PREGLED NAUČNIH I STRUČNIH REZULTATA INSTITUTA IMS U 2011. GODINI

Institut za ispitivanje materijala a.d.

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PREGLED NAUČNIH I STRUČNIH REZULTATA

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Izdavač

Institut IMS a.d.

Beograd, Bulevar vojvode Mišića 43

www.institutims.rs

Za izdavača

Dr Vencislav Grabulov

Urednici

Dr Vencislav Grabulov

Dr Aleksandra Mitrović

Goran Petrović

Štampa

Razvojno-istraživački centar grafičkog inženjerstva

Tehnološko-metalurški fakultet, Beograd, Karnegijeva 4

Tiraž

300 primeraka

I ove godine nastavljamo sa upoznavanjem naučne i stručne javnosti sa ostvarenim rezultatima istraživačkog rada u nauci i realizovanim značajnijim projektima. Kao i prošlih godina, rezultati su razvrstani prema klasifikaciji datoj u Pravilniku o postupku i načinu vrednovanja i kvantitativnom iskazivanju naučno-istraživačkih rezultata istraživača Ministarstva za nauku i tehnološki razvoj.

Tokom 2011. Institut IMS je ostvario značajne naučne i poslovne reference. U okviru novog ciklusa naučnih projekata za period 2011-2014. godina, Ministarstvo prosvete i nauke odobrilo je učešće istraživačima IMS na 8 projekata iz Programa tehnološkog razvoja, 2 projekta iz Programa integralnih i interdisciplinarnih istraživanja i 4 Projekta iz Programa osnovnih istraživanja. Posebno čime se IMS može ponositi je 14 mladih istraživača upisanih na doktorske studije, čije školovanje Institut finansira iz sopstvenih sredstava. Rezultati istraživačkog rada, u odnosu na prethodne godine, ukazuju na značajan kvalitativni napredak – kroz povećan broj publikacija u međunarodnim časopisima i učešće istraživača na vodećim međunarodnim skupovima. Takođe, Institut IMS je organizator ili suorganizator 4 naučno-stručna skupa, od kojih su 2 međunarodnog značaja.

Stručne reference, navedene u poglavlju Odabrane stručne reference, su kao i svake godine impresivne. Uprkos problemima sa kojima je suočena građevinska i mašinska industrija, Institut je uspeo da obezbedi značajne poslove u oblasti projektovanja, ispitivanja i istraživanja građevinskih objekata, ispitivanja materijala, razvoja i transfera tehnologija građenja. Svaka od pomenutih referenci ima svoj značaj. Ovoga puta treba istaći izradu studije „Primena i plasman pepela nastalog u elektranama EPS-a", kao i ekspertize na poslovima revitalizacije Hidroelektrane Đerdap, čime je potvrđen povratak Instituta IMS na poslove najveće složenosti za Elektroprivredu Srbije.

Urednici

SADRŽAJ

REZULTATI NAUČNO-ISTRAŽIVAČKOG RADA

REZULTATI NAUČNO-ISTRAŽIVAČKOG RADA

1. RADOVI U TEMATSKIM ZBORNICIMA MEĐUNARODNOG ZNAČAJA (M14)

Z. Odanović, B. Bobić, V. Grabulov, B. Katavić, M. Arsić

INVESTIGATION OF THE LIGHT WEIGHT CERAMICS/METAL COMPOSITE ARMOUR PROTECTION CAPABILITIES

„New Design Concepts in Light-Weight Armour for Vehicles“, Universidade de Aveiro, Aveiro, Portugal, 2011, 1111-P, 1-17.

Ballistic protection of the two layer composite ceramic/metal armour applicable for non battle vehicles was investigated. Composite armour consisted of ceramic Al2O3 elements on the facing - front side and high strength aluminium alloy or armour steel sheets on the back side. Different combinations of ceramics in thickness of 8, 9 and 13 mm with Al alloy in thickness of 5, 8 and 16 mm or armour steel of 5 and 6 mm in thicknesses were used in ballistic tests. Protection effects were analyzed by using different test bullets as 5.56, 7.62, 7.9 and 12.7mm. Also, tests were performed at target distances of 100 and 10 m. Projectile velocities as V10 and V3 were measured. Obtained results relating to ballistic protection effects and ballistic efficiency of the composite ceramic/metal armour were analyzed and discussed.

2. RADOVI OBJAVLJENI U NAUČNIM ČASOPISIMA MEĐUNARODNOG ZNAČAJA (M20)

RAD U VODEĆEM MEĐUNARODNOM ČASOPISU M21

M. Cocić, M. Logar, S. Cocić, S. Dević, D. Manasijević

TRANSFORMATION OF CHALCOPYRITE IN THE ROASTING PROCESS OF COPPER CONCENTRATE IN FLUIDIZED BED REACTOR

JOM, 05,Vol. 63, 2011, 55-60.

This work presents the results of investigation process of copper concentrate roasting in fluidized bed reactor with the aim of studying the transformations of copper concentrate minerals as well as to check the accordance with theoretical predictions. The roasted samples were examined using chemical analysis, x-ray diffraction, and mineral microscopy

B. Međo, M. Rakin, M. Arsić, Ž. Šarkoćević, M. Zrilić, S. Putić

DETERMINATION OF THE LOAD CARRYING CAPACITY OF DAMAGED PIPES USING LOCAL APPROACH TO FRACTURE

Materials Transactions. JIM, doi:10.2320/matertrans.M2011210.

The subject of this study was the application of local approach to ductile fracture in order to estimate the integrity of damaged seam casing pipes for oil and gas drilling rigs. The experimental testing included tensile testing of specimens and a pressure test of a pipe with different levels of damage simulated by machined notches. In exploitation, such structures (i.e., pipes with local thin areas) can fail by the ductile fracture mechanism or by plastic collapse in the ligament. However, the majority of the procedures for determining their integrity are based on limit loads, i.e., plastic collapse criteria. In this work, a pipe subjected to internal pressure was modelled using the finite element method and local approach to fracture (the Complete Gurson Model - CGM),

with the aim of determining damage development in the material (i.e., at the bottom of a machined defect) and of establishing the criteria for the maximum pressure that a damaged pipe can withstand. The results obtained using the micromechanical model are discussed and compared with several often used limit load expressions from the literature and a stress-based finite element criterion. It is shown that local approach can give appropriate results and represent failure criterion for pipes with local thin areas.

Keywords: casing pipe, simulated corrosion defect, local approach, finite element method, maximum pressure.

M. Đurđević, Z. Odanović, N. Talijan

CHARACTERIZATION OF THE SOLIDIFICATION PATH OF ALSI5CU(1–4 WT.%) ALLOYS USING COOLING CURVE ANALYSIS

JOM, Vol. 63 No. 11, 2011, 51-57.

