Jovović[2], R. Prokić Cvetković[2], M. Šljivić[3], B. Arsenović[4]

[1] City Administration Banja Luka, B&H
[2] Univrsity of Belgrade, Faculty of Mechanical Engineering, Serbia
[3] Univrsity of Banja Luka, Faculty of Mechanical Engineering, B&H
[4] "Orao" A.D. Bijeljina, B&H

In this work we presented the possibility of re-use of already used polymer materials by their recycling from the point of view of the change of tensile strength. In the experimental part, the standard test tubes of basic material of polyethylene, polystyrene and polypropylene as well as secondary materials were tested through five recycling cycles. The measurement of the values characteristic for testing by the process of tension. Scientific part presents the results of change of the most important mechanical characteristics and laws of their changes depending on the recycling cycles.

Keywords: recycling, thermoplast, tensile strength.

THE INFLUENCE OF MATERIAL MICROSTRUCTURE ON THE CHIP FORMING PROCESS

P. Kovač[1], B. Savković[1], L. Sidanin[1], O. Lukač[2], I. Mankova[3]

[1]University of Novi Sad, Faculty of Technical Science, Serbia
[2] Technical faculty, Slovak University od Agriculture in Nitra
[3] Technical University of Košice, Faculty of Mechanical Engineering, Department of Technology and Material, Slovakia

For number of alloys the process of metal cutting is accompanied by extensive plastic deformation and fracture. In the paper are investigated quick stop samples of the chip formation of materials with different chemical composition and microstructure. The type of chip formation is classified according to the mechanism of crack formation and propagation. During cutting, most samples that are used, quasi-continuous chips with built-up edge (BUE) are obtained. The formation of BUE is undesirable since it is a highly deformed body with a semi stable top which periodically breaks away giving rise to poor workpiece surface quality.

Keywords: chip formation, material structure.

RESEARCH IMPROVED METHODS OF SURFACE PREPARATION OF ALUMINUM AND ITS ALLOYS BEFORE APPLICATION OF PROTECTIVE COATINGS

B. Malinović[1], G. Latinović[1], M. Tomić[2], J. Mandić[1], P. Sailović[1]
[1] University of Banja Luka, Faculty of Technology, B&H
[2] University of East Sarajevo, Faculty of Technology, B&H

This paper studies electrochemical deposition of nickel and copper to aluminum and investigated coating appearance, coating thickness and current efficiency in electrochemical deposition. Preparation of the aluminum samples was carried out chemically. The aim of this study is that after chemical preparation, examination of the three solutions used for deposition of coatings on aluminum core has a positive effect on getting a thick top coating of nickel and copper, as well as higher current efficiency in electrochemical deposition. The results show that of the three tested solutions for surface preparation of aluminium for electroplating, most effective solution is solution for intermediate protection.

Keywords: electrochemical metal deposition, coating thickness, current efficiency, chemical preparation, activation.

NEW MULTI-LAYERED METALS

S. Petrović[1], V. Petrović[1], B. Mihelič[2], Ž. Keravica[1], S. Bunić[3], R. Smileski[2], O. Popovski[2]
[1] EKSPLO M d.o.o., Slovenia
[2] Ministry of Defence, Slovenia
[3] TEM INŽENJERING d.o.o., B&H

Simultaneous plaquing two, three or more metal energy density of large, exploded after processing operations of three-manufactured: steel-titanium alloy. Stock and / or multi-layered metals are used in various industries: chemical, petroleum, food, pharmaceutical, technology in the production of aluminum or other metals, shipbuilding, motor industry, agriculture, power industry, power transmission, the construction and furnishing of electric utilities, the grounding of transmission and transformer systems, today, multi-layered metals used in electronics and microelectronics.

Keywords: explosion flashed metals, three-ply, stock, steel-titanaluminijum.

MODELLING OF THE COAGULATION PROCESS IN THE SYSTEM OF CLARIFICATION OF SURFACE WATER

R. Kukobat, Lj. Vukić, S. Papuga
University of Banja Luka, Faculty of Technology, B&H

In order for a surface water to be eligible for a particular purpose, it is necessary to remove the existing turbidity in water, that is caused by suspended and colloidal composition. It is achieved by process of coagulation / flocculation with subsequent sedimentation. Most frequently used coagulants in treating raw water system are aluminium sulphate and iron(III)chloride. Conducting the jar-test method, the effectiveness of the clarification process of the river Vrbas surface water, with application of the two coagulant, was studied. Water temperature and dose of the coagulant were varied. Through relevant indicators of the quality of treated water, the analysis of the efficiency of the process was carried out. On the basis of the measured turbidity at optimum water samples, the simple mathematical model, that can be applied to simulate the process of coagulation/flocculation, was developed. Developed model can be used for the process optimisation and possible automatsion as well.

Keywords: coagulation/flocculation, aluminium sulphate, iron(III)chloride jar-test, water turbidity, mathematical model.

TEXTILE PROCESSING WITH EXTRACT OF THE PLANT YARROW (ACHILLEA MILLEFOLIUM L.) IN ORDER TO ALLEVIATE ALLERGY FROM THE SWEAT

D. Grujić, A. Savić, Lj. Topalić Trivunović, S. Janjić
University of Banja Luka, Faculty of Technology, B&H

In this paper was examined the processing effect on knitwears with different composition intended for making men's shirts for the summer period, with aqueous extract of the plant yarrow (Achillea millefolium L.) in order to alleviate allergy from the sweat. Antimicrobial activity of knitwear samples with aqueous extracts of yarrow on bacteria Escherichia coli and Staphylococcus aureus was performed using parallel streaking method (AATCC TM 147). The treated samples were commercial knitwear and knitwear previously treated with 10% NaOH solution at a temperature of 20°C for 30 minutes. The effect of NaOH treatment was determined by measuring the mass loss and water retention. It was found that the samples processed with yarrow extract, which are composed of a higher percentage of cotton fiber, show some antimicrobial properties, whose effect is lost with first washing. It was also revealed that the samples of knitwear, previously treated with NaOH, after treatment with the same extract showed

no antimicrobial properties. Knitwear with good thermal and sorption characteristics showed some antimicrobial properties. By using the test wearing of men's shirts made from this knitwear, it was found that slightly calms redness of the skin caused by a secreted sweat.

Keywords: knitwear, sweat allergy, antimicrobial.

INFLUENCE OF PHTHALATE PLASTICIZERS AS CHEMICAL DANGEROUS SUBSTANCES FROM POLYETHYLENE TEREPHTHALATE BOTTLES FOR WATER PACKAGING ON HEALTH SAFETY

M. Lazić[1], D. Jašin[1], N. Stanojković[2]

[1] High Technical School in Zrenjanin, Serbia
[2] Institute of Public Health, Novi Sad, Serbia

Phthalate esters plasticizers are chemical dangerous substances that influence on human health. Migration of phthalate plasticizers from the coloured and transparent plastic bottles made of polyethylene terephthalate (PET) widely used for mineral water packaging was detected to control their healt safety. The testing was carried out in Institute of Public Health in Novi Sad, in the department of Laboratory services, in the laboratory for food and common usage products control, with model solutions distilled water during 24h at 20±2°C according to standard procedures. Phthalate plasticizers migration in the coloured and transparent PET samples was not detected. According to present Act on conditions dealing with health safety of common usage goods that can be put on market (Official Gazette SFRY 26/83) the samples are health safety considering presence migration of phthalate esters plasticizers.

Keywords: PET plastic bottles, phthalate esters plasticizer, phthlatate migration, chemical dangerous substances, health safety.

ACTUAL PROCESS PARAMETER SETTING FOR MICRO-ENGRAVING OF FULLERENE FILM

I. Petrović[1], M. Nikolić[1], B. Bojović[2], I. Đuričić[3]

[1] University of Belgrade, Faculty of Mechanical and Biomedical Engineering, Serbia
[2] University of Belgrade-Faculty of Mechanical Engineering, Serbia
[3] University of Belgrade, Faculty of Mechanical Engineering, Nanolab, Serbia

Mechanical engineers are consistently challenged with the requirements of contemporary materials machining using existing equipment. In this case the cutting conditions setting become an actual problem. This paper offers a response to that request. It is the micro-machining of thin fullerene film deposited on a glass plate using chemical vapor deposition method. Experimental verification of thin fullerene film machinability

is conducted on computer numerical control engraving machine using a diamond scraper. Different values of process parameters are combined to determine adequate parameters set from groove edge quality aspect. Advanced equipment is used for qualitative analysis and near-optimal cutting condition selection. The results are basis for further process optimization of thin fullerene film micro-engraving and the introducing of cutting conditions in existing table for well-known materials.

Keywords: fullerene film, cutting condition setting, micro-engraving.

ANALYSIS OF CONSUMPTION NITROGEN NEAR LASER CUTTING STAINLESS STEEL

D. Dobraš[1], T. Šestić[2]

[1] University of Banja Luka, Faculty of Mechanical Engineering Banja Luka, B&H
[2] Kaldera Company d.o.o., Republic of Srpska, B&H

While laser cutting is possible to use three types of gas, depending on the type and thickness of the base material. These are respectively, compressed air, oxygen (O2) and nitrogen (N2). Nitrogen is used in the purity of 99.99%. Consumption of nitrogen participates in cost cutting parts made of stainless steel in an amount that is much higher than the price itself material to be processed. Given the high cost of nitrogen and the need to establish cost of laser cutting, it is necessary to make a calculation of consumption of nitrogen when cutting stainless steel and materials that intersect with the same other parameters cutting. Input parameters were obtained by measuring the actual cutting parameters. Used a battery of nitrogen from 12 bottles total weight of 969 kg. How the to prevent the ingress of air into the battery, the entire amount of nitrogen from the battery is not discharged to the end, the analysis will not take the amount of nitrogen in liters or kg, already price of gas of spent in convertible marks.

Keywords: laser cutting, nitrogen, stainless steel, costs calculation.

ANALYSIS OF HEXAVALENT CHROMIUM SORPTION ON MACROPOROUS COPOLYMER GRAFTED WITH HEXAMETHYLENE DIAMINE

Z. Sandić[1], B. Ekmeščić[2], D. Maksin[3], I. Stefanović[2], D. Marković[3], J. Marković[3], M. Pergal[2]

[1] University of Banja Luka, Faculty of Natural Sciences and Mathematics, B&H
[2] IHTM, Serbia
[3] Vinca Institute of Nuclear Sciences, Serbia

Functionalized polymers based on glycidyl methacrylate are very attractive and effective metal adsorbents since they can be regenerated and reused, while epoxy group can be easily transformed into various functionalities. In this study, macroporous GMA

based copolymers with different crosslinking degree and porosity parameters, functionalized with hexamethylene diamine (PGME-HMDA), were tested for Cr(VI) sorption. Sorption kinetics and adsorption isotherms were obtained in static experiments with a series of acidic aqueous solutions of Cr(VI) ions in the concentration range 0.01-0.1 mol/dm3, at room temperature (298 K) and pH=1.8. Concentration of Cr(VI) ions after sorption was analyzed by ICP-OES. Several kinetic models (chemical reaction- and diffusion-based) were used for sorption kinetics analysis. Acknowledgements. This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Projects III43009, TR37021 and ON172062).

Keywords: Cr(VI) ions sorption, hexamethylene diamine, kinetic models, ICP-OES.

EPOXY CATAPHORETIC COATINGS ON STEEL MODIFIED BY Zn-Mn ALLOYS

M. Tomić[1], M. Bučko[2], V. Mišković[2], M. Pavlović[1], J. Bajat[2]

[1] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[2] TMF Belgrade, Serbia

There are many factors that influence the corrosion stability of organic coatings and surface pretreatments play an important role. Pretreatments based on zinc coatings alloyed with iron-group elements have been widely investigated during a last decade. However, steel surface modification with Zn-Mn coating prior to deposition of organic coating has not been investigated so far. In this work an attempt has been made to determine the influence of steel surface pretreatments with electrodeposited Zn-Mn alloy on the adhesion and corrosion stability of thin, nonpigmented epoxy coating. Epoxy coating was deposited cataphoretically from epoxy emulsion during different times and at both low and high voltage. The corrosion stability of protective systems was analyzed by electrochemical impedance (EIS) in 3% NaCl solution. The appearance of two time constant EIS plots, after only 24 h of exposure to corrosion agens, in protective system based on epoxy coating deposited at low voltage indicates its poor corrosion stability. This behaviour was confirmed by adhesion measurements. Based on all results the optimum deposition time and voltage were determined.

Keywords: Zn-Mn alloy, cataphoretic deposition, epoxy coating, corrosion.

THE MICROWAVE SYNTHESYS OF STAR-SHAPED POLYMERS BASED ON PLLA AND CASTOR OIL

V. Aleksić[1], Z. Petrović[1], D. Balčaković[1], N. Vukić[2], J. Budinski Simendić[2]
[1] University of East Sarajevo, Faculty of Technology Zvornik, B&H
[2] University of Novi Sad, Faculty of Technology, Serbia

Poly(l-lactide) (PLLA) is a linear aliphatic polyester that is usually prepared by ring-opening polymerization of l-lactide. This polymer is a biodegradable and bioadsorbable material. Its major drawback is it nonfunctionality, that is, in its pure form, it lacks easily accessible sites in the main chain that are susceptible to chemical alteration. Various strategies for achieving a functional PLLA have therefore been developed, such as ring-opening copolymerization with a functional monomer, the use of a functional initiator, and various post polymerization modifications. Star shaped polylactide polyol can be obtained using, as an initiator, natural oil that has at least three hydroxyl groups in its molecule. The goal of this work was to synthesize star shaped polymers based on castor oil (as core) and PLLA (as arms). The polymerization was carried in the microwave reactor using tin(II) ethylhexanoate as catalyst. FTIR spectroscopy was used to estimate the molecular structure of obtained materials. The GPC method was used to monitor the average molar masses and dispersity of the polymers. It was assessed that the molar masses of obtained polymers significantly influenced glass transition temperature measured by DSC method.