Available databases presently used by commercial simulation software packages for the aluminum casting industry usually come with material properties for only a few selected standard alloys. In the case of other alloys with different chemical compositions and refinement or modification treatment, thermal analysis could be an invaluable tool in order to gain necessary properties. The aim of this paper is to characterize the solidification paths of Al-Si5-Cu(1–4) alloys and quantify the amount of solid fraction using cooling curve analysis. The correlation between solid fraction and temperature has been determined using Newtonian and Fourier techniques of base line. Both techniques are also briefly described in this paper. The obtained results have been compared with results obtained using available commercial software (e.g., Pandat and JMatPro).

RAD U ISTAKNUTOM MEĐUNARODNOM ČASOPISU M22

D. Momčilović, Z. Odanovic, R. Mitrovic, I. Atanasovska, T. Vuherer

FAILURE ANALYSIS OF HYDRAULIC TURBINE SHAFT

Engineering Failure Analysis, 2011, doi: 10.1016/j.engfailanal.2011.10.006

This paper describes the analysis of major failure of 28MW horizontal hydro turbine shaft. The analysis of load carrying capacity of critical radius and fractography analysis are presented. Special emphasize is on metallurgical failure analysis of in-service crack initiation. The analysis of stresses is obtained by the finite element method and the developed model and load conditions are described. Finite element analysis is performed for case of normal service and start-up regime. Based on the failure analysis and numerical calculations, it could be concluded that the seal box design led to constant flow of river water in zone of critical radius which resulted as occurrence of corrosion fatigue cracks and major failure of turbine shaft. Suggestions for problem solution for the turbine shaft are also presented.

S. Bošnjak, M. Arsić, N. Zrnić, M. Rakin, M. Pantelić

BUCKET WHEEL EXCAVATOR: INTEGRITY ASSESSMENT OF THE BUCKET WHEEL BOOM TIE-ROD WELDED JOINT

Engineering Failure Analysis, 2011, Vol.18, 212-222.

The bucket wheel boom tie-rods are vital structural parts of the bucket wheel excavators (BWE). Their failures inevitably cause BWE collapse and are followed, among other things, by a substantial financial loss (millions of €). Non-destructive testing revealed a flaw in the butt welded joint of the body and eye-plate of the bucket wheel tie-rod. Its size exceeds the level allowed by current technical regulations. An integrity assessment of the bucket wheel tie-rod has been carried out, i.e. the remaining fatigue life has been determined based on the stress-state characteristics in the welded joint and defined by experimental research in real working conditions. The calculation results show that despite the excessive size of the internal flaw the welded joint integrity is

not compromised. During periodical inspections of the welded joint in the past two years (BWE was put into operation in December 2007) changes that could compromise the structural integrity were not observed. In this way, by using a fail-safe philosophy design, a considerable financial saving (ca. 1,600,000 €) was achieved while at the same time there was no threat to the worker's safety and life, the safety of the machine and the production process in the open pit mine.

Keywords: bucket wheel boom tie-rod, non-destructive testing, welded joint, fatigue, structural integrity.

M. Savković, M. Gašić, M. Arsić, R. Petrović

ANALYSIS OF THE AXLE FRACTURE OF THE BUCKET WHEEL EXCAVATOR

Engineering Failure Analysis, 2011, Vol.18, 433-441.

The common design of the bucket wheel drive mechanism in some bucket wheel excavators (BWE) consists of a gearbox and a hollow shaft, while the bucket wheel is supported by the axle passing through the hollow shaft. Improper maintenance and inadequate elimination of axis misalignment of the hollow shaft and the bucket wheel axle are the main causes of excavator failure and axle fracture. The paper examines the causes of bucket wheel axle fractures. Experimental testing of the chemical composition and mechanical properties of the material used to make the bucket wheel axle and metallographic inspections of the fracture surfaces in the bucket wheel axle by means of electronic and light microscope carried out in the first part of the paper have shown that there are no significant inhomogeneities and errors in the material of the axle. The second part of the paper presents the FEM analysis of influences of disturbances on the manner of support of the bucket wheel axle on the fracture. It shows that the negative influences of support of the axle reflected through the increase in the stress concentration and occurence of the initial crack are the main causes of the axle fracture.

Keywords: bucket wheel excavator, bucket wheel axle, failure analysis, experimental testing.

M. Arsić, S. Bošnjak, N. Zrnić, A. Sedmak, N.Gnjatović

BUCKET WHEEL FAILURE CAUSED BY RESIDUAL STRESSES IN WELDED JOINTS

Engineering Failure Analysis, 2011, Vol.18, 700-712.

Cracks in the welded joints on the bucket wheel (BW) body of the bucket wheel excavator (BWE) SRs 1300 were discovered after merely 1800 h of operation. Investigations are carried out in order to detect the causes of cracks occurrence and thus prevent possible heavy damages to the machine. Working stresses in the BW body are defined by using FEM. Methods of strain gauges are used for the experimental stress analysis in real working conditions. Measurements of welding residual stresses are carried out by applying the centre hole drilling method. Additionally, experimental investigations defined the chemical composition, tensile properties, hardness, impact toughness, as well as the susceptibility to cracking (measurement of residual hydrogen, FISCO, Tekken and CTS methods). External loads induced by the resistance-to-excavation are determined by following a model that encompasses all relevant structural parameters and also the BWE duty cycle parameters. By using FEM, it was identified that the maximum values of equivalent stress in the zones of cracks occurrence are lower than the allowable values. This conclusion is confirmed by measurements. The measured values of welding residual stresses reach the value of yield strength in critical zones. Non-compliances during grooving (clearance in the root is substantially larger than the prescribed one) caused large filler material deposition and heat input. Such welded joints are susceptible to cold cracking. Based on the results of the numerical–experimental analysis, findings show that in critical zones the combination of working (dynamic) and residual (static) stress can be above the limit lines of modified Goodman's.

Keywords: bucket wheel, cracks, residual stress, stress analysis, fatigue safety evaluation.

N. Bajić, V. Šijački-Žeravčić, B. Bobić, D. Čikara, M. Arsić

FILLER METAL INFLUENCE ON WELD METAL STRUCTURE OF MICROALLOYED STEEL

Welding Journal, 2011, Vol. 90, 55-62 .

This paper investigates the impact of the chemical composition of the filler metal and welding regimes on the structure of weld metal and the HAZ of micro alloyed steel of increased strength, class Nb/ V, mark X65 (according to API 5L standard). Experimental welding of samples of the steel strip (thickness 9.5, 11.0 and 14.5 mm) was performed by E - procedure, with different welding regimes, using two fillers of different chemical composition. Based on the analysis of the structure of the weld metal and the HAZ the proportion of individual micro constituents was determined in order to select the optimal composition of the filler and welding regime. It was shown that the filler marked NM1 (1.4% Ni, 0.35% Mo) affects the achievement of optimal relations of structural components (AF, SF, FS) which was confirmed by testing of fracture toughness at low temperatures. It was also shown that finer structure in the HAZ area could be achieved at low level of heat input.

Keywords: ferrous metals, steel alloys, welding, microstructure.

M. Arsić, S. Bošnjak, Z. Odanović, M. Dunjić, A. Simonović

ANALYSIS OF THE SPREADER TRACK WHEELS PREMATURE DAMAGES

Engineering Failure Analysis, 2011, doi:10.1016/j.engfailanal.2011.11.005

The superstructure of the ARs 2000 spreader leans on three crawlers of identical length, width and height. Serious damage to the track wheels threads occurred already during the spreader's travel from the erection site to the open pit mine as well as immediately after the overburden system exploitation started. The goal of the study presented in this paper was to diagnose the cause of the track wheels premature damage. Contact stresses on the track wheel bearing surface are defined by applying Hertz's theory and FEM. In order to clarify the causes of the damages, experimental investigations were performed with the purpose of defining the chemical composition, tensile properties, impact toughness and

macro and microhardness of the track wheel material. Metallographic examinations were also conducted. Based on the results of the analytical-numericalexperimental analysis, it can be concluded that track wheels failures are predominantly caused by the 'design-in' and 'manufacturing-in' defects.

Keywords: spreader, track wheels, damage diagnostics, stress analysis, experimental investigations.

RAD U MEĐUNARODNOM ČASOPISU M23

B. Jegdić, A. Alil, Z. Milutinović, Z. Odanović, B.Gligorijević, B. Katavić

PRIMENA ELEKTROHEMIJSKIH METODA ZA ISPITIVANJE INTERKRISTALNE KOROZIJE ZAVARENOG SPOJA AUSTENITNOG NERĐAJUĆEG ČELIKA 19CR–9NI

Hem. Ind. 65 (2), 2011, 179–186.

Stepen senzibilizacije zavarenog spoja austenitnog nerđajućeg čelika 19Cr–9Ni (AISI 304) na koroziju, ispitivan je elektrohemijskim metodama potenciodinamičke reaktivacije sa povratnom petljom (DL EPR) u rastvoru H2SO4 + KSCN i merenjem korozionog potencijala u kapi rastvora HNO3 + FeCl3 + HCl. Postoji dobra saglasnost rezultata ispitivanja navedenim elektrohemijskim metodama. Pokazano je da su osnovni metal i metal šava otporni prema interkristalnoj koroziji, a zona uticaja toplote (ZUT) senzibilizovana ili na granici visoke sklonosti prema interkristalnoj koroziji.

S. Dević, M. Logar, M. Cocić

STRUCTURE AND MINERALS OF MAG-CHROME REFRACTORY BRICKS FROM CASTING LADLES AFTER CONTACT WITH SLAG

Refractories Manual, 1, 2011, 59-60.

Refractory bricks for casting ladles in the production process are in contact with steel and slag. During the transfer and technological treatment with steels (alloying, deoxidation, dephosphorization, vacuuming, etc.) refractory bricks are exposed to high temperatures, the effects of slag and steel effect.. The effects of slag in part cause considerable changes to the refractory bricks. This paper provides the structure and minerals of mag-chrome refractory bricks from casting ladles after the effect of slag. Optical microscopy in transmitted light served to investigate and present the gradual degradation of the structure of mag-chrome refractory bricks. The degradation ranges from contact of the slag with a brick. Slag gradually penetrates into the brick structure, destroying it and while spreading, it creates favourable conditions for chemical reactions and

further destruction. The strength of the effects of slag and refractory bricks' destruction depends on many factors. These are technological treatments to which the steel is exposed, technological parameters that are the proper conduct of the process, types of supplements in the treatment process of steel that are added, the quality of lining ladles and refractory bricks built into the same and more, but that is a topic for another paper.

S. Dević, M. Logar, M. Cocić

THE CHARACTER OF TWO CLAY DEPOSITS OF SERBIA, AS APPLIED TO THE CERAMICS INDUSTRY

Interceram - International Ceramic Review, 60 [3], 2011, 194-195.

The character of the clay is determined based on the results of mineralogical and chemical investigations presented in this paper. Clay mineral were investigated, using XRD and electron microscopic method, a chemical XRF method. Basic characteristics of tested clays show that they have the character of ceramic clay. Both belong to the kaolinite clay type of clay. This confirms the mineral composition of clay in which the main mineral kaolinite. Displayed the characteristics of clay that have are suitable for use in the production of fine and coarse pottery. Produces fine and coarse pottery are the most common ceramic tiles, sewer pipes, acid-drawn plates, collector plates and so on.

G. Mladenović, J. Ćirilović, C. Queros

NETWORK-LEVEL PAVEMENT MANAGEMENT:
THE CASE OF SERBIAN LOW-VOLUME ROADS

Transport Research Record, 2011, vol. 2, 221-228.

The paper presents the application of World Bank's model RONET to strategic network level analysis of the Serbian state low volume road (LVR) network. This network condition deteriorated considerably during the 1990s due to under-financing of operations and maintenance. In recent years financing for the road sector has gradually increased focusing on the most hazardous and highly trafficked parts of the road network. However, the overall budget allocated to the sector remains inadequate to maintain the entire state road network in stable condition. The goals of the presented study are to obtain the optimum

maintenance and rehabilitation (M&R) strategy and related budget, estimate the impact of different funding levels on the future quality, and estimate the economic consequences of budget constraints for maintenance and rehabilitation of the LVR network. Application of the RONET model to the prevailing conditions on the Serbian LVR network led to an optimal M&R strategy with a good balance between rehabilitation, periodic and recurrent maintenance. Implementation of the "Optimal" M&R strategy would cause major improvement compared to the current condition of the LVR network. Implementation of higher M&R standards would lead to substantially higher road agency costs and consequently lower net benefits, while the implementation of lower M&R standards would lead to considerably worse network condition for approximately the same or slightly lower agency costs. This means that even minor budget constraints would result in considerably worse network condition and much higher total road transport costs.

Lj. Milović, T. Vuherer, M. Zrilić, D. Momčilović, D. Jaković

STRUCTURAL INTEGRITY ASSESSMENT OF PRESSURE VESSEL PRODUCED OF HSLA STEEL

Journal of Iron and Steel Research International, 2011, vol. 18, 888-892.