Keywords: polylactide, star shaped polymers, copolymerization, initiator.

DETERMINATION OF THE CONCENTRATION OF LASER PRINTER TONER PARTICLES IN THE AIR DURING PRINTING

B. Simendic[1], V. Marinkovic[2], N. Vukic[2], V. Simendic[2]
[1] High Technical School, Serbia
[2] University of Novi Sad, Faculty of Technology, Serbia

Due to decrease of prices of laser printers and toners compared to ink-jet printers, as well as quality, durability, and speed, use of laser printers has increased. However, careless use of laser printers can result in severe consequences. Recent studies have shown that during printing, laser printers release in a room or office a significant amount of toner particles. Other studies have shown a correlation between inhaled particles and lung damage. The aim of this study is to determine the optimal distance from the printer during printing. To measure the concentration of particles in the air, Casella Microdust Pro was used. It can measure the concentration of particles between 0,01 and 2500 mg/m3. The concentration is measured using the techniques of light scattering

angle. For the experiment, three printers were chosen, taking into account the date of manufacture, in order to determine whether the rate of emitted particles is lower in newer printers, to indicate the manufacturer\'s effort to solve this problem. The second test was to determine the concentration of toner particles in the air at different distances from the laser printer and with different speeds and print quality. At the end, the optimal distance from the printer during printing was recomended.

Keywords: laser printer, toner particles, occupational health.

REVITALIZATION OF INSULATION OF POWER TRANSFORMERS

N. Damjanović[1], D. Poletan[2], Z. Davidović[3]

[1] NIS Petrol d.o.o., B&H
[2] Elektroprenos, B&H
[3] Bargos loa d.o.o., Serbia

Revitalization of insulation, deep drying and purification, stops the aging process of cellulose insulating elements of power transformers, extending their life service and increasing their function reliability. Revitalization is done by the conventional drying method with simultaneous regeneration of electro-insulating oil through percolation adsorption of natural adsorbents. The outcome shows that the revitalization of insulation, adding the oxidation inhibitors and metal de-activators into oil, which is in direct contact with insulation, results in stopping the depolymerization of cellulose insulation elements.

Keywords: revitalization, insulating elements, drying, cellulose, adsorbens, process.

PHYTOREMEDIATION: GREEN TECHNOLOGY FOR TREATMENT CONTAMINATED SITES OF HEAVY METALS IN AQUATIC ECOSYSTEMS

P. Ilić[1], S. Ilić[1], T. Maksimović[2]

[1] Institute of Protection, Ecology and Informatics, Banja Luka, B&H
[2] University of Banja Luka, Natural Sciences and Mathematics, B&H

Aquatic macrophytes are exceptional accumulators of heavy metals and they are very important in phytoremediation of the pollutants. The aim of the survey was to show the situation of chemical contamination of these localities according to content of heavy metals in aquatic macrophytes DTD canal complex at localities under great human influence and assesment possibility and to assess the possibility of using aquatic macrophytes in phytoremediation of heavy metals in aquatic ecosystems We analyzed the content of heavy metals (Pb, Cd, Cu, Fe, Co,

and Ni) in tissue plants Potamogeton crispus L. Potamogeton perfoliatus L. i Potamogeton pectinatus L. at five locations in the area DTD canal. As best bioakumulator of the examined heavy metals the species Potamogeton crispus L. which indicates that the listed species can be used to remove these pollutants, from aquatic environment, for phytoremediation. in relation to site, highest concentrations of heavy metals were present in Potamogeton crispus from site Vlajkovac, folow Dobričevo and Jermenovci. The results show that mentioned species can be used for removal of heavy metals from water, what means that it has the ability of phytoremediation of pollutants.

Keywords: phytoremediation, green technology, heavy metals.

GLOBAL TRENDS IN ECO-TECHNOLOGY-COMPOSTING OF ORGANIC FRACTION OF MUNICIPAL WASTE

P. Ilić, S. Ilić

Institute of Protection, Ecology and Informatics, Banja Luka, B&H

In recent decades, as a line in eco-technology began to develop composting of organic fraction of municipal solid waste as hygienic processing of waste, in order to minimize waste to landfills, and also the utilization of compost as a useful raw materials from an environmental and economic point of view. Application of eco-technologies such as composting needs, both at local and global levels, in order to reduce the amount of waste going to landfill, which means reducing the generation of greenhouse gases that cause the global warming. The paper presents the possibilities of composting waste and analysis capabilities of the plant for composting in Banja Luka. Among other things, the proposal was given the composting facilities, in the case of the city of Banja Luka.

Keywords: waste management, composting, Eco-Technology, Banja Luka.

TREATMENT OF WASTEWATER FROM THE PROCESS OF POLISHING THE DISHES

V. Đukić, E. Jakupović

Paneuropean University APEIRON Banja Luka, Faculty of Health Sciences, B&H

To reduce the risk of technological process of polishing dishes on the environment, performed the analysis and determination of critical points with respect to the minimization of waste and energy released, or prevent degradation and environmental threats. The analysis is carried out in relation to the inputs of the technological process and output elements (characteristic forms of waste materials),

based on which the estimate of the impact on the environment. On the basis of this decision is the conclusion that it is necessary to the realization of the technological process and apply other measures, such as. wastewater or other pollutants. Wastewater treatment is one of the most rational measures in the field of water protection from pollution. Therefore, one of the most important tasks in the field of water construction and optimal functioning of the treatment plant wastewater. During the manufacture of "Treatment of wastewater from the process of polishing the dishes", activities are focused on the study of the characteristics of waste water and waste water treatment proposal.

Keywords: wastewater; treatmen; polishing the dishes.

FEATURES OF INVESTIGATION OF ILLEGAL LABORATORIES FOR THE PRODUCTION OF MARIJUANA – SCIENTIFIC APPROACH

M. Dragoljić, B. Vasić Dakić

Ministry of Internal Affairs of Republic of Srpska, Department of Forensic

Cannabis plant lat. Cannabis sativa L. and preparations of this plant are most widely used psychoactive substances in the world. Large number of users implies a high consumption level, and this provides stability to illegal production and trafficking of this drug over decades. However, recent years have seen changes of trends related to trafficing of certain specific cannabis preparations, and especially production methods. Most countries report increased in so-called indoors production of cannabis plants, in cmparison to outdoors cultivation - plantations. In recent years, the Republic of Srpska have recorded the phenomenon of increased indoors production of marijuana. As indoor cannabis production involves the application of sophisticated cultivation techniques (hydroponic techniques, cloning, automatic supply with food and water etc.) the investigation itslef also requires a scientific approach of teams formed by experts in various fields, and this is intensly significant in court proceedings, where the evidence are being presented. This study is aimed to present the characteristics of specific technology of indoor cannabis cultivation, and therefore a specific – scientific approach to detection and investigation of illegal drug laboratories.

Keywords: cannabis, marijuana, indoor cultivation, hydroponic techniques.

THERMAL LOAD INFLUENCE ON SURFACE ROUGHNESS CHANGES OF TEXTILE MATERIALS PRINTED WITH DIGITAL PRINTING TECHINQUE

M. Stančić[1], N. Kašiković[2], D. Novaković[2], D. Grujić[1], R. Milošević[2]
[1] University of Banja Luka, Faculty of Technology, B&H
[2] University of Novi Sad, Faculty of Technical Sciences, Serbia

At the present time, textile materials are increasingly subjected to the printing process. Printing quality significantly depends on the printing substrate, on which the printing process is performed. One of the fundamental substrate characteristics is the surface roughness. Thermal load, to which textile materials are exposed, results in changes of material structure and roughness parameters. The research included the analysis of the influence of thermal effect on roughness parameters of printed textile materials. Therefore, the Ra, Rp and Rv analysis of roughness parameters of textile materials, before printing, after printing and after thermal load, were performed. Taking the results into account, it can be concluded that the process of printing textile materials, increases the values of roughness parameters of these materials. Further thermal influence results in the decrease of surface roughness. It is concluded that printing colours, with their characteristics, influence roughness parameters.

Keywords: textile materials, substrate roughness, thermal load, textile printing.

TEXTILE TECHNOLOGICAL PROPERTIES OF LAMINATED SILICA AEROGEL BLANKET

V. Prevolnik, P. Kraner Zrim, T. Rijavec
University of Ljubljana, Slovenia

Silica aerogel blankets made from silica aerogel integrated into non-woven fabrics are superinsulative thin materials that can be also used in technical textiles and clothings. Textile technological properties of silica aerogel blanket laminated with a water vapour permeable membrane and polyester warp knitted fabric were studied. The five layers laminate had good mechanical properties, and was resistant to rubbing, was water vapour permeable, hydrophobic and oleophylic material with good thermal insulation. For using in clothings the laminated material is a little too heavy and rigid a bit. Silica aerogel is inclined to crushing at using. The laminate will be softer and more flexible after certain time of using. Analysed laminated silica aerogel blanked is suitable for technical textiles, such as sleeping bags, as flexible protective covers such as outdoor pillows, wheelchairs pillows for winter conditions etc.

Keywords: silica aerogel, laminated silica aerogel blankets, clothings.

BIOPOLYMERS WITHIN THE FAÇADE ENVELOPE OF THE BUILDING

M. Miletić
Faculty of Technical Sciences, Serbia

Construction industry is the second largest market for polymer based materials after packaging. These kinds of materials are constantly criticized by the public as major pollutants contributing by the fact their slow degradation in the nature and creation from nonrenewable recourses. Large material manufacturers are increasingly turning their production processes towards the production of biopolymers. As a specific category, these materials are becoming increasingly important within the framework of polymers. However, compared to polymers based on petrochemical resources, their contribution to the overall polymer production is at the minimum level, at least for now. It is expected in the years to come crude oil to lose its significance as a basis for the production of plastic masses. By 2020, the production of bioplastics is expected to be increased by 20 to 30%, which would mean that as much as 3 million tons of bioplastics will be produced annually (currently, this production is 350.000 tons) Polymer-based biomaterials are being increasingly used in civil engineering industry. This paper provides an overview of polymer-based biomaterials for use on facades, specifically in facade woodwork, panels and overlay elements, insulation and pastes and coatings as the final facade envelope layers. This is followed by the description of individual biopolymers that are used on building facades, discussing their properties, the scope and method of application, as well as their behavior in terms of sustainability.

Keywords: biomaterials, biodegradable materials, biopolymers, building facades.

FIBER REINFORCED SELF-COMPACTING CONCRETE – POSSIBILITY OF MODELING PROPERTIES

D. Jevtić[1], *A. Savić*[1], *G. Broćeta*[2]
[1] Faculty of Civil Engineering, Serbia
[2] Faculty of Architecture and Civil Engineering, University of Banja Luka, B&H

Experimental research results of basic physical and mechanical properties of fiber reinforced self compacting concrete (FR SCC) are presented in this paper, both in fresh and in hardened state. Both steel and polypropilene fibers have been used in this investigation. The programme of investigation of these composites included following properties of fresh and hardened concrete, consistency, density, compressive strength and splitting tensile strength. The obtained experimental re-

sults showed change and improvement of technological and mechanical properties of the SCC made with addition of steel and polypropilene fibers.

Keywords: Self compacting concrete, steel and polypropilene fibers, superplasticizer, fresh and hardened concrete.

SUSTAINABLE AND MULTI-PURPOSE MATERIALS WITHIIN THE THERMAL ENVELOPE OF THE BUILDING CONTEMPORARY MATERIALS USAGE AIMED AT IMPROVING THE ENERGY EFFICIENCY OF THE STRUCTURES

M. Miletić[1], *O. Ilić*[2]

[1] Faculty of Technical Sciences, Serbia
[2] Bureau of Civil Engineering Projects, Studio A, Serbia

Buildings can be rehabilitated and enhanced with respect of their energy efficiency. One of the traditional methods of doing this is improving the thermal properties of the thermal sheathing elements. In recent years, innovative materials are being increasingly used within the thermal envelope of buildings, increasingly proving their high effectiveness. This paper provides an overview of innovative materials that are being applied in the thermal envelope of buildings in order to improve their energy efficiency. In addition to biomaterials and biodegradable materials, multifunctional material are also being increasingly used, which, as their name suggests, perform several functions when applied. Some of the parameters of achieving energy efficiency are small dimensions and lightweight structures. When it comes to energy efficiency, recycling also cannot be ignored, recycling-based materials are increasingly used in the facade envelope of buildings. Thus, lightweight structural elements and new insulation materials that simplify the structure are being increasingly used, especially in the finishing layers of buildings.

Keywords: thermal envelope, sustainable materials, multipurpose materials, recycling materials, innovative insulation materials.