Welded joint is a critical region of a welded structure. The oprational safety of welded pressure equipment mostly depends on he behaviour of loaded weldments. Safetz of welded structure is dependent on the properties of welded joint as whole and of its constituents)parent metaal, heat affected zone and weld metal). In this paper the behaviour of welded joint cracked constituents is considered. Structural integrity assessment procedure is applied to welded pressure vessel produced of high-strength-low-alloy steel, operating at -40oC, comparing crack driving force and material crack resistance, using path independant contour J-integral as fracture mechanics parameter. The comparison of crack driving force, expressed bz J-integral and material resistance curve J-R curve, provide posssibilitz to determine the extent of the stable crack as well as the crack size for its final fast propagation and also to assess the structural integritz of a cracked pressure vessel.

N. Obradović, A. Terzić, Lj. Pavlović, S. Filipović, V. Pavlović

DEHYDRATION INVESTIGATIONS OF A REFRACTORY CONCRETE USING DTA METHOD

Journal of Thermal Analysis and Calorimetry,
DOI: 10.1007/s10973-011-1880-3

The base mix refractory concrete is corundum based, containing corundum as refractory aggregate and CAC as hydraulic binder, with a spinel as an additive. The authors investigated the dehydration reactions which occur from the moment when water is added (at the beginning of components mixing), to the moment when installed refractory concrete lining is put into the service. Sintering process kinetic of low-cement content refractory concrete was investigated by means of differential thermal analysis (DTA) at four different heating rates (5, 10, 20 and 30 ˚C/min). Thus, temperature was increased from 20 to 1100 ˚C. It was noticed that first dehydration step occurs at lower temperatures, indicating at a desorption of physically adsorbed and interlayer water molecules. Second dehydration step, at higher temperatures is due to dehydroxylation of the lattices and decomposition of the interlayer anions.

Keywords: sintering kinetics, DTA, refractory concrete.

K. Janković, S. Stanković, D. Nikolić, D. Bojović, Lj. Loncar

DETERMINATION OF RECYCLED AGGREGATE CONCRETE DEGRADATION BY RESONANCE FREQUENCY ANALYSIS

Romanian Journal of Materials, Vol. 41, No.1, 22-25, 2011.

The evaluation of the dynamic modulus of elasticity of twelve different concrete mix proportions as a function of the density and degradations due to freeze/thaw cycles is presented in this paper. Pore system and saturation are the main factors for concrete freeze-thaw resistance. The frequency analysis of ultrasonic waves in concrete after every 25 cycles was done. Dynamic modulus of elasticity was determination by resonance frequency analysis. This parameter is 35-50% smaller for concrete with recycled bricks as aggregate than ordinary concrete. For all concrete mixes dynamic and static (measured by destructive testing) modules of elasticity were compared.

Keywords: dynamic modulus of elasticity, ultrasonic waves, freeze-thaw resistance, recycled aggregate concrete.

K. Janković, Z. Romakov, D. Bojović, D. Nikolić

CONCRETE MIX DESIGN FOR RECONSTRUCTION OF NORTHWEST BREAKWATER IN THE TRIPOLI HARBOUR - LIBYA

Technical Gazette, Vol. 18, No.1, 141-151, 2011.

Reconstruction of Northwest breakwater in Tripoli Harbour - Libya (about 4500 m long) required manufacture of various concrete elements (cubes and accropodes) in total amount of 550000 m3. Volumes of cubes are 6.3, 8.5 and 12.7 m3, volumes of accropodes are 6.3 and 9.0 m3. After preliminary trials and trial production, an optimum mix proportion was chosen, in compliance with technical specifications requirements. One of the main causes for concrete blocks cracking is the temperature difference between core and external surface of the blocks, so new blocks with new mix proportions were made (three variations in cement content). Temperature was measured at three characteristic points: in the middle of the cube, in the middle of vertical outer surface and in the middle of horizontal upper edge. Finally, optimal proportions of the constituent materials were adopted.

Keywords: marine structure, mass concrete, temperature.

K. Janković,G. Ćirović, D. Nikolić, D. Bojović

MECHANICAL PROPERTIES OF ULTRA HIGH PROPERTIES SELF COMPACTING CONCRETE WITH DIFFERENT MINERAL ADMIXTURES

Romanian Journal of Materials, Vol. 41, No.3, 211-218, 2011.

Preparation and microstructure of ultra high performance concrete (UHPC) have been intensively analyzed in the last few years. The mechanical properties (compressive strength and flexural strength) were investigated under different curing conditions (standard and steam curing). Silica fumes have characteristics that make them necessary in cement composites with ultra strength properties. The search for substitute products thus appears important if the use of UHPC is

to become more widespread in the concrete industry. Possibilities of making ultra high performance self compacting concrete (UHPSCC) with materials available in Serbia, based on experimental work are discussed in this paper. Three series of samples were made with different types of fine reactive additives (silica fume was replaced with metakaolin at 20% and 40% and with fine fly ash at 20%). The produced mixes had self compacted consistency. The 28th day compressive strength varied between 165 and 195 MPa for the heat treated specimens and between 135 and 150 MPa for the ones that had not been heat treated. Furthermore, this paper presents SEM micrographs of C-S-H phase formed after steam curing and super-heated steam under preassure.

Keywords: UHPSCC, fine reactive additive, steam curing regime, super-heated steam under preassure.

M. Vasić, Z. Radojević, M. Arsenović, Ž. Grbavčić

DETERMINATION OF THE EFFECTIVE DIFFUSION COEFFICIENT

Romanian journal of Materials, Vol 2, 2011, 169-176.

The equation for drying kinetics is obtained, based on the analytical solution of the differential equation with a boundary condition in the form of the flux. This equation was initially developed by G. Efremov. In this paper a modification of the Efremov drying equation shell be presented. Shrinkage correction will be included in that equation for the first time. Software for determination of the effective diffusion coefficient is designed and the predicted value agrees well with the experimental data.

Keywords: effective diffusion coefficient, analytical solution, software.

M. Vasić, Z. Radojević, Ž. Grbavčić

CALCULATION OF THE EFFECTIVE DIFFUSION COEFFICIENTE DURING THE DRYING OF CLAY SAMPLES

Journal of the Serbian Chemical Society, doi: 10.2298/JSC110717191V

The aim of this study was to calculate the effective diffusion coefficient based on experimentally recorded drying curves for two masonry clays obtained from different localities. The calculation method and two computer programs based

on the mathematical calculation of the second Fick's law and Cranck diffusion equation were developed. Masonry product shrinkage during drying was taken into consideration for the first time and the appropriate correction was entered into the calculation. The results presented in this paper show that the values of the effective diffusion coefficient determined by the designed computer programs (with and without the correction for shrinkage) have similar values to those available in the literature for the same coefficient for different clays. Based on the mathematically determined prognostic value of the effective diffusion coefficient, it was concluded that, whatever the initial mineralogical composition of the clay, there is 90% agreement of the calculated prognostic drying curves with the experimentally recorded ones. When a shrinkage correction of the masonry products is introduced into the calculation step, this agreement is even better.

Keywords: diffusion, drying, mathematical modeling, computer program.

V. Gardić, V. Conić, B. Petrović, M. Ignjatović, V. Trujić, V. Stanković,

TBP AS AN EXTRACTANT FOR ZINC(II) FROM SPENT PICKLING SOLUTION

Technics Technologies Education Management, Vol.6. No.4, 2011.

This work presents the possibility of use the tributyl phosphate (TBP) as an extractant of zinc (II) from the spent pickling solution (content 84.8 g/dm3 Zn, 17.87 g/dm3 Fe, 39.4 g/dm3 HCl) formed during the hot galvanizing process. Experimental studies has shown that using 80% v/v TBP in aromatic kerosene (D220/230) as diluent, 91.65% zinc(II), could be extracted from these solutions, and simultaneous regeneration of hydrochloric acid. The analysis of equilibrium isotherms has found that the zinc extraction is achieved in two-stage extraction and one stage of stripping. Identification of process kinetics has defined maximum extraction of zinc, achieved for 15 minutes. The stripping of zinc with efficiency of 90% was carried out by the use of distilled water.

Keywords: spent acid solution, extraction of zinck, TBP.

N. Bajić, Z. Kovačević, M. Rakin

TECHNOLOGICAL POSSIBILITIES AND JUSTIFICATION OF ELECTRO-CONTACT RAPAIRING

TTEM - Technics Technologies Education Management, Volume 6/2/2011, 300-307.

This paper presents a selected repair technology for different types of electro-contacts by replacing the contact plates on the brass body of the electrocontacts and connecting the elements by process of brazing with silver solder. Quality assessment of the soldered connection was performed by metallographic examining of the structure soldered connection of the contact plates, hard brazing, and the body of the electro-contacts carrier. Determination of the exploitation period of the repaired electro-contacts is derived by comparison with new electro-contacts in industrial conditions. Analysis of economic and financial data is derived by comparing the costs of reparations and the cost of purchasing new electrocontacts annually in production conditions in the manufacturing Steel Plant - Smederevo. On the basis of investigation of the structure of the soldered connection, the exploitation period and analysis of economic and financial indicators, a feasibility assessment was given of the applied technology of repair of electro-contacts in industrial conditions of the Steel Plant - Smederevo.

RAD U MEĐUNARODNOM ČASOPISU M24

B. Međo, M. Rakin, N. Gubeljak, J. Predan, M. Arsić, A. Sedmak

INFLUENCE OF CRACK LENGTH ON DUCTILE FRACTURE INITIATION IN WELDED JOINTS WITH ONE AND TWO WELD METALS

Key Engineering Materials, 2011, Vol. 465, 578-581, doi:10.4028

www.scientific.net/KEM.465.578

Among various micromechanical models for ductile fracture analysis using local approach, those based on the Gurson plastic flow criterion have been intensively developed in the past three decades. However, their application is still subject of many researches, with the aim to improve the assessment of ductile fracture in various, mainly metallic, materials. In this work, Gurson criterion is applied to welded joints produced with one or two different weld metals (one of these is overmatched, while the other is undermatched). Welded single-edge notched bend (SENB) specimens are examined, with an initial pre-crack located in the symmetry plane of each joint. Local approach is chosen for assessment of behaviour of the joints under the external loading, to capture the effect of material inhomogeneity and initial crack length on deformation and ductile fracture initiation in analysed specimens.

Keywords: welded joints, constraint, micromechanical models, ductile fracture, Gurson yield criterion.

N. Zrnić, S. Bošnjak, V. Gašić, M. Arsić, Z. Petković

FAILURE ANALYSIS OF THE TOWER CRANE COUNTERJIB

Procedia Engineering, 2011, Vol. 10, 2238–2243.

Failures of the cranes' structural parts unavoidably lead to serious damages or total collapses; these accidents are often followed by very high financial losses and possibly serious injuries or crane-related fatalities. The objective of this research was to identify the causes that led to the failure of the hammerhead tower crane (x1425C) counterjib. The crane is used for assembly works at the

hydropower dam. The counterjib collapse resulted from a gusset plate failure and caused such significant damage of the whole crane structure that the crane was dismantled and removed from operation. The study of the accident includes: (1) Identification of the stress-state, where a FEM model is developed to provide a useful tool for studying stress analysis; (2) Labaratory investigations are conducted in order to define the chemical composition and mechanical properties of the material, the tensile properties, hardness, impact toughness, as well as the metallographic analyses. The analysis of the obtained results showed that the principal reasons behind the gusset plate failure originated from design and fabrication faults. The working stress was higher than the allowable one. Also, impact toughness was too low and the fabrication of welds was incorrect.

Keywords: tower crane counterjib collapse; failure analysis; FEA; experimental investigation.

S. Bošnjak, M. Arsić, N. Zrnić, Z. Odanović, M. Đorđević

FAILURE ANALYSIS OF THE STACKER CRAWLER CHAIN LINK

Procedia Engineering, Vol. 10, 2011, 2244-2249.

Stacker ARs 2000 presents the final link in the system for continuous overburden removal in the open pit mine “Kostolac”- Serbia. Its superstructure leans on three crawlers of the same length, width and height. During the stacker’s travel from the erection site to the open pit mine, three crawler chain links fractured, presenting an indication of the problems that were to occur during exploitation. In fact, after only 1000 working hours (about three months), 30 chain links sustained fractures resulting in direct and indirect costs due to the downtime that substantially diminished the effects of the overburden removal system. The goal of the study presented in the paper was to diagnose the cause of chain link breakdown occurrence. Working stresses in the chain link are defined by applying FEM. Experimental investigations define the chemical composition, the tensile properties, the impact toughness and the macro and microhardness. Metallographic examinations are conducted additionally. Based on the results of the numerical-experimental analysis, it can be concluded that chain link breakdown is predominantly caused by (a) substantial deviation of the mechanical properties of the material with respect to

those prescribed by the standard and (b) the existence of macro and microcracks in the material structure.

Keywords: stacker; crawler chain link; failure analysis; FEA; experimental investigation.

M. Rakin, B. Medjo, M. Arsić, Ž. Šarkoćević, I. Ivanović, A. Sedmak

API J55 STEEL CASING PIPE WITH AN INITIAL SURFACE CRACK UNDER INTERNAL PRESSURE - DETERMINATION OF FRACTURE PARAMETTERS

Key Engineering Materials, 2011, Vol. 488-489, 577-580.