MIX DESIGN OF SELF-COMPACTING CONCRETE

D. Jevtić[1], *G. Broćeta*[2], *A. Savić*[1]

[1] Faculty of Civil Engineering, Serbia
[2] Faculty of Architecture and Civil Engineering, University of Banja Luka, B&H

Self-compacting concrete (SCC) is a contemporary concrete composite that does not require vibration for placing and compaction. It is able to flow under its own weight, completely filling formwork and achieving full compaction, even in the presence of congested reinforcement or in highly complex shapes. This paper presents the principles, fundamentals and approach to mix design of self-compacting concrete with

a detailed description of the procedure of mix design. Possible corrective actions of unwanted concrete faults in the fresh state are given and suggested in the paper. Typical examples of application of SCC mixes in Japan, Europe and the United States are also presented.

Keywords: self-compacting concrete, composite, superplasticizer, fresh state, robustness.

DESIGN OF COMPOSITION OF THE WATERBORNE COATINGS

V. Simendic, J. Đokić Majkić, M. Jovičić, R. Radičević
University of Novi Sad, Faculty of Technology, Serbia

Coatings, which are nowadays being intensively developed and which are considered to be environmentally friendly are waterborne coatings. Synthetic resins are mainly used as binders. In waterborne coatings, binder can be present as a solution, emulsion or dispersion in water or as a solution in organic solvents, which is diluted with water to obtain the viscosity necessary for production and application. In this paper, waterborne coatings based on acrylic and vinylacetate resins as a binder have been prepared and examined in order to design composition of the paints for exterior use. In addition to binders, type and concentration of filler were varied, as well. Properties of the prepared coatings have been determined, and experimental results have been statisticaly processed. Based on the experimental results it can be concluded that satisfactory properties have been shown by coatings with acrylic resin, as well as by coatings with vinylacetate resin. Important feature of the waterborne coatings are barrier properties. Results of regression analysis of experimental data on barrier properties show that in the coating containing acrylic resin as a binder, filler mass fraction (30 to 50%) significantly affects the properties of the coatings. In vinylacetate resin coatings, influence of the mass fraction of fillers is negligible.

Keywords: Waterborne coatings, Polyacrylate, Polyvinyl acetate, Fillers.

PERCEPTION OF THE ROLE AND PLACEMENT OF MATERIALS WITHIN SPACE FORMATION IN CONTEMPORARY ARCHITECTURE

O. Ilić Martinović[1], M. Miletić[2]
[1] Bureau of Civil Engineering Projects, Studio A, Serbia
[2] Faculty of Technical Sciences, Serbia

Perception of the role and placement of the materials within space formation is considered from few aspects. Thru formatting characteristics of the material, construction and composition, concern of material and form, relation between traditional and contemporary ways of material usage till interpretation of the material in ambiental perception. Traditional materials are representing the device for crea-

tion of structure and form although in contemporary architecture materials are aspiring toward language of surface, means creation of structural allusion. Applying of materials in contemporary architecture is gaining wider meaning and evaluation. We are experiencing contemporary materials as artistic elements. In the role of surfacing materials have symbolic meaning, not a real form, the form is explained thru our experience about the material. Thru form the one is experiencing the space and identifying with it. Materials and many possibilities are enabling creation of the space that gives emotional and ideological sense of architecture.

Keywords: contemporary materials, contemporary architecture, form, ambient.

USE OF NANOMATERIALS IN ARCHITECTURE OF STUDENT DORMITORIES

M. Dačić, N. Cekić, A. Kostić

Faculty of Architecture and Civil Engineering, Serbia

Reduction in availability of natural resources for forming traditional construction materials and needs of modern society demand for rational use of raw material sources, energy and workforce. Latest research in nanotechnology has allowed us to form architectural materials with superior and desirable characteristics for construction of buildings. Architects now have modern materials with which they can achieve short term and long term savings, better environment for work and life whilst preserving the ecosystem. This paper researches the possibilities of use of mentioned nanomaterials on student dormitories. Using analysis and combination of already created architectural solutions which deploy nanomaterials and requirements of contemporary student housing, recommendations are being synthesized for designing new dormitories or renovation of already existing ones. Also, hypothesis for future multidisciplinary research are defined.

Keywords: nano materials, architecture, civil engineering, student housing, design, renovation, ecology.

SELECTED ASPECTS OF LASER APPLICATION IN THE PRESERVATION OF CURTURAL HERITAGE

M. Srećković[1], A. Bugarinović[2], V. Svoboda[3], S. Polić Radovanović[3], N. Borna[4], N. Kovačević Ratković[5], M. Janićijević[6], Z. Fidanovski[7]

[1] Faculty of Electrical Engineering, Belgrade, Serbia
[2] Telekom Srpske, Bijeljina, B&H
[3] Central Institute for Conserving, Belgrade, Serbia
[4] Faculty of Technology and Metallurgy, Belgrade, Serbia
[5] Faculty of Mechanical Engineering, Beograd, Serbia
[6] Metalac AD, Gornji Milanovac, Serbia
[7] Faculty of Infromatics, Belgrade, Serbia

This paper discusses aspects of laser application in the preservation of cultural heritage in the world. As the cultural heritage is a very broad term, it can choose the aspects that are of interest to the application of general type, especially for objects based on ceramics, metals, glass and others. Other aspects are divided into diagnostic problems (descriptive nature), the problems of cleaning, storage, preservation and recognition and others. In the diagnostic area, there are more classical approaches, where a laser is only a source or methods that are only possible through the generator of stimulated radiation. Besides the general approach, are given the results of the author, related to cultural heritage objects, whose origin is from the Balkans, Europe or other continents.

Keywords: cultural heritage, cleaning, preservation, lasers, diagnostic problems, ceramics.

EFFECT OF NITRIC ACID PASSIVATION ON THE AISI 316L STAINLESS STEEL CORROSION PROPERTIES

D. Petković, G. Radenković

Faculty of Mechanical Engineering University of Niš, Serbia

Corrosion resistance of these alloys is due to the formation of a protective oxide film. Passivation of a biomedical grade 316L stainless steel by means immersion in nitric acid was used to improve a protective oxide layer on the surface and to increase resistance to pitting corrosion in physiological solution. Regression analysis was employed to reveal the effects of operating parameters of the nitric acid passivation (HNO3 concentration. temperature and passivation period) on the corrosion resistance of 316L stainless steel in Hank's solution. The experiment designed as full factorial with three factors and three levels. The responses were the pitting potential values (Ep) obtained from potentiodynamic tests. According to

the mathematical model, the effects of each variable and interactions between them were analyzed.

Keywords: stainless steel, nitric acid passivation, pitting potential, regression analysis.

POSSIBILITIES OF APPLICATION OF BROWNIAN GAS IN MECHANICAL ENGINEERING

D. Dobraš, S. Petković

University of Banja Luka, Faculty of Mechanical Engineering Banja Luka, B&H

Combustion of fossil fuels and gases on the basis of hydrocarbons produces exhaust gases, which pollute the atmosphere and altering the structure of the ozone layer, which negatively affects the quality of life on Earth. Braun gas is a mixture of one and two-atomnog hydrogen with oxygen, which is obtained by electrolysis of water in a chamber with a single output. In mechanical engineering the combustion Brown\'s gas as a renewable energy source can provide the necessary amount of energy without the occurrence of harmful gases.

Keywords: water electrolysis, Brown\'s gas, applications in mechanical engineering.

THE USE OF TRADITIONAL MATERIALS IN CONVERSION OF FORMER INDUSTRIAL BUILDINGS

S. Vrećić, B. Turnšek

Faculty of Architecture and Civil Engineering, Serbia

In view of the building facade, or outer covering of the object leaves a first impression on the viewer. Materials, their texture, color, transparency, contrast, layout are an essential element in the design of the facade. This paper analyzes the use of traditional materials in a contemporary conversion of former industrial buildings. Work presents a brief survey of the history of the development of usage of the earliest materials in architecture, and then from the perspective of contemporary architectural design flows their usage on walls. The paper considers the combination of old and new, tradition and technology, traditional and modern materials, aesthetic contexts of stone, brick, wood usage on facades of converted industrial buildings. The aim of this paper is to provide answers to questions on how the usage of traditional materials reflects to the energy efficiency and sustainability of buildings, economic justification of their use and does their long tradition justifies their quality and performance.

Keywords: traditional materials, facade, conversion, industrial buildings, architecture.

PHYSICO-CHEMICAL WEDING PROCESS

J. Savanović, R. Zrilić, M. Stanojević
University of Banja Luka, Faculty of Mechanical Engineering

When welding under welding powder between the molten slag and weld cavity, the reactions of oxidation reduction occurs, which tries to make a balance by the following equation. Physico-chemical processes during welding occurs in a very nonisotermic conditions. The time available for the completion of the welding process under welding powder is about 25 seconds. In a very short time, the temperature changes from the drop\'s temperature level, which is 2150±100°C. According to Erohin, nonisotermic welding process of manual arc welding is described as a function of time with the following equation which is derived from practical heuristic observations and it describes the decrease of initial temperature of weld cavity from 2300 K towards temperature of weld on 1800 K for about 5 seconds. He identified that if calculates nonisotermic reaction flow, one gets the same result if considers that reaction flows under average temperature of weld cavity on 2050 K. These reactions run in one nonisotermic process, or it had better to say, the reactions are in pseudo-equilibrium flow. It is therefore very important that the reactions establish equilibrium. Based on the chemical analysis of welding slag, it has been calculated the coefficients of thermodynamic activities of FeO, MnO and SiO2 in molten welding slag on 1600 ºC. Also, it has been calculated the equilibrium equation in nonisotermic conditions. Under high alkali level of slag, burning out of Si is quite high, but concentration of Mn in weld corresponds to equilibrium concentration. The whole process of oxidation-reduction reactions is the transferring process of oxygen. It has been calculated the equilibrium oxygen activity in molten weld metal, which is in proportion of reduction, precisely an oxidation of elements in the weld. For good weld it is is essential, also, that all reaction products get out from molten metal and to dissolve in molten slag.

Keywords: oxidation-reduction reactions, nonisotermic conditions.

THE COMFORT RESEARCH OF SEATING FURNITURE IN SCHOOL

M. Mehanović
MSS Musa Ćazim Ćatić, B&H

The paper presents the study of possible changes in the comfort of school chairs through changing design and construction of test models of chairs. The basic hypothesis is that high schools are not adequately equipped with school sitting furniture towards the real needs of students (ergonomic, anthropometric, functional), especially with chairs, so students do not sit in proportion to natural body move-

ments, thus teachers have some difficulties in educational process. Evaluation of ergonomic seating is reflected through anthropometry of the users, as well as construction and rigidity of the chair seat, and their resultant on health aspect of the spine and the load of the fourth and fifth lumbar vertebra region. The research has been done on the basis of a survey made within a group of fifty students .The sample consisted of 50 volunteer students (25 male, 25 female) ranging from 12 to 20 years of age. The respondents – students normally sit under the real conditions in the classroom, during the lesson, actively participate in the educational process, then answer the questions given in the questionnaire. Four models of school work-chairs were used as the samples. Two of them are the chairs with a seat made of a veneer molded beech with various angles between the seating and the back of the chairs, and the other two models are the chairs with upholstered seat and backrest in different density foam structure(soft foam and semi-rigid foam). The testing site is a mixed secondary school "Musa Ćazim Ćatić" in Olovo municipality. The obtained results confirm the hypothesis and suggest that students cannot sit quietly/ still. The results also suggest that the offered equipment and working furniture for sitting, with its functional dimensions, do not match the anthropometric dimensions of the user and the same furniture does not help in maintaining a healthy and physically appropriate position of students in classes. It is concluded that the present everyday design-construction solutions which are applied in schools encourage even larger student body movement, restlessness and fidgeting, rocking on a chair, all that because of their strength, stiffness, rigid and static frameworks. According to this students can have serious health consequences for a short or long term/period. On the basis of the obtained results new interdisciplinary guidelines in designing school furniture have been set which includes visual perception, aesthetics, function, medicine, ergonomics, pedagogy, psychology, ecology, technology and design. The goal of new solutions and proposals is to eliminate or at least reduce the observed symptoms, provide a proper, comfortable and safe learning environment and protect students' health. This is the challenge for technologists and designers to promote the new solutions of school working furniture suitable to the needs of time which we work in and all that in the function of the observed anthropometric changes.

Keywords: school work-chair, seating, ergonomic seating, furniture and health, design, anthropometry, seat comfort.

EXPLORATION OF ZEOLITE TUFFS WITHIN PRNJAVOR AND ŠNJEGOTINA BASIN

R. Cvijić[1], V. Malbašić[2], A. Milošević[2], E. Salčin[3], M. Čelebić[2]

[1] Ecological Faculty , Independent University Banja Luka, B&H

[2] Faculty of Mining, Prijedor, B&H

[3] Ministry of Economy, Energy and Mining in the Republic Srpska Government

Geological structure of the Prnjavor basin broadly and thus Šnjegotina basin were studied by several researchers. However, many geological, petrological and sedimentological and similar problems remain inclompleted and unexplained. Through performing the BGM *Basic geological Map) sheet "Derventa" (1984) were defined interstratified tuffs in sedimentary burdigal-helvet complexes. The tuffs previously explored and exploited at the Pilipići site. At the site Novakovići the outcrop areas were sampled tuffs, coal and marl (1995) by the Mining Institute in Prijedor, where four samples determined as tuffs. Based on laboratory analysis of selected outcrops for further research. On this way are registered appearances of amorphous, green and white zeolite tuffs at this site. Green and white zeolite tuffs and zeolites are economically interesting as modern materials and they have a wide application. At the most promising outcrop on the site Novakovići had performed through several occasions geological exploration but at minor level. The main disadvantage of these explorations were disregarding of performance dynamic by the project and providing a small volume of exploration work. This exploration has not solved the fundamental problems of regional geology for zeolite tuffs like formation analysis, the contol factors for distribution of mineral occurrences, mineralization indicators, the position of ore occurrences and their categorization through minerogenetic zoning. Future explorations are important strategic task for fullfilling of all previous geological research gaps in the appropriate scientific manner.