Seam casing pipe used in an oil drilling rig, manufactured by high frequency (HF) contact welding of API J55 steel, is tested. The influence of an initial defect (machined surface crack) is analysed, by performing pressure test of a pipe segment closed at both ends. Besides the damages at the internal surface, casing pipes are exposed to damage at the external surface, which is why such configuration is analysed here. Measurement of strains and crack mouth opening displacement (CMOD) enabled the application of direct method for J integral evaluation. This procedure is based on the path independence of the J integral and can be applied both in labaratory conditions (on specimens) and on structures. However, it requires a demanding experimental-computationalprocedure, which is accomplished here using the developed routine. Additionally, the behaviour of the pipe under internal pressure, including fracture mechanics parameters determination, is modelled numerically (by finite element method) in software package Abaqus. The pressure is aplied as distributed load acting on the inner surface of the three-dimensional model, and axial tension is applied at the end of the pipe to simulate the closed end. J integral values determined numerically and using direct method are used for estimation of the critical pressure corresponding to the crack growth initiation. Additionally, plastic limit load, i.e. pressure which causes yielding of the ligament, is determined. Based on the results, criteria for pipe integrity assessment are discussed.

Keywords: casing pipe, surface crack, direct method for J integral evaluation, finite element method, pipe integrity.

3. ZBORNICI MEĐUNARODNIH NAUČNIH SKUPOVA (M30)

PREDAVANJE PO POZIVU SA MEĐUNARODNOG SKUPA ŠTAMPANO U CELINI (M31)

M. Arsić

METHODOLOGICAL APPROACH TO INTEGRITY ASSESSMENT AND DETERMINATION OF REMAINING FATIGUE LIFE FOR WELDED STRUCTURES OF THE BUCKET-WHEEL EXCAVATORS

The 9th International Conference „Structural integrity of welded structures“, November 2011, Timisoara, Romania, CD (16 pages), Sudarea, *www.isim.ro*.

In this paper the methodological approach to integrity assessment and determination of remaining fatigue life of vital welded structures of the bucket-wheel excavator, made of S355J2+N structural steel, is presented. Results of researches regarding the integrity of the bucket-wheel boom tie rod of SRs 1301 bucket-wheel excavator, or, more precisely, its most sensitive spots-butt-welded joints of tie rod bodies and eye-plates, at which flaws were detected through the use of NDT methods (radiographic and ultrasonic testing) which sizes surpass the allowable size prescribed by current technical regulations. On the basis of results of the numerical-experimental analysis of the stress-strain state of welded joints, obtained experimentally in realistic operating conditions, as well as results laboratory tests regarding the fatigue life of K-weld joints (welded joints with full root penetration) which include: test results of smooth specimens, specimens with short cracks (with limited length of the initial crack) and side-notched specimens for determination of dependence between crack growth rate and stress intensity factor range, the integrity assessment of the bucket-wheel boom tie rod and establishment of remaining fatigue life have been carried out. The calculation results showed that the integrity of the welded joint was not compromised by the existence of the large size internal flaw.

Keywords: welded structure, stress concentration, bucket-wheel excavator, fatigue, structural integrity.

V. Grabulov

IMPACT TOUGHNESS AS A CRITERION OF WELDABILITY AND SAFETY OF WELDED JOINTS

The 9th International Conference „Structural integrity of welded structures“, November 2011, Timisoara, Romania, CD (10 pages), Sudarea, *www.isim.ro*.

In this paper a specific approach to the instrumented Charpy impact test results is presented. It specific nature primarily related to the determination of impact energy absorbed in Charpy instrumented test which can significantly contribute to the assessment of weldability of materials, and safety of welded joints. The conventional Charpy test measures the total energy absorbed in fracturing the specimen. Additional information can be obtained if the impact tester is instrumented to provide a load-time history of the specimen during the test Charpy test. The idea is that, using load – time records and values of the total absorbed energy (At), crack initiation (Ai) and crack propagation (Ap) and Ai/Ap ratio can be used to evaluate the weldability of steels and safety of welded joints. The paper explains in details of the methodology for interpreting results of the instrumented Charpy test and transition – temperature curve. Furthermore, these results are suitable for comparison with values of the Nil ductility temperature determined by the drop- weight test. These comparisons can be applied to characterize the material from the viewpoint of weldability assessment and evaluation of safety of welded joints. This approach has been experimentally demonstrated on the example of evaluation of weldability of high and middle strength steel.

Keywords: impact toughness, instrumented charpy test, crack initiation energy, crack propagation energy, transition temperature, weldability.

SAOPŠTENJE SA MEĐUNARODNOG SKUPA ŠTAMPANO U CELINI (M33)

Z. Kovačević, Z. Karastojković, R. Perić, M. Mladenovic

MICROSTRUCTURE CHANGES DURING CREEP DEFORMATION OF G 20MO5 STEEL

11th International Multidisciplinary Scientific GeoConference & EXPO „SGEM“, Albena, Bulgaria, 2011, Volume II, 89-96.

Creep damage of pressure equipment involves a great variety of high temperature components ranging from superheaters, boiler drums, furnaces, reactors, etc. Consequence of failures of these components are of high economic and safety concern. Moreover, the probability of failure of high temperature components is now increasing due to frequent cyclic of power plants imposed by a deregulated market and the search for increasing temperatures in ultra supercritical plants. A housing from high-pressure steam turbine in power plant is projected in order to meet construction period 100000-200000 of operating hour. Housing is produced by casting. Such after long-term servicing, the surface layer at housing is changed under the influence of pressure and temperature in creeping conditions. For improve the evaluation precision of creep damage of steam turbine casings at thermal power plants, the microstructures of casing materials are examined. NDT during service are a fundamental tool for residual life assessment as well. The material from cast housing is observed metallographically by means of the replica technique. In this paper is presented an evaluation of microstructure the housing highpressure steam turbine castings in viewing into the microstructure changes, according to the recommendations of the European Commission, using light microscopy. The paper also includes a short description of the replica method.

Z. Kovačević, Z. Karastojković, R. Perić

HOW TO AVOID CHEMICAL AGRESIVE SUBSTANCES IN WASTE WATERS FROM GOLD JEWEL PRODUCTION

11th International Multidisciplinary Scientific GeoConference & EXPO „SGEM“, Albena, Bulgaria, 2011, Volume III, 405-410.

Cyanides/cyanates of sodium or potassium not only during centuries but over millenniums were used in methods for extraction the gold from ores, and further in refining of obtained golden mud. In those processes the cyanides/cyanates still are not changeable. According to the huge amount of treated ore, it is expected that the amount of waste treated materials also be huge. Welding and brazing of golden parts frequently are obvious in usage for the purposes of gold jewel making. Therefore, it becomes resonable that almost of these aggressive substances will be appeared in waste water(s). Mass parts of used fluxes and refining substances always are not at the level of golden alloys mass, because golden alloys possess high density values. But, the volume parts of used aggressive substances are multiple higher than the volume of a gold jewel. In this paper is discussed the using of laser welding technology as substitution of using the harmful substances, therefore the amount of waste compounds are markably reduced.