Keywords: Prnjavor and Šnjegotina basin, zeolite tuffs, heulandit, clinoptilolit, exploration, application.

CHARACTERIZATION OF SKIN CANCER WITH OPTO-MAGNETIC IMAGING SPECTROSCOPY

G. Nikolić[1], J. Bandić[2], D. Dobrosavljević[3], J. Šakota[1], B. Jeftić[1], I. Mileusnic[1], M. Tomić[1], L. Matija[1]

[1] Faculty of Mechanical Engineering, Serbia
[2] ORS Hospital, Serbia
[3] Department of Dermatology, Clinical Center Serbia

Melanoma is the most malignant skin cancer in human population due to late detection, high invasiveness and rapid infiltration. Beside melanoma, skin cancer includes Basal cell cancer (BCC), Squamous cell cancer (SCC), and other rare cancers like Mercel cell carcinoma and Langerhans cell carcinoma. The annual increase of melanoma patients in Serbia is 6%, while this number varies in rest of the world between 5% and 7%. Various techniques are used for detection and differentiation of skin cancers that differ in principle of operation and detection efficiency. A novel method is an opto-magnetic imaging spectroscopy (OMIS) based on light-tissue interaction. In more details, this technique measures the difference between responses of the skin when it is illuminated with white or polarized light under normal incidence or at Brewster angle. Different skin responses could be also measured under fixed incident angle of the blue and the violet light. In this study, OMIS is used for detection and differentiation between simple mole (naevus) and melanoma, and for differentiation between non-melanoma cancer and melanoma. Investigations have included 65 patients with dermoscopic and histopathology confirmed different lesions. It is shown that good agreement between the results of the OMIS method and histopathological diagnosis were obtained in the sample covering 97% of the patients. This demonstrates that OMIS method could be one of the diagnostic methods for detection and differentiation of skin lesions.

Keywords: melanoma, OMIS, histopathology, dermoscopy.

COMPARISON BETWEEN DIFFERENT TYPES OF COLON CANCER USING OPTO-MAGNETIC IMAGING SPECTROSCOPY

A. Dragičević[1], G. Nikolić[1], B. Jeftić[1], Z. Krivokapić[2], V. Marković[2], I. Dimitrijević[2], Đ. Koruga[1], L. Matija[1]

[1] Faculty of Mechanical Engineering, Serbia
[2] Clinical Center of Serbia

The colon carcinoma is the second most frequent cancer among male and female population around the world. According to the histological data, the most frequent

colon carcinoma is adenocarcinoma (90 %) with rectal and sigmoidal localization (75 %), followed by ceccum and ascendant colon (16 %). Approximately, one million people annually suffer from this carcinoma and half of them die [1]. Remaining 10 % of cases include other histological types of colon carcinoma such as carcinoid, anaplastic carcinoma, and squamous carcinoma as well as different types of lymphomas and melanomas. A number of optical techniques are used for detection and differentiation of colon carcinomas with different success. The opto-magnetic imaging spectroscopy (OMIS) is a novel method, which was successfully applied for differentiation of various types of colon carcinomas after its noticeable application in detection of hydrogen bounds in water [2] and characterization of epidermal skin layers [3]. Investigations have included 60 patients with histologically confirmed adenocarcinoma and 2 patients with other colon cancers (one with MALT lymphoma and the other with metastasis of melanoma). Digital images of healthy mucous and tumor infected tissues were taken under the white light and reflected polarized light, ten times each, and were processed with spectral convolution algorithm according to the OMIS method [4]. It was shown that the OMIS findings of adenocarcinoma patients significantly differ from findings of MALT lymphoma and melanoma patients. Different OMIS results were also obtained for MALT lymphoma and melanoma patients.

Keywords: colorectal carcinoma, OMIS, MALT lymphoma, melanoma.

INFLUENCE OF NANOMATERIAL-BASED CONTACT LENSES ON SOLUTIONS WITH DIFFERENT GLUCOSE CONCENTRATIONS

J. Šakota Rosić[1], M. Tomić[1], N. Milojević[2], I. Mileusnić[1], B. Jeftić[1], Z. Golubović[1], G. Nikolić[1], Đ. Koruga[1]

[1] Faculty of Mechanical Engineering, Serbia
[2] Institute for Intellectual Property, Serbia

Goal of this research is focusing on early detection of high glucose level in blood via eye, using contact lenses, because we have come to conclusion that skin is not the most suitable place for measuring glucose level, considering invasive and expensive techniques. These specific contact lenses, made of biocompatible nanostructured materials, present biosensors for continuous, noninvasive glucose monitoring and other bioanalits which can be found in tears. In this paper we present the comparative studies of the influence of nanomaterial-based contact lenses on five solutions with different glucose concentrations. The nanophotonic contact lens and contact lens made from base material were dipped in solutions over a specific period of time, in order to determine their influence on the glucose solutions. The base material of contact lens was made from PMMA and the nanophotonic contact lenses were made of fullerene doped PMMA. Fullerenes were used because of their good transitive characteristics in ultraviolet, visible and near infrared light

spectrums. Measurements were done at room temperature. Results of all solutions are presented and compared.

Keywords: contact lenses, glucose, fullerene, OMIS.

STUDY OF STAINED AND UNSTAINED PAP SMEARS USING OPTOMAGNETIC IMAGING SPECTROSCOPY

B. Jeftić[1], M. Papić Obradović[2], G. Nikolić[1], A. Dragičević[1], J. Šakota Rosić[1], M. Tomić[1], L. Matija[1]

[1] Faculty of Mechanical Engineering, Serbia
[2] GAK Narodni Front, Serbia

Papanicolaou test is a conventional screening test used to detect cervical pre-cancerous and cancerous processes. A sample of cells from the outer opening of the cervix and endocervical canal is stained using Papanicolaou technique so the cells could be examined with a light microscope. In order to get good results, staining procedure must be optimally conducted. Otherewise, the chances of getting false negative results are increasing. In this paper, we've investigated unstained and stained Pap smears with Optomagnetic imaging spectroscopy to show that staining of cervical samples could be excluded from the test for cervical cancer detection. Results point the influence of overstaining on diagnostic decision, since diagrams depicting the Optomagnetic method applied on overstained smears are notably different from diagrams depicting the same method applied on normaly stained as well as on unstained smears. Since overstaining is one of the factors that lead to false negative results in diagnostics, investigation of unstained smears instead of stained smears could improve existing diagnostic techniques. The use of unstained smears in screening would also save time and resources, considering chemical stain and time needed for staining procedure to be done.

Keywords: Optomagnetic imaging spectroscopy, Pap smears, cervical cancer detection.

STUDY OF THE OPTICAL POWER OF NANOPHOTONIC SOFT CONTACT LENSES BASED ON POLY (2- HYDROXYETHYL METHACRYLATE) AND FULLERENE

A. Debeljković[1], D. Stamenković[2], M. Conte[3], V. Šijački Žeravčić[1], L. Matija[1], Đ. Koruga[1]

[1] Faculty of Mechanical Engineering, Serbia
[2] Optix, Serbia
[3] Soleko, Italia

This work presents a comparative study of the optical power of soft contact lenses (SCL) made of today standard material and nanophotonic materials with di-

fferent measurement techniques used for the final contact lens controllers. Three types of nanophotonic soft contact lenses were made of standard polymacon material (Soleko SP38TM) incorporated with fullerene C60, fullerol C60(OH)24 and fullerene metformin hydroxylate C60(OH)12(OC4N5H10)12. For the purposes of material characterization for potential application as soft contact lenses, the optical properties of the soft contact lenses were measured by Rotlex and Nidek device. With Rotlex device the following optical results were obtained, optical power, the radial profile of power and a map of defects, while with the Nidek device, optical power, cylinder power and cylinder angle. The obtained values of optical power and map of defects showed that the optical power of synthesized nanophotonic soft contact lens is same to the nominal value, while this was not the case for the standard soft contact lens. Also, the quality of the nanophotonic soft contact lens is better than the standard one. Hence, it is possible to synthesize new nanophotonic soft contact lenses of desired optical characteristics, implying possibilities for their application in this field.

Keywords: nanophotonic soft contact lenses, pHEMA, fullerenes, optical power.

ZIRCONIA AS A BIOMATERIAL IN PROSTHETIC DENTISTRY – A CASE REPORT

M. Kovačević, B. Petronijević, I. Šarčev, D. Marković, A. Anđelković
Dental Clinic of Vojvodina, Novi Sad, Serbia

Zirconia is a crystalline zirconium dioxide (ZrO2). Good mechanical properties have brought it the title \"ceramic steel\" and the great interest of researchers of various specialties, while biocompatibility and color similar to tooth enabled its use in dentistry. In prosthodontics, zirconia is used for fabrication of frameworks and \"full contour\" zirconia restorations. Case report, The radiograph of 30-year-old male patient was observed, indicating the presence of chronic periapical lesion on the mesial root of tooth 36. Composite fillings were present on teeth 35 and 37. Hemisection was performed on the tooth 36, and the resulting bone defect was filled with bone substitute material (Bio-Oss, Osteohealth, USA). The distal root was endodontically treated and composite post was placed (RelyX Fiber Post, 3M ESPE AG, Germany). Tooth 25 was prepared for the class II inlay, and the teeth 36 and 37 were commonly prepared ("rounded shoulder" finish line). Impressions were taken, and direct provisional restorations were made (Structur 2SC, VOCO GmbH, Germany). Fixed partial denture was made of zirconia substructure (ICE Zirconia Blanks ZIRKONZAHN GmbH, Germany) and compatible veneering ceramic (IPS e.max Ceram, Ivoclar Vivadent AG, Germany), and cemented with composite cement (RelyX Unicem, 3M ESPE AG, Germany). Conclusion, Proper-

ly indicated, and with adequate clinical and technical protocols, fixed partial dentures made of zirconia are functional and aesthetically pleasing alternative to metal-ceramic restorations.

Keywords: zirconia, biomaterial(s), dentistry.

ZIRCONIA CERAMICS FOR DENTAL CROWNS

Đ. Božović[1], N. Ivković[1], S. Ristić[1], M. Milosavljević[2], D. Ćirić[2], V. Mirjanić[3]

[1] Faculty of Medicine, Foča, B&H
[2] Faculty of Medical Sciences, Serbia
[3] Faculty of Medicine, Banja Luka, B&H

Introduction. In recent years, strongly increased possibilities for reconstructive dentistry due to the introduction of innovative technologies (such as CAD-CAM), the further development existing materials and improvement of athezive cementation. The aim. Replacement of old metal-ceramic crown on tooth 11 with zirconia ceramic. Material and methods. The patient, aged 25, in which, during clinical examination for aesthetic reasons indicated replacement of metal-ceramic crown on tooth 11 with new restoration. After removing the metal-ceramic crown, we determined darker color of preparation tooth with preserve tooth vitality. In order to prevent dark shade of preparation tooth, due to the optical properties of ceramic restorations, which would significantly reduce the crown aesthetic, we used substructure thickness 0.5 mm which made of zirconium dioxide with CAD-CAM technology (e.max ZirCAD, Ivoclar Vivadent, Liechtenstein). The substructure material is veneered with ceramic (VM7, Vita, Germany) color B2 with Vita (3d master, Vita, Germany) shade guide. Conclusions. Today, selecting the most appropriate reconstructive material for individual crowns is more difficult due to many opportunities. Zirconia ceramic compared to metal-ceramic crown offers a dynamic light that is similar natural tooth and aesthetic advantages.

Keywords: Zirconia ceramic, metal-ceramic, CAD-CAM technology.

ALL-CERAMIC RESTORATIONS – EXCELLENT AESTHETICS

Đ. Božović[1], N. Ivković[1], D. Moravčić[2], M. Milenković[2]

[1] Faculty of Medicine Foča, B&H
[2] Faculty of Medical Sciences, Serbia,

The front teeth, due to changes in color, shape and position, often distort the appearance of a smile and a negative impact on the self esteem of the individual. Today, there is available a large selection of all-ceramic systems for the restoration

of tooth with significantly improved mechanical and optical properties. The aim. Manufacture all-ceramic crowns in the anterior region of the upper dental arch. Material and methods. For 26 years-old female patient in the aesthetic evaluation indicated four all-ceramic restorations in teeth 12, 11, 21 and 22. To create the front restorations we are selected lithium disilicate glass-ceramic all-crowns that comes in the form \"ingots\" of different colors and translucency (IPS e.max Press, Ivoclar Vivadent, Liechtenstein). This all-ceramic system is further layering with nano-fluorapatite ceramic (IPS e.max Ceram, Ivoclar Vivadent, Liechtenstein), which provides esthetic results. For success of all-ceramic restorations plays an important role and cementation technique. In this case we selected adhesive cementation technique. It provides better mechanical properties of restorations. For the cementation of all-ceramic crowns a light-cured composite cement (Variolink Veneer, Ivoclar Vivadent, Liechtenstein) is used which can be polymerized under a layer of lithium disilicate glass-ceramic up to 2 mm. Conclusions. Ceramic materials are an important part of modern dentistry. Their resistance and optical properties enabling production of excellent and durable restorations that are at the same time achieves compliance of various requirements (aesthetic, functional and preventive).

Keywords: all-ceramic restorations, adhesive cementation technique.

NANOCOMPOSITES IN DENTISTRY

R. Paunović[1], N. Mihajlović[2], D. Ćirić[2], M. Milenković[1], V. Obradović[3]

[1] Students of doctoral studies, Faculty of Medical Sciences Kragujevac, Serbia
[2] Faculty of Medical Sciences Kragujevac, Serbia
[3] Department of Dentistry Kragujevac, Serbia

Composites are the most widely used biomaterials for tooth reconstruction. Contemporary composites filled with nanoparticles and improved material properties are nanocomposites. The aim of this study was to review the characteristics of nanocomposites and to compare them with conventional composite materials. Material and Methods, This article reviews and analyzes characteristics and adventages of nanocomposites,so as characteristics of conventional composites from literature published until today. Conclusion, Nanocomposites are the closest to the ideal composites. Beside the size and shape, proper scattering is very important for improvement of their quality. Otherwise,they are considered for conventional composites, no matter their nanometric size. Nanocomposites combine aesthetic characteristics of microstuffed and mechanical characteristics of hybrid composites. Transparency and durability because of the good polishability are theirs most important adventages over the conventional composites.

Keywords: nanocomposites, conventional composites, adventages.

APPLICATION OF ELASTOMERS IN THE REGISTRATION AND TRANSFER OF THE ECCENTRIC POSITION OF THE MANDIBLE INTO AN ADJUSTABLE ARTICULATOR

D. Moravčić[1], M. Milosavljević[2], M. Milenković[1], N. Ivković[3], Đ. Božović[3]

[1] Students of doctoral studies, Faculty of Medical Sciences Kragujevac, Serbia
[2] Faculty of Medical Sciences Kragujevac, Serbia
[3] Faculty of Medicine Foča, University of East Sarajevo, B&H

When making fixed dental restorations it is recommended to use adjustable articulator in which maxillary and mandibular plaster casts are transferred appropriately. In these articulators, slope values of sagittal condylar path and Benet angle is adjusted on the basis of positional registrations eccentric position of the lower jaw. Positional records are made of different materials, ranging from wax through various bite registration paste to the elastomer. The aim of the paper is to present the transmission model fork in the articulator and adjust the guides joint system articulator using elastomers. Case report, A male patient, 36 years old, came to our clinic for prosthetic treatment. After diagnostic procedures were done, indication for lower posterior fixed partial denture was established. The preparation of the abutment teeth and impressions were done. After creating maxillary and mandibular plaster casts, their transfer into semi-adjustable articulator Ar-Con type (Whip Mix 8500 Series ®, USA) was preformed. Using compatible Whip Mix facebow and elastomers based on polyvinyl siloxane (Deli Bite ® HappiDen, South Korea) spatial relationship of the upper jaw relative to the center of rotation of the mandible was registered . Based on the acquired registration, maxillary cast is transmitted and plaster attached to the upper branch of the articulator. Mandibular cast is transferred to the articulator using an adequate procedure. For adjusting guides joint system of semi-adjustable articulator according to individual values obtained with the patient, positional records of eccentric position of the lower jaw (protrusive, left and right laterotrusive) were made. The material used for the registration of eccentric position of the lower jaw is based on polyvinyl siloxane (Affinis Putty Super Soft ® Coltène Whaledent, Switzerland). After adjusting hinge articulator guides, the laboratory stages of development lower posterior dental bridge were done.

Conclusion: In clinical practice, wax records are most commonly used. However, dimensional, thermal stability and ease of use of elastomeric materials based on polyvinyl siloxane are the advantages of these materials over the wax.

Keywords: polyvinyl siloxane, positional records, adjustable articulator, facebow.

THE USE OF COMPOSITE MATERIALS IN THE PRE-PROSTHETIC PREPARATION OF ENDODONTICALLY TREATED TOOTH

M. Milosavljević.[1], *D. Moravčić*[2], *N. Mihajlović*[1], *R. Paunović*[2], *Đ. Božović*[3]

[1] Faculty of Medical Sciences Kragujevac, Serbia

[2] Students of doctoral studies, Faculty of Medical Sciences Kragujevac, Serbia

[3] Faculty of Medicine Foča, University of East Sarajevo, B&H

Introduction: After endodontical treatment of the tooth there is decreased resistance of tooth structure to fractures. Due to these characteristics it is necessary, after the endodontic treatment and subsequent prosthetic care, to strengthen the tissues by cementing pulpal pins. Pulpal pins are made of different materials, ranging from various metals through ceramics to various composite pins. For cementing pulpal pins different types of cements are used, from zinc phosphate through glass-ionomer to composite cements. The aim of the paper is to present the use of materials on the basis of composites during pre-prosthetic preparation of endodontically treated tooth.

Case report: A male patient, 36 years old, came to our clinic for prosthetic treatment. After diagnostic procedures, the indications for making the lower posterior fixed partial denture were established. During pre-prosthetic preparation, endodontic treatment of distal abutment tooth, the lower second right molar, was done. It was necessary to strengthen endodontically treated tooth. By using appropriate mechanical expander, root canal preparation for acceptance of pulpal pins of proper dimensions was performed. In the buccal and mesial canals, glass fiber composite posts with diameter 1.35 mm (Glassix® Nordin, Switzerland) were placed. In the distal canal carbon fiber post with diameter 1.40 mm (Sogeva C post millennium black®, Sogeva, Italy) was placed. After trial of pins, cementing was started. Self-etching dual cure composite cement (Maxcem elite® Kerr, USA) was used for cementing all pins. Characteristic of this cement is that polymerization is performed by chemical and photo polymerization. After the pulpal pins had been cemented, compensation of the removed part of the tooth was done. For these purposes fiber-reinforced composite material for the upgrade (Build-It Fr® Pentron, USA) was used. After these procedures endodontically treated tooth is prepared for the grinding and acceptance of fixed prosthesis.

Conclusion: Composite posts and dentin have approximate values of elasticity module so that, if cementing procedures are properly done, tooth and restorations make homogenous whole. Glass fiber composite post has the ability of conducting light and does not affect the aesthetic value of ceramic restorations. Except for these advantages it is important to note that the application of this procedure rationalizes number of visits to the dentist. These reasons should encourage clinicians to apply composite materials more often for the purpose of reinforcement of endodontically treated teeth.

Keywords: pulpal pin, glass fiber composite post, carbon fiber post, dual cure composite cement.

TESTING THE EFFECT OF AGGRESSIVE BEVERAGE ON THE DAMAGE OF ENAMEL STRUCTURE

Đ. Mirjanić[1], V. Mirjanić[2], J. Vojinović[2], S. Čupić[2], I. Hut[3]

[1] Health Center Banja Luka, B&H
[2] University of Banja Luka, Faculty of Medicine
[3] NanoLab, Faculty of Mechanical Engineering, Serbia

Examining the enamel surface with the Atomic Force Microscopy (AFM) enables more precise registering and defining of the changes of enamel surface structure and of microhardness. This method can be used to compare the efficiency of application of different preventive and therapy materials and medicaments in dentistry. Under the influence of coca cola, a change of crystal structure and nanomorphology on enamel surface occurs. The trial was conducted on a total of 40 extracted teeth which were divided into two groups treated with the solution of coca cola during 5 minutes, and then prepared and tested with a standard AFM procedure, type SPM-5200. Quantitative analysis was performed by comparing the roughness parameters (Ra) of treated and non-treated sample.

Keywords: AFM; enamel structure.

EVALUATION OF SURFACE ROUGHNESS OF CEMENTS USED FOR RETENTION OF IMPLANT SUPPORTED DENTAL PROSTHESES, IN VITRO ANALYSIS WITH ATOMIC FORCE MICROSCOPY

D. Brajković[1], Z. Rakočević[2]

[1] Department of Maxillofacial surgery, Faculty of Medical Science, University of Kragujevac, Serbia
[2] Vinca Institute of Nuclear Sciences, Belgrade, Serbia

Objective: Surface roughness is dental material substrate condition that is critical for bacterial adhesion. Surface microtopography has an important influence on the initial biofilm formation. Thus, in order to clarify its contribution to the complex mechanisms involved in bacterial adherence, the aim of this study was to investigate the surface roughness of four different groups of commercial luting agents used for cementation of implant restorations. Materials and methods. Zinc phosphate (ZPC), glass ionomer (GIC), resin modified glass ionomer (RMGIC) and resin cement (RC) were investigated. Five specimens of each group were made using metal ring steelless molds of 8 mm in diameter and 1 mm in thickness. Materials' average roughness (Ra) was calculated based on Atomic Force Microscope (AFM) topography images (Multimode quadrex SPM with Nanoscope IIIe controller, Vaeco Instruments, Inc.).The changes in surface roughness were elucidated from the topography AFM images using the Nanoscope software (Version 5.31r1).

Results: One way ANOVA showed that material type significantly influenced the Ra ($p < 0.001$). Post hoc Tukey test revealed that for Ra parameter, RMGIC (21 ± 7 nm) and RC [(36 ± 15) nm] were not statistically different between each other ($p > 0.05$). In addition, GIC [(16 ± 4) nm] and RMGIC were not statistically different ($p > 0.05$), while statistically significant difference existed between GIC and RC ($p<0.05$). ZPC [(77 ± 21) nm] presented significantly higher roughness means than did the other groups ($p < 0.05$).

Conclusion: Glass ionomer cements presented smoother surface than other groups of the materials. Clinical Significance: This in vitro investigation provides evidence that glass ionomer cements experience superior surface properties than zinc phosphate and resin cements, which may result in reduced bacterial adherence and hence improved clinical results of implant restorations.

Keywords: implantology, surface roughness, dental cements, bacterial adhesion.

INFLUENCE OF INFRARED LASER BEAMS ON ORGANISMS AND THE ANALYSIS OF MODELING MATERIALS OF EQUIVALENT PARAMETERS

S. Pelemiš[1], M. Srećković[2], S. Jevtić[3], F. Živić[4]

[1] Faculty of Tehnology, University of East Sarajevo, B&H
[2] Electrical Engineering, Serbia
[3] Arhi. pro.doo, Serbia
[4] Department of Engineering Science, Serbia

The effects of laser beams on selected materials has been examined in the paper. The propagation and influence modeling of laser radiation in continuous CW mode in the infrared part of the spectrum through the sample material has been performed. For the two-layer material modeling, optical and thermodynamic data of equivalent parameters would have been used and the data would have been obtained from the description of the plant with coefficients of reflection, absorption, thermal conductivity, etc. For this certain thermal model, with multilayer case in general, this would be a simpler case. For cases in biology, the seven-layers are to be stated as well sometimes. In the experiment, the effect of infrared IR radiation on inner and outer layer of beans has been analysed. For the given dose, the effects of biostimulation and biomodulation have been examined. Particularly, the data of reflection coefficients have been obtained at different wavelengths. It is also possible to obtain a basis for more precise description of the seeds, their pathological and manifested conditions, as well as the connection to the level of development of the plant. These spectra can be used for Kramers-Kronig analysis and the constants of material response can be obtained from this analysis using the various programs.

Keywords: biostimulation, reflection spectra, laser, optical constants.

NANOSENSORS IN MEDICINE

S. Obradović[1], B. Milošević[2]
[1] Faculty of Electro technical engineering, East Sarajevo, B&H
[2] Technical College University of Nis, Serbia

Detection of biological and chemical structure is the most important thing in many areas dealing with the preservation of health and the science of life, from detection and diagnosis of various diseases and the possibility of screening of new molecules and the discovery of \"smart\" drugs. Therefore, the development of new devices that allow direct, sensitive and rapid analysis of these structures could affect the human race in a very significant way. Devices based on nanoscale appear as powerful and ultrasensitive electric sensors for direct detection of biological and chemical structure. This paper will talk about the possibilities of building and using these nanosensors, their ability to detect the substances, from protein and DNA molecules through and viruses, to the drug at the level of even one molecule. Moreover, we will demonstrate how to progress in their integration and multiplexing opens a clear path for variety interesante applications of these devices in medicine.

Keywords: nanosensors, CNT, FET, DNA, SWNT, MWNT, nanowire.

CORRELATION INCIDENT DERMAL DOSE IN STANDARD VERTEBROGRAPHY

R. Reljić[1], D. Mirjanić[2]
[1] Health Center, Kozarska Dubica, B&H
[2] Academy of Sciences and Arts of Republic of Srpska, B&H

During radiological examinations, the patient was inevitably a certain amount of radiation. The radiation dose depends on the type and on during of examinations. After discovery of X-ray device it was observed that X-ray has harmful effects on the human body and can even be lethal when administered in high doses over 5-6 Gy. International institution who work in this area established a system of units and measures for the reduction of the dose to the lowest possible dose with preservation of radiographic image quality. On the basis of World Health Organization report dose per capita within last 10 years has increased 20 %. In this study we shall analyze incident dermal dose per unit tests, the year of manufacture and the manufacturer of the equipment x-ray machine in correlation to new materials for absorption of x-ray.

Keywords: radiation dose, the old and the new generation of X-ray machine.