D. Nikolić, D. Bojović, K. Janković, Lj. Lončar

MIX DESIGN AND ENGINEERING PROPERTIES OF ULTRA HHIGH PERFORMANCE SELF COMPACTED CONCRETE

fib symposium “Concrete engineering for excellence and efficiency”, Prague, Czech Republic, 353-356, 2011.

The mechanical properties (compressive strength and flexural strength) were investigated under different curing conditions (standard and steam curing). Silica fumes have characteristics that make them necessary in cement composites with ultra strength properties. The search for substitute products thus appears important if the use of ultra high performance concrete (UHPC) is to become more widespread in the concrete industry. Possibilities of getting ultra high performance self compacting concrete (UHPSCC) with materials

available in Serbia, based on experimental work are discussed in this paper. Four series of samples were made with different types of fine reactive additives (silica fume in referent concrete was replaced with metakaolin at 20% and 40% and with fine fly ash at 20%.). The produced mixes had self compacted consistency. The compressive strength varied between 145 and 180 MPa for the steam cured specimens and between 180 and 205 MPa for the ones that had not been heat treated. Furthermore, this paper presents SEM micrographs of C-S-H phase formed after steam curing and autoclaving.

Keywords: UHPSCC, fine reactive additive, steam curing regime, autoclave.

M. Knežević, D. Bojović, D. Nikolić, K. Janković, Lj. Lončar

THE EFFECT OF ENTRAPPED AIR ON CONCRETE COMPRESSIVE STRENGTH – NEURAL NETWORK APPROACH AND CLASSICAL RESEARCH

„MASE“, XIV international symposium, Vol. 1, Struga, Macedonia, 69-74, 2011.

Many parameters influence on the characteristics of fresh and hardened concrete. One of the most important characteristic of concrete is its porosity. Measure the porosity of fresh concrete is measured by the amount of entrained air. The effect of entrained air in concrete on compressive strength investigated by many authors including Wright, Hughes, Kaplan, Ujhelyi, Popovics, Teychenne and others. On the bases these works we have two formulas applicable in practice. Soft programming techniques especialy neural networks and the formation of databases related to the testing in laboratories for concrete opened up new approaches in predicting the impact of the quantity of entrained air in concrete on compressive strength.

Keywords: neural networks, entrapped air, concrete, compressive strength.

K. Janković, D. Nikolić, D. Bojović, Lj. Lončar

EFFECT OF CRUSHED CLAY BRICK AGGREGATE ON FROST RESISTANCE OF CONCRETE

DIMKS international symposium, XXV Congress DIMKS, Tara, 17-22, 2011.

The results of investigation presented in this paper include concrete containing crushed clay brick as aggregate. The freeze-thaw resistance is used as a indicator of concrete durability. The crushed brick aggregate concrete is compared with a concrete made with combination of brick and natural aggregate. The evaluation of modulus of elasticity as a function of the water absorption and degradations due to frost action is presented. The different methods for the assessment of the frost resistance are discussed too.

Keywords: crushed brick, recycled aggregate, concrete, durability, freezing and thawing.

M. Vasić, Z. Radojević

ESTABLISHING A METHOD FOR DETERMINATION OF EFFECTIVE DIFFUSION COEFFICIENT

15th International Conference „Modern Tecnologies, Quality and inovation, MODTECH“, Vadul lui Voda, Chisinau, Moldavija, 2011, 673-676.

The aim of this paper is to calculate the effective diffusion coefficient for typical masonry clay on the base of experimentally recorded drying curves. Two computer programs for calculation of diffusion coefficient, which are based on mathematical calculation of Fick's and Cranck's diffusion equations, were developed. First program did not include shrinkage effect during drying into the computation algorithm while the second one has included it. Results presented in this study have show that the values of effective diffusion coefficient determined by designed computer programs have similar values as literature available values of the same coefficient for different clays. The presented models witch include shrinkage effect corresponds with experimental data well.

Keywords: drying, mathematical model, effective diffusion coefficient.

R. Vasić, Z. Radojević, M. Vasić

FENOMEN VLAŽNOG ŠIRENJA I NJEGOV UTICAJ NA PROPADANJE PROIZVODA STONE KERAMIKE

XIII international conference „YUCORR“, Tara, 2011, 135-139.

The paper describes the results of a review of moisture expansion phenomenon studies and its harmful effects that decrease aesthetic and usable properties of fired clay items. Porous ceramic glazed products made of fired clay, and small series hand-made unique items of with high aesthetic value, very often highly usable too, have found wide application in our everyday surroundings, either as decorative craft items or as tableware. Cracks and damages of glazed surface appeared as a result of restrained expansion of the ceramic body and were caused by moisture expansion phenomenon. Glaze practically do not show tendency to moisture expansion and if it happens its value is negligible. Experimentally obtained values for ceramic body moisture expansion varied from 0.36 mm/m to 0.42 mm/m. Glaze cracks appeared in all cases when strains that built up in a ceramic body due to moisture expansion, exceeded the elasticity modulus of the applied glaze.

N. Zrnić, S. Bošnjaka, V. Gašić, M. Arsić

SOME ASPECTS IN FAILURE ANALYSIS OF CRANES

10th Anniversary International Conference on Accomplisments in Electrical and Mechanical Engineering and Information Technology - DEMI, 2011, Banja Luka, Bosnia and Herzegovina, 185-190.

Failure of a structural or mechanical component of cranes usually can beassociated with materials-related problems and/or design-related, as well as the fabrication-related problems or inadequate structural maintenance. Also, crane components and structure experience a spectrum of stresses while operating. Therefore, about ten percent of material handling high-performance machines failures can be attributed to fatigue failure. In most cases these failures were unexpected and lead to catastrophic consequences. This paper discusses some aspects in failure analysis of cranes, particularly high-performance ones, gives the background for failure analysis and presents some typical examples of failure. The aim of this article is to encourage practitioners

in the failure investigation process to look beyond the metallurgical issues and to also examine the loads and stresses.

Keywords: cranes, failure analysis, finite elements method.

M. Arsić., B. Vistać, Z. Savić, Z. Odanović, M. Mladenović

TURBINE SHAFT FAILURE CAUSE ANALYSIS

Seventh International Triennial Conference „Heavy machinery“, D session: Design and mechanics, 2011, Vrnjačka Banja, 49-54.