HYDROGELS FROM POLYACRYLIC ACID FOR REDUCED BIOADHESION ON SILICON CONTACT LENSES

Z. Ademović[1], P. Kingshott[2]
[1] Faculty of Tehnology, University of Tuzla, B&H
[2] Swinburne University of Technology, Australia

Contact lenses suffers from two limitations, low oxygen permeability and deposition of protein and lipids. In order to prevent bioadhesion surface must be completely inert to all biological reactions and to achieve this surface properties must be tailored. Also, to improve comfort surface must be highly wettable/lubrious and tear break up time should be improved. In this work surface of silicon contact lenses was modified by plasma induced copolymerization of acrylic acid. A wettable surface was generated and in addition carboxyl groups that were created on the surface provided the ideal reactive platform for subsequent grafting of polyethylene glycol and starch. Each surface modification step was analysed by FTIR, XPS and contact angle measurements. Protein adsorption on modified silicon contact lenses was analysed by surface-MALDI-ToF-MS. After 12 h incubation with artificial tear fluids SDS-PAGE and XPS analysis showed a reduction of adsorbed protein on hydrogel modified contact lenses. Additionally, fibroblast adhesion on modified contact lenses was reduced. Surface modification of silicon with PEG and starch is a method for reduction of protein adsorption and cell adhesion on contact lenses.

Keywords: hydrogels, protein adsorption, contact lenses.

POLYMERIC NANOPARTICLES AS DRUG CARRIERS

J. Sadadinović[1], Z. Iličković[1], M. Burgić[1], Z. Petrović[2]
[1] Faculty of Tehnology, University of Tuzla, B&H
[2] Faculty of Tehnology, University of Banja Luka, B&H

The properties of nanoparticles used as drug carrier are high stability, high carriers capacity, feasibiliy of incorporation of both hydrophvlic and hidrofobic substances, and feasibility of variable routes of administration. Nanoparticles for the purpose of drug delivery defined as submicron (<1μm) coloidal particles. This definition includes monolitic nanoparticles in wich the drug is adsorbed, dissolved, or dispersed through out the matrix and nanocapsules in wich the drug is confined to anaqueous or oily core surrounded by a shell. Alternatively, the drug can be covalently attached to the surface or into the matrix nanoparticles are made form biocompatibile and biodegradibile materials such as polymers, einther (eg. glatin, al-

bumin) or synthetic (eg. Polylactide (PLA), polyglycolide (PGA), polylactid-co-glycolide (PLGA), polymethylmethacrylate (PMMA), polyalkylcyanoacrylate (PACA), polystyren (PS), ethylcelulose (EC) and et.). In the body, the drug loaded nanoparticles in is usually released from matrix by diffusion, swelling, erosion or degradation.The concept of targeted therapy implies a suitable carrier of coloidal or polymeric nature of which is related (chemical bond orsorption) medicinal substances, with the carrier should be directed to take an active substance exactly to certain organ or group of cells where it is supposed to be free and it works. Carrier determines the path and fate of drugs in it, allowing to drug leaves the system with controlled speed.

Keywords: nanoparticles, polymers, drug delivry.

ALL - CERAMIC MATERIALS IN DENTAL CAD/CAM SYSTEMS - RECENT TRENDS IN THE DEVELOPMENT

B. Trifković[1], A. Todorovic[1], T. Puškar[2], R. Rudolf[3], A. Todorovic[1], V. Lazić[1], D. Jevremović[4]

[1] University of Belgrade, Faculty of Dentistry, Serbia
[2] University of Novi Sad, Faculty of Medicine, Department of Dentistry, Serbia
[3] University of Maribor, Faculty of Mechanical Engineering, Slovenia
[4] Bussines Academy, Faculty of Dentistry, Pančevo, Serbia

The initial concept of current CAD/CAM systems for intraoral digitization had three tenets, esthetic ceramic reconstruction, a single patient visit and minimal tooth reduction (inlays and onlays instead of crowns). However, different clinical indications induce aplication of CAD/CAM systems for extraoral digitization and ceremics materials with specific aesthetics and mechanical properties. The author reviews the structure, optical characteristics and mechanical properties of ceramic materials for CAD/CAM–fabricated restorations. On the market today are available different ceremic materials for the CAD/CAM technology, silica based ceramics, infiltration ceramics and oxide high performance ceramics. Several CAD/CAM systems offer silica based ceramic blocks for the fabrication of inlays, onlays, veneers, partial crowns and full crowns. The basic characteristics of silica based cereamic material are multicolored layers and highly esthetic. Blocks of infiltrated ceramics for CAD/CAM systems originate from the Vita In-Ceram system and they hawe various optical and mechanical characteristics. Currently available oxide high performance ceramics for the CAD/CAD technology are blocks of aluminum oxide and zirconium oxide. Alumina oxide is high performance ceramic. It is clinically indicated in cases of crown copings in the anterior and posterior area, and 3-unit fixed partial dentures (FPDs) in the anterior region. Zirconium dioxide ceramics have excellent mechanical properties. Zirconium oxide ceramics are indicated for the fabrication of crowns, FPDs and individual implant abutments. The cores have high radiopacity which is very useful in evaluation

of marginal integrity. Circonia has a color similar to teeth but if translucency is needed then other ceramic materials should be considered. This paper presents recent trends in development of aesthetic and mechanical properties of ceramic materials for CAD/CAM technology.

Keywords: CAD/CAM, ceremic, fixed partial denture.

APPLICATION OF STATISTICAL ANALYSIS METHOD IN THE INTERPRETATION OF RESULTS THE SURFACE WATER QUALITY

B. Matijević, Đ. Vaštag, M. Bečelić Tomin, S. Apostolov, B. Dalmacija

Faculty Natural Sciences and Mathematics, Department of Chemistry, Biochemistry and Environmental Protection, Novi Sad, Serbia

Monitoring of chemical and physical-chemical parameters of surface water is a very important factor in the quality control and managemen. Surface water quality is largely determined by atmospherics (natural process) and the discharge of industrial and municipal waste water (anthropogenic process). By applying different statistical methods (multivariate statistical analysis) can significantly reduce the bulkiness of the available data obtained by monitoring, and therefore the correct interpretation of the results of the quality and the ecological status of water. In this paper, using multivariate statistical analysis (cluster analysis, factor analysis and principal components analysis) processed the results of the analysis of surface water in AP Vojvodina during the 2011 year. Based on the results of statistical analysis it could by identified the main factors that have an impact on the ecological status and ecological potential of water flows. In this way it can improve the existing monitoring network.

Keywords: water quality, multivarite analysis, cluster analysis, principal components analysis.

STUDYING OF RETENTION BEHAVIOR, LIPOPHILICITY AND PHARMACOKINETIC CHARACTERISTICS OF N-SUBSTITUTED PHENYL-2-CHLOROACETAMIDES

S. Apostolov[1], Đ. Vaštag[1], B. Matijević[1], J. Nakomčić[1], A. Marinković[2]

[1] Faculty Natural Sciences and Mathematics, University of Novi Sad, Serbia
[2] Faculty Technology and Metallurgy, University of Belgrade, Serbia

The biological activity of compounds is mostly determined by its physical and structural characteristics. Among the many molecular descriptors that may indicate a potential biological activity of a compound, lipophilicity occupies the most important place. Since chloroacetamides show a variety of physiological activity, the task of this study was to investigate the potential biological activity of newly synthesized derivatives of selected N-substituted phenyl-2- chloroacetamides. Analysis was performed by

thin layer chromatography on reversed phase (RP18 F254s TLC), and the mobile phase consisted of mixtures of water-acetic acid and water-dimethyl formamide. By varying the volume fraction of organic modifier were determined chromatographic retention constants, RM0, of the compounds. Then RM0 were correlated with the software calculated partition coefficient, log P, as a standard measure of lipophilicity. Also, RM0 were correlated with selected pharmacokinetic parameters, intestinal absorption, HIA, the ability to bind to plasma proteins, PPB, and the distribution through the blood-brain barrier, BBB.

Keywords: RM0, log P, HIA, PPB, BBB.

RETENTION BEHAVIOR AND BIOLOGICAL ACTIVITY OF N-SUBSTITUTED-2-PHENYLACETAMIDE DERIVATES

Đ. Vaštag[1], S. Apostolov[1], B. Matijević[1], J. Nakomčić[1], A. Marinković[2]

[1] Faculty Natural Sciences and Mathematics, Novi Sad, Serbia
[2] Faculty Technology and Metallurgy, Belgrade, Serbia

Phenylacetamide derivatives are a group of compounds that exhibit a wide range of biological activities as analgetic, anticonvulsant, pesticide, cytostatic. It is well known that the biological activity and field of activity of the substance is greatly dependent on its physical, chemical and structural properties. In this paper, was applied QSRR analysis (Quantitative Structure Retention Relationships), which based on the prediction of biological properties of compounds based on their chromatographic retention behavior. In aim of this, retention constants of investigated N-substituted-2-phenylacetamide were determined by reversed phase thin-layer chromatography, (HPTLC RP18 F254s) in the presence of different volume fraction of n-propanol and tetrahydrofuran. The obtained data were correlated with different molecular descriptors in order to establish the mathematical model that describes the relationship between retention properties and biological activities of investigated phenylacetamides.

Keywords: N-substituted-2-phenylacetamide, QSRR analisys, TLC, RM0.

THREEDIMENSIONAL EXPERIMENTAL ANALYSIS OF DISPLACEMENT AND STRAIN FIELDS OF DENTURES

N. Mitrović[1], M. Milošević[2], I. Tanasić[3], Lj. Tihaček-Šojić[3], A. Petrović[1], T. Maneski[1], A. Sedmak[1]

[1] University of Belgrade, Faculty of Mechanical Engineering
[2] University of Belgrade, Innovation Center of the Faculty of Mechanical Engineering
[3] University of Belgrade, Faculty of Dentistry

In dental biomechanics it is very important to understand the nature of stress and strain distribution. Better explanation of stress and strain propagation through the jaw bone can improve standards in oral rehabilitation. This means, increasing

of biomaterials properties, above all their interactions with oral tissues. The aim of this study was to determine displacement and strain fields of the system of posterior mandible bone and dentures. System was subjected to vertical loading of 50-300 N and photographed using two digital cameras. Experiment was conducted using 3D system Aramis based on Digital Image Correlation Method. In this study are shown regions with highest strain and displacement values that can help in treatment planning of edentulous patients.

Keywords: strain field, displacement field, denture, Digital Image Correlation Method.

BIOCOMPATIBILITY OF GLASS IONOMER CEMENTS

D. Ćirić[1], T. Kanjevac[1], M. Milenković[2], R. Paunović[2], D. Brajković[1]

[1] Faculty of Medical Sciences Kragujevac, Serbia

[2] Students of doctoral studies, Faculty of Medical Sciences Kragujevac, Serbia

Biocompatibility, as one of the main features of glass-ionomer cements, is defined as an ability of a material to perform a certain function after its application in an organism, without provoking an adverse response of the host tissue. The aim of this review article was to present the results of studies that have examined the biocompatibility of glass-ionomer cements, which were conducted from 2008 to 2013. Resin modified and metal reinforced glass ionomer cements, in comparison to conventional glass ionomer cements, show less biocompability effects on pulp cells. The cytotoxicity of resin modified glass ionomer cements can be due to their constituents monomers HEMA or TEGDMA which, because of their hydrophilicity and low molecular weight, can easily diffuse through the dentinal tubules and induce apoptosis of dental pulp cells. Copper, silver and zinc ions are the components mainly responsible for the toxic effects of metal reinforced glass ionomer cements. The dentin barrier between toxic glass ionomer cements and the pulp cells may prevent pulp cell damage, so toxic glass ionomer cements should not be applied directly to the pulp tissue.

Keywords: glass ionomer cements, biocompatibility, citotoxicity.

ENDOSCOPES AND THEIR APPLICATION IN ROBOTIC SYSTEMS

M. Nikolić, I. Petrović, Z. Golubović

University of Belgrade, Faculty of Mechanical Engineering, Serbia

Endoscopic surgery has become the standard for performing many types of surgical procedures, and has applications in diagnostic and therapeutic methods. Endoscopes are devices of small diameter, that can be inserted in body cavities or

holes, and thus provide doctor access to certain part of the body. They can be in the form of endoscopic capsule and within remote controlled robotic systems. Endoscopic capsule, a promising diagnostic tool, an almost perfect product is made of bio-compatible material, dimensionally very favorable, applicable in less accessible parts of the human body, while not threatening the tissue of organs it moves through. This paper provides an overview of the type and structure of endoscopes and endoscopy capsules. In addition to this, it will be also presented a robotic system, the da Vinci system. This system consists of an endoscope (EndoAssist) which is designed as an assistance manipulating the endoscope.

Keywords: endoscopes, capsule endoscopy, robotic systems in surgery.

GUIDED BONE REGENERATION OF ORAL CAVITY: BIORESORBABLE COLLAGEN MEMBRANE

N. Tanasković

University Clinical Centre Banja Luka, B&H

The local deficit in bone mass, in the structure of lower and upper jaw can be a consequence of a trauma, infection, surgery or of congenital nature. Four models of bone augmentation are cited in literature: osteoinduction, in which appropriate growth factors are used, osteoinduction, where the graft materials are used as a matrix for growing of a new bone formation, distraction osteogenesis, where surgically implemented fracture of bone fragments enables their gradual movement in order to fill the existing bone defect and guided bone regeneration where the use of collagen membranes allows selective growth of bone tissue in the area formed by their application.

Keywords: bone regeneration, oral cavity, bio-resorbable collagen membrane.

ENDODONTIC NICKEL TITANIUM ROTARY INSTRUMENTS – NEW STANDARD IN ENDODONTICS

I. Nešković[1], V. Veselinović[2], I. Stojanac[1], S. Vujkov[1]

[1] Dental Clinic of Vojvodina, Serbia

[2] University of Banja Luka, Faculty of Medicine, B&H

Shaping of root canals in modern dentistry could be done in many ways by using, finger endodontic instrumenst, rotary endodontic instruments, or by using sonic or ultrasonic devices. Main question is could rotary Ni-Ti instruments really prove status of new standard in modern dentistry. Traditional finger endodontic

instuments are using step back techinque of shaping root canals, otherwise modern Ni-Ti rotary instruments are using crown down preparation techinque. Today on the market we can by many different rotary endodontic instruments, but only Pro-Taper instuments by, Densply, Maillefer Instruments Sa, Ballaigues, Switzerland, publicated details about Ni-Ti alloy that theese instuments are made of. The main characteristic of the instruments is memory shape effect that is caused by thermo-dynamic trait of Ni-Ti alloy. Name of alloy that endodontic instruments are made of is Nitinol, which is acronime of NI- Nickel, TI- Titanium and NOL- Naval Ord-nance Laboratory. This alloy showed unique, super-elastic feature that allows this material ability to revert into original shape after termination of the load.Rotary endodontic instuments could be flexed more than conventional instruments made of steal. This instument are highly corrosion resistant, and after all they are bio-compatible. Basic set of ProTaper instruments that is mainly used, has three shap-ing and three finishing instruments. Shaping instruments are for shaping root ca-nals, and finishing instruments are for final processing of root canal preparation. Finishing files are designed for finishing apical part of root canal, and also to ex-pand the central third of root canal. Progressive taper of the ProTaper insturments affect smaller dentine surface, and as resoult of that, torque fatigue and separation of the instruments is on low level. All ProTaper instuments are moving out dentine and bacterial debris out of the canal while shaping it. As other rotary instruments, ProTaper instruments could be operated by reducted rotary machine 150-350 rpm, but nowdays modern rotary machines allows to modify speed and resistance for each specific instrument. Rotary Ni-Ti instruments are new standard in modern clinics, beause time for shaping canals is reduced as well as the average number of instruments that are used.

Keywords: nickel titanium, endodontic instruments, pro taper.

EXPERIMENTAL ANALYSIS OF POLYMER VOLUME CHANGES USING 3D DIGITAL IMAGE CORRELATION METHOD

M. Milosevic[1], J. Perovic[2], S. Sedmak[2], U. Tatic[2], N. Mitrovic[3], M. Milosevic[2]

[1] Hemofarm AD, Serbia

[2] University of Belgrade, Innovation Center of the Faculty of Mechanical Engineering

[3] University of Belgrade, Faculty of Mechanical Engineering, Serbia

Volume change is an important mechanical property of polymers that can usually cause negative effects, such as errors during the determining of mold di-mensions and failure of tooth – polymer integrity. The aim of this study was to investigate the possibility to analyze local deformation fields of dental polymers upon polymerization using a non-contact optical method. A conventional dental polymer was placed in standardized molds and polymerized with a conventional

halogen light. Local deformation fields were determined using the two-camera system, Aramis 2M, by correlating sample dimensions before and after polymerization. Development of this experimental concept could help in understanding the behavioral patterns of different dental polymers.

Keywords: deformation, displacement, composites.

LOADING ANALYSIS OF DENTINE-COMPOSITE CONTACT AREA

M. M. Milošević[1], S. Sedmak[1], U. Tatić[1], J. Perović[1], V. Miletić[2]

[1] University of Belgrade, Innovation Center, Faculty of Mechanical Engineering, Serbia
[2] University of Belgrade, Faculty of Dentistry, Serbia

The aim of this study is to investigate composite loading conditions during chewing. Composite materials are widely applied in restorative dentistry, due to their improved aesthetic features and hardness. Flaws of composites include the occurrence of light-curing polymerization shrinkage and restoration failure due to chewing. Finite element method was used for analyzing of loads and deformations caused by chewing. An example of restoration on a pre-molar tooth was used as the model. A detailed description of preparing a 3D model with cavity is also shown in this study. Loading was applied to the composite, and maximum stresses which lead to failure were defined.

Keywords: restoration, loading, composites.

HYPERPLASIA OF THE UPPER LIP MUCOSA CAUSED BY CERTOMLIZUMAB PEGOL: A CASE REPORT

V. Biočanin, M. Stevanović, R. Paunović, M. Milenković
Faculty of Medical Sciences, Kragujevac, Serbia

Introduction: Hyperplasia of lip mucosa could be produced by different medicines. The aim of this report was to present a patient having unusuall mucosal hyperplasia of the upper lip caused by certomlizumab pegol. Patient's report, A 67 year old edentulous woman, with severe rheumatoid arthritis (RA), came to our clinic, after she had noticed painless duplicature of the upper lip a year ago. The patient came to our department because she had difficulties with eating and speaking caused by lip duplicature. Oedema in the region of upper lip duplicature was formed from time to time and was connected with certomlizumab pegol injection (Cimzia®). We suggested the patient to consult her doctor about changing the medicine (Cimzia®) if it is possible. Two months before the operation (excision of hyperplastic mucosa), Cimzia® was replaced with other medicine (Diclofenac Duo®). We performed the surgical intervention –

excision of hyperplastic mucosa and the wound was sutured primarily with resorptive sutures. The wound healed uneventfully. After two months of follow- up period, there was not any sign of recidive.

Conclusion: This case showed that Cimzia® caused mucous hyperplasia of the upper lip. Like all medicines, Cimzia® can cause side effects. The most common side effects produced by Cimzia® were bacterial and viral infections, fever, rash, itching and high blood pressure. It is interesting to note that it was the first case which shows lip hyperplasia caused by Cimzia®. In adition, this case showed that after changing the medicine and doing the surgery, there was not any recidive of the upper lip hyperplasia. The exact mechanism of lip hyperplasia produced by previously mentioned medicine is not known and could be the subject for the future research.

Keywords: certomlizumab pegol, lip hyperplasia.

INFLUENCE OF FISSURE SEALANT HELIOSEAL F IN CARIOUS FORMATION

J. Ilić[1], J. Stojičić[2], T. Adamović[3]

[1] Health Center Banja Luka, B&H
[2] Department of Dentistry, Banja Luka, B&H
[3] Faculty of Medicine Banja Luka, B&H

Introduction: Fissure sealing is a preventive therapeutic measure during which the fissures of healthy teeth are filled with different kinds of sealants. The deepest parts of fissures are hardly accessible, because of their anatomic characteristics, to toothbrush fibers, and because of that they represent an ideal place for carious formation. In order to prevent carious formation on that places fissure sealing is conducted. Helioseal F is a material resin-based, featuring fluoride release, increases remineralization, inhibits demineralization, increases enamel resistance. The main aim of this research is to assert the significance of fissure sealing in preventing carious formation.

Material and methods: The research was conducted in school health centre JZU Dom zdravlja Banja Luka. Thirty one child, aged nine participated in the study. On all patients fissure sealing was applied on occlusal surfaces of their first permanent molars (in total 186 teeth) with the Helioseal F sealant. Before the application of the sealant the teeth were cleaned with prophylactic toothpaste, isolated with cotton rolls and after that brushing of occlusal surface was executed with 37% phosphoric acid (20 sec). After the brushing and drying (20 sec) Helioseal F, which was polymerized (40 sec), was applied into the fissures. Results, First dental control was conducted one year after, during which new carious lesions were noticed on occlusal surfaces of three permanent molars (1,16%). Second dental con-

trol was conducted 24 months after and new carious lesions were registered on occlusal surfaces of seven permanent molars (3,8%).

Conclusion: The study showed that surveyed material shows positive prophylactic characteristics in carious formation, and the process of fissure sealing reduces the number of carious lesions in the area of occlusal surface.

Keywords: caries, fissure sealants.

EFFICACY OF ORAL ANTISEPTICS ELMEX AND LISTERINE ON THE DENTAL PLAQUE

T. Adamović, J. Stojičić, J. Ilić, A. Arbutina

University of Banja Luka, Faculty of Medicine, B&H

Introduction: Dental plaque is anopalescent biofilm composed of microorganisms, primarily bacteria, which accumulate on the hard and soft tissues of the oral cavityif oral hygiene is not adequate, causing a number of diseases.Elmexis an oral antiseptic containing amine fluorides, which are very easy to concentrate on the tooth surface and form a protective layer over the enamel. This makes enamel more resistant to the action of cariogenic bacteria. Amine fluorides have influence on the metabolism of bacteria that form dental plaque and they inhibit the accumulation of dental plaque. Listerineis an oral antiseptic that is one of the derivatives of phenols to which are added essential oils with antibacterial effects, menthol, eucalyptol, and methyl salicylate. Listerine inhibits the accumulation of dental plaque, has antibacterial activity andit is also effective against bad breath. The aim of this study was to determine the effectiveness of Listerine and Elmex to prevent the accumulation of dental plaque.

Materials and Methods: The study was conducted at the Faculty of Medicine (Department of Dentistry) in Banja Luka. 30 patients of different ages (20-30 years) and of different gender (10 male, 20 female) were divided into three groups. Dental plaque and tartar were removed from teeth of all patients, and they were given instructions how to maintain proper oral hygiene in the next two weeks. The first group (10 patients) was consisted of patients who had oral cavity washed out with Listerine (twice a day). The second group (10 patients) was consisted of patients who had oral cavity washed out with Elmex (twice a day). The third group, the control group (10 patients)was consisted of patients who did not use any solvent for mouthwashing. Patients of the first and second group were instructed to use oral antiseptics in addition to daily oral hygiene. For determining the state of oral hygiene of patients, in this research were used plaque index (Silness&Loe PI) and approximalplaque index (API). The measurements were performed at the beginning of the research and two weeks later. Results, At the beginning of the research, for the first group (Listerine)plaque index was 0.947 and after two weeks

0.867. At the beginning,for the second group (Elmex) plaque index was 0.818 and after two weeks 0.702. The third control group remained almost at the same level (0.784 to 0.799). Approximal plaque index for patients who used Listerine was 57.66% at the beginning of the research and decreased to 45.97% two weeks later (a reduction of 11.65%). Approximalplaque index for patients who used Elmex decreased by 8.85%, from 60.18% at the beginning of the research to 51.33%. For the control group decrease was only 7.72%.

Conclusion: In summary, this study has shown that oral antiseptics reduce dental plaque accumulation, but that regular oral hygiene is the essential prerequisite for oral health.

Keywords: dental plaque, oral antiseptics.

COMPARATIVE ANALYSIS OF MATERIAL FOR MAKING OF RETENTIVE POST CONSTRUCTION AT ENDODONTICALLY TREATED TEETH – BIOMIMETIC ASPECT

V. Veselinović, N. Gajić, N. Trtić, R. Arbutina

University of Banja Luka, Faculty of Medicine, Department of Stomatology, B&H

Rehabilitation of endodontically treated teeth is a constant problem in reconstructive dentistry. When the remaining dental tissues does not provide sufficient retention for conventional restorations, the treatment must include the kind of post construction that will support future prosthetic restoration. The "golden standard" in our region is individual, laboratory fabricationed metal cast posts of various precious and non-precious alloys. In addition to individually cast posts, there are also a pre-fabricated posts made of different kind of alloys. With the development of aesthetic dentistry and the introduction of all-ceramic restorations in practice, there is a need for aesthetic type of posts, made of different kind of ceramics, polyethylene fibers and fiber reinforced composites. Modern dentistry is based on the principle of biomimetics, or replacement of lost tooth tissue with artificial materials that faithfully reproduce features of tissue that are restored, and show very similar mechanical, physical, biological and aesthetic qualities. Type of material for posts affects the behavior of the tooth and the restoration under functional loading during mastication, as well as the quality, aesthetics and durability of restoration. The objective of this study is a comparative analysis of the existing post systems through their material, speaking in the light of the functions and biomimetic considerations of these restorations as a functional part of the living human organism.

Keywords: comparative analysis of material, retentive post construction at endodontically treated teeth, biomimetic aspect.

INFLUENCE OF THERMOCYCLING AND MECHANICAL CYCLIC LOADING ON RETENTION OF TEMPORARY CEMENTS FOR CEMENTATION OF PROSTHETIC RESTORATIONS ON IMPLANTS

V. Veselinović[1], D. Marković[2], I. Nešković[2], V. Mirjanić[1]

[1] University of Banja Luka, Faculty of Medicine, Department of Stomatology, B&H
[2] University of Novi Sad, Faculty of Medicine, Dental Clinic of Vojvodina, Serbia

Introduction: The most common way of retention of fixed restorations on implants is cementing. Luting agents, filling the space between the abutment and restoration surface , compensate for differences in the overlaps of the two areas and ensure retention of fixed restauration to the suprastructure. Cemented restoration is, in function in the oral cavity, exposed to a number of influences that can affect its retention, the most significant factors are masticatory load, temperature changes and high levels of humidity. The weakening of the retention force leads to the mobility of restorations and debonding. Simulation of the conditions in the oral cavity is achieved in vitro by thermocycling and mechanical cyclic loading in the machine for artificial aging.

Objective: Determine the effect of thermocycling and compressive mechanical loading on retention force of temporary cement used for the cementing of crowns on implants.

Material and Methods: Ten cast suprastructures were cemented on the implant abatment (Easy abatment, NP Nobel Biocare) with zinc oxide non eugenol temporary cement. During cement seating on the suprastructure is applied controlled pressure of 5 kg. Samples were then stored during the next 24 hours at 100% humidity and a temperature of 37 degrees C, after which they were subjected to thermocycling. Retention force, necessary to separate the cast from the abatment, is measured in the Universal Instrom testing machine. Retention force is recorded 24 hours after cementation, without application of the load, and then after the application 192, 2500, 5000 and 10 000 cycles of mechanical loading. Masticatory mechanical loads were simulated in the machine for artificial aging.

Results: Value of the retention force was changing depending on the number of cycles of mechanical cyclic loading. The mean value of the separation force ranged from 4.5 N with unloaded samples up to 18 N with the samples after 10 000 cycles.

Conclusion: Masticatory loading, conditions of moisture and temperature changes significantly impact the retention between restoration and implants abatment and consequently the stability and duration of the fixed restauration in function.

Keywords: influence of thermocycling and mechanical cyclic, retention of temporary cements, cementation of prosthetic restorations on implants.

THE INFLUENCE OF DIFFERENT LIGATION SYSTEMS ON THE OCCURENCE OF FRICTION DURING THERAPY WITH FIXED ORTHODONTIC APPLIANCES

A. Arbutina, V. Mirjanić, S. Marin, T. Adamović,
M. Umićević Davidović, M. Arapović Savić, I. Čupić
Faculty of Medicine, Departmant of Dentistry, Banja Luka

One of the factors that can significantly slow down the therapy with fixed orthodontic appliances is friction that occurs during teeth's movement along the archwire. A large number of factors influence the occurrence of friction such as: bracket material, material of archwire, surface roughness of the bracket slot and archwire, mesiodistal width of brackets (interbracket distance), diameter of archwire, type of ligature applied during treatment. The choice of ligation systems should be adapted to the therapy plan (elastomeric ligatures, elastomeric ligatures coated with silicone, stainless steel ligatures, self-ligating brackets) so that the side-effects that can significantly prolong orthodontic therapy could be avoided. The aim of this study is to make a brief review of the impact of different ligation systems on the occurrence of friction in orthodontic therapy.

Keywords: friction, ligation systems, orthodontic therapy.

ENERGY TRANSFER CAUSE CHANGES IN NIR SPECTRA OF WATER

D. Šarac[1], J. Munćan[1], L. Matija[1], R. Tsenkova[2], Đ. Koruga[1]
[1] Faculty of Mechanical Engineering, Serbia
[2] Faculty of Agriculture, Tokyo, Japan

In our everyday diet we take water into our organism by drinking or through food which is processed in different ways. The quality of drinking water and food has direct effect on human health. Today there is so many recommendations about what kind of water to drink or what kind of food to eat, and how it should be processed in order to stay healthy. In this paper we analyzed several tap and commercial mineral waters (non-carbonated), and we exposed them to several types of processing. Every type of water was subjected to heating on the stove up to boiling point, because there are different recommendations by medical doctors that boiled water has positive health effects [1]. We also exposed waters to heating in microwave oven, because food processed in this way is regular part of diet today and various conflicting reports exist and can be found about whether the exposure leads to harmful, beneficial or no effect at all on human health, but this topic is rarely or if at all, a subject of serious investigation. And we also wanted to see if the exposure to sunlight has any effect on these water

types, due to hypothesis present today that sun irradiation creates some kind of organization in water [2]. After exposure to these various types of irradiation, all waters were left to cool down in room ambient, and their near infrared spectra were recorded and compared to original waters which were left untreated. The samples of treated and untreated water were used to water the wheat plants in order to see if there is a difference in plant growth dependent on water type and type of water processing. The results of analysis of water are discussed from Aquaphotomics point of view, and presented using aquagrams [3]. The plant growth was measured and results of measurements are presented in histograms.

Keywords: water, microwave, heating, sun irradiation, aquafotomics.

THE IMPACT OF FILTER MEMBRANES TO STRUCTURAL CHANGES IN LOW MINERAL WATER

Č. Lalović[1], Z. Golubović[2], B. Jeftić[2], J. Šakota Rosić[2], M. Tomić[2]

[1] High Technological School of Professional Studies, Serbia
[2] Faculty of Mechanical Engineering, Serbia

This paper presents the structural changes that can be identified in low-mineral Aqua Viva water using four separate samples corresponding to different stages of its filling,

1. The stage before final treatment (inlet pipework)
2. After the first treatment phase using polypropylene membrane surface porosity 2.5 μm.
3. After the second treatment phase using polypropylene / glassfibre membrane porosity 0.45 μm.
4. After the final treatment phase using the double polyethersulfone membrane porosity of 0.2 μm.

As a comparative parameter is used demineralized water Aqua Purificata with conductivity of 0,055μS/cm. Characterization of water was done by two methods, Opto-Magnetic and NIR Spectroscopy with Aquaphotomics approach, based on the interaction of light and water. Aqua Viva manifests itself as a strong pair - diamagnetic and its clear structuring occurs only after treatment at the level of 0.2 μm. Resulting Aquagrams suggest that only the 0.2 μm filter leads to the appearance of an increased number of water dimer and its major reorganization.

Keywords: structural changes, first treatment phase, porosity, low-mineral water.

NEAR INFRARED STUDY OF SEMIHEAVY WATER

J. Munćan[1], I. Mileusnić[1], R. Vojnić Tunić[2], L. Matija[1], Đ. Koruga[1]
[1] Faculty of Mechanical Engineering of Belgrade, Serbia
[2] Dr Rudolf's Magnet System d.o.o, Serbia

Physical properties of heavy D2O and semi heavy water D2O are different comparing to H2O. For example, heavy water has greater density, it is more viscous and has higher melting and boiling point. Chemical bonds in heavy water are stronger comparing to hydrogen bonds of ordinary water. [1] In the present study the NIR spectroscopy with Aquaphotomics approach [2] has been applied for analyzing 2 water types. These two waters are semi heavy waters, one contains 155ppm of D2O and the other type contains 105ppm of D2O. In order to describe structural and organizational aspects of water molecules and thereby characterize each of these waters the NIR spectra of these waters were recorded and analyzed using multivariate analysis and Aquaphotomics. Changes in water matrix coordinates (WAMACs) upon perturbation due to presence of D2O are identified and discussed. [3] D.J. Kushner, A.baker, T.G.Dunstall, Pharmacological uses and perspective of heavy water and deuterated compounds, Canadian Journal of Physiology and Phramacology, 77(2), 79–88, 1999 [4] R.Tsenkova, Introduction to Aquaphotomics, dynamic spectroscopy of aquaous and biological systems descibes peculiarities of water. Journal of Near Infrared Spectroscopy, 2009. 17, p. 303–314.

Keywords: semiheavy water, heavy water, water, deuterium, near infrared spectroscopy, aquaphotomics.

CHANGES IN THE INFRARED SPECTRA OF LIQUID WATER EXPOSED TO SUN IRRADIATION

J. Munćan, D. Šarac, A. Vasić, J. Simić Krstić, Đ. Koruga
Faculty of Mechanical Engineering of Belgrade, Serbia

Recent advances in water science have introduced a relatively new idea that water may have not just three, but four phases, and this fourth phase of water – gel phase can explain phenomenon of so called exclusion zone water [1]. It is hypothesized that life has come from water because photons from sunlight may exert effects on water that go beyond mere heating, and that part of this solar energy is spent on separating the charges in water. This process may be a central protagonist for the origin of life [2]. According to one spectroscopic study of changes in liquid water induced by sunlight irradiation, distinct changes were found in the area of the O-H stretching region [3]. The spectrum shape in the range 2800-3800cm-1 be-

came trapezoidal on irradiation for more than 30min under sunlight, and the spectrum gradually changed to restore to the original spectrum after 180min. The changes in this part of the region of infrared spectra of water were related to formation and elimination of clathrate like structures [3]. The aim of this study was to examine does sun irradiation cause changes of water spectrum in entire mid infrared region – approximately from 400-4000cm1, where fundamental stretching mode and in-plane bending mode occur within the 3900-2800cm-1 and at around 1640cm-1. The experiment was conducted with several types of waters which were exposed for 2 hours to sun irradiation, the strength of which was approximately 700W/m2. The FTIR-ATR spectra were recorded for all waters immediately after exposure, and 1h after exposure. The changes in infrared spectra of all waters were noticed in both broad peaks, around 3500cm-1, which corresponds to two stretching modes, and also around smaller peak 1600cm-1 corresponding to bending mode. The changes were similar, and in spectra of waters 1h after exposure to sun irradiation, the spectra were almost returned to original, non-exposed waters‘ spectra. In order to test whether these changes come from thermal effects, the same waters were exposed to heating up to same temperature measured in samples after sun irradiation and the spectra of these heated samples are recorded and compared to spectra of water under sun irradiation.

The results are presented and discussed.

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Keywords: sun irradiation, water, FTIR spectroscopy.

ENERGY OPTIMIZED UV REACTOR FOR HIGH DYNAMIC OF CAPACITY AND WATER QUALIT

S. Obradović[1], S. Milanović[2], Đ. Milanović[2], P. Štrbac[2], V. Petrović[2]

[1] Electrotechnical Faculty, University of East Sarajevo, B&H
[2] FKN, Serbia

Microorganism\'s inactivation is achieved by ultraviolet radiation at 254 nm (about 5 eV) as well as unstable oxidizing chemicals (ozone, hydrogen-peroxide, hypo-chlorites, etc.) decomposition, for their elimination, or unwanted fluid content accelerated oxidation, which can be hardly achieved by any other means. In

order to achieve reliable water sterilization, it is necessary to provide suitable radiation dose for the worst conditions. UV radiation source power is determined the worst conditions. The worst conditions are, maximum water flow, minimum requested radiation dose that UV reactor must deliver, UV radiation sources power at the end of their service life, the UV lamps quartz sleeves maximum fouling permitted level, the mains lowest voltage and the lowest fluid transparency that can fluctuate in real working conditions. This approach leads to the conclusion that for the large UV reactor a high power is consumption is requested. Since the water flow rate through the reactor is not constant, the power regulation by number of active lamps to obtain adequate intensity and UV radiation dose, is mandatory. When water flow rate is reduced the UV reactor power can also be reduced, but without diminishing the required radiation dose that insures water UV treatment. In order to determine the radiation dose and to optimize the reactor geometry, we must analyze the distribution of intensity of UV radiation in a prismatic shaped reactor, with square cross-section, in which walls partly reflect UV radiation of multiple radiation sources (UV lamps). The fact that the UV reactor has multiple sources of radiation is the basis for optimizing the energy efficiency, depending primarily of the flow rate and the age of the UV lamps. The paper describes a system for a water facility, for water disinfection-sterilization in where the number of active radiation sources over open channel shaped UV reactor changes proportionally to the consumption, i.e. changes with the water flow rate. The system is designed so that the number of active radiation sources over the UV reactor always provides the desired radiation dose for a given water flow rate. System operation is based on measuring the water flow rate and water transparency at the reactor inlet pipe. This UV reactor concept makes possible to achieve significant savings in power consumption. It also makes possible to extend the lamps life by optimizing the individual radiation sources usage and even automatic replacement lamp that does not work with one that is in stand by arrange, by detection a lamp failure. This is not possible in UV reactors when lamps are immersed in the fluid.

Keywords: UV radiation, radiation dose, energy efficiency.

WHY DOES EXCLUSION ZONE APPEARS ONLY ON THE POSTERIOR SIDE OF THE CORNEA AND CONTACT LENSE

V. Munćan, P. Nikolovski, B. Kosić, I. Petrović, M. Nikolić
Faculty of Mechanical Engineering of Belgrade, Serbia

Lots of hydrophilic materials when put in water/aqueous solutions show near-surface zones that exclude suspended colloids, microspheres, and/or other dissolved molecules. These "exclusion zones" (EZ) can extend up to hundreds of micrometers from the hydrophilic surface, and show different physical and chemi-

cal properties from regular water. EZ were observed near many types of surfaces, both artificial and natural, hydrogels, biological tissues, hydrophilic polymers, monolayers, as well as with a variety of solutes. EZ, the unexpectedly large layers of water that form next to many submersed materials, got its name because it excludes practically everything. In 1970, a study by K. Green and T. Otori, showed that EZ also forms on the posterior side of undamaged samples of natural cornea (rabbit cornea) and of contact lens, when submersed in water. The size of the EZ was directly measured by optical apparatus, and under different rates of stirring. EZ, the unstirred layer of fluid, bounding only to the posterior surface of the sample was around 350 μm thick on the cornea, and 150 μm thick on the lens. After heavy stirring, this layer was reduced, but remained visible (65 μm on the cornea and less than 20 μm on the contact lens). However, EZ did not form on the anterior side of the membrane. An interesting fact is that the exclusion zone appeared on posterior surface of both biological membrane (cornea) and of artificial one (contact lens), which leads to the conclusion that formation of EZ is not determined by uneven or rough surfaces or the origin of the material. Taking into account that all samples were submersed into the same water, and that EZ is created because of separation of charge, we come to the conclusion that the only difference between the posterior and the anterior side of cornea or lens is in its shape, and that the shape of surface is the reason for creating EZ only on the posterior side. In this paper, we will review possible theories for this phenomenon. We will investigate what happens on each side of the membrane (convex and concave), and discuss the properties like surface pressure, adhesive and cohesive forces, wetting angle, and search for crucial differences because of which EZ forms only on posterior side. The answer on this question is important for understanding the principles of how exclusion zones forms, and under what conditions EZ will form - that are not based just on properties of the material alone.

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Keywords: water, exclusion zone, cornea, contact lens, adhesive forces, cohesive forces, surface tension, wetting angle.

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