Hydropower plant turbine and hydro-mechanical equipment straining originates during the production of components and equipment assembling (residual stresses), during the process of performing functional requirements in exploitation (stationary and dynamic loads) and during the disturbed process of exploitation (non-stationary dynamic loads). Taking into account unpredictable influence of corrosion, erosion and cavitation during exploitation, it`s clear that straining of components and equipment as a whole can`t be expressed by a simple mathematical function. After approximately 20 years of service horizontal bulb turbine Kaplan, 28 MW of nominal output power, stopped because of shaft failure due to the occurence of the through crack. Turbine shaft has been designed as a welded structure which consists of a cylindrical body of the hollow shaft and a flange (estimated service lifetime of the shaft is 40 years). Through experimental tests and calculations (analitical and numerical) it has been determined that values of bending stresses of the turbine, which occur due to the action of load and corrosion fatigue, as well as stress concentration, are bigger than 25 MPa for flanges exposed to water, and in other case bigger than 40 Mpa for flanges protected by epoxy fibres exposed to `corrosive water` and can cause the occurence of surface cracks on the transition radius between the cylindrical part of the shaft and the flange. It has been determined that stress values in the zone under the influence of bending stresses were bigger than allowable values, which led to the occurence of many cracks due to fatigue corrosion. One of those cracks caused the failure of the shaft and of the whole turbine.

Keywords: turbine shaft, bending stress, stress concentration, fatigue, crack.

Z. Odanović, V. Grabulov, M. Arsić, M. Đurđević, B. Katavić

SELECTION OF THE OPTIMAL FILLER MATERIAL FOR ON-SITE REPAIR WELDING OF THE TURBINE SHAFT AT THE HYDROPOWER PLANT

II International conference „Global Trends in Joining, Cutting and Surfacing Technology, Global Trends in Joining, Cutting and Surfacing Technology“, Narosa PH, New Delhi, 343-350.

The most significant components of hydropower plants are turbine shafts and generator rotors which undergo time-dependent processes such as high stresses, fatigue and corrosion. It is therefore desirable to prevent in-service damages, improve reliability and extend the operational life of the plant. Plant operation can lead to cracking and failures in homogeneous materials, therefore a need for repair welding on plant components, which can be expensive and time-consuming. In the circumstances when repair welding has to be carried out on site, special care has to be taken in defining repair welding technology, process parameters and selection of filler materials. In this research a selection of filler materials for repair welding on site of hydropower turbine shaft was performed and results were presented. The shaft was made of the cast steel 20 GSL (~20Mn5) and presence of damages in the form of cracks which were up to 400 mm long and up to 20 mm deep was detected through the use of NDT methods. As the repairing was planned to be carried out without disassembling of the shaft, application of heat treatment procedures was not feasible. Weldability analysis of the base material was performed through the use of analytical equations. Results have shown that weldability of this steel is limited. For the repair welding a MMA (111) welding process was selected and two covered austenitic electrodes were analyzed in order to establish the feasibility of their use as potential filler material for repairing. In this research a Fe-Ni-Cr-Mo electrode and Ni based electrode were tested and their properties were compared. Tensile testing, absorbed energies tests, bending tests, hardness measurements and sensitivity tests such as ”CTS” and ”Y” were performed on test joints obtained by welding of base material, 20Mn5 steel, with investigated filler materials. Obtained results were analyzed and a Ni based electrode was selected as most suitable for repair welding.

M. Arsić, Z. Savić, Z. Odanović, M. Burzić, B. Međo

FAILURE PREVENTION OF TURBINE AND HYDROMECHANICAL EQUIPMENT AND ENVIRONMENTAL PROTECTION THROUGH THE USE OF TECHNICAL REGULATIONS

Integrated International Symposium - TIORIR ’11 (8th International Symposium Mine Haulage and Hoisting ISTI ’11, International Symposium Sustainable Development of Mining and Energy Industry ORRE ’11, 3rd International Conference History of Mining in the Central Europe IRSE ’11), 2011, Zlatibor, Vol.1, Session ORRE, 323-330.

Turbine and hydromechanical equipment of "Đerdap" hydropower plant is subjected to conditions which lead to degradation of the material of equipment parts during service. Taking into account the frequency of failures (damages, defects) and experience accumulated through many years of testing and inspection, it can with certainty be said that main causes of degradation are fatigue, corrosion, erosion and cavitation. Because of the vast scope of the subject matter, only failures of horizontal and vertical hydro generator turbine shafts were taken into account in this paper, clearly linking the increase of the shaft oscillation frequency with the decrease of shaft lifetime. The guidelines for establishment of technical regulations regarding design characteristics of turbine and hydro-mechanical equipment in order to prevent failures and protect the environment are also presented in this paper.

Keywords: turbine equipment, hydro-mechanical equipment, technical regulations, environmental.

Z. Savić, M. Arsić, M. Mladenović, N. Bajić, Ž. Šarkoćević

IMPLEMENTATION OF EUROPEAN DIRECTIVES REGARDING THE GENERAL APPROACH TO STANDARDIZATION AND TECHNICAL REGULATIONS IN HYDROPOWER PLANTS

Integrated International Symposium - TIORIR ’11 (8th International Symposium Mine Haulage and Hoisting ISTI ’11, International Symposium Sustainable Development of Mining and Energy Industry ORRE ’11, 3rd International Conference History of Mining in the Central Europe IRSE ’11), 2011, Zlatibor, Vol.1, Session ORRE, 331-338.

Hydroelectric generating units in hydropower plants (HPP) consist of turbine and hydro-mechanical equipment. Turbine and hydro-mechanical equipment is subject to a large number of European Directives. For example, turbine equipment is subject to Pressure Equipment Directive 97/23/EC, Simple Pressure Vessels Directive 87/404/EEC, Machinery Directive 98/37/EEC and Low Voltage Directive 2006/95/EC, because parts of the hydro turbine regulator, lubrication system, runner and regulating system are individually subject to suitable directives. Responsibility of the manufacturer or distributor of the hydroelectric generating unit is to make sure that all equipment parts are in compliance with the requirements of the specific Directive. In this paper the overview and primary characteristics of the contemporary and general approach to standardization and technical compliance regarding the integrity of structures is presented.

Keywords: European Directives, standardization, integrity of structures.

Z. Odanović, V. Grabulov, M. Arsić, R. Miković, R. Mitrović

INVESTIGATION OF THE OPTIMAL REPAIR WELDING TECHNOLOGY FOR A TURBINE SHAFT IN A HYDROPOWER PLAN

International Congress on Advances in Welding Science and Technology for Construction, Energy and Transportation Systems (AWST - 2011), Istambul, 2011, 243-248.

Turbine shafts and generator rotors are the most significant components in a hydropower plants. In plant operation these components undergo a time-dependent degradation processes such as multiaxial stresses, fatigue and corrosion. Plant operation can lead to cracking and failures in homogeneous materials and there is a need for weld repair on such plant components. Repair work can be expensive and time-consuming. Expenses of the repair work could be reduced if the repairing is performed without disassembling of the turbine shaft. Purpose of presented investigation was to define welding technology for turbine shaft repairing on site. As the repairing was planned to perform without disassembling of the shaft, application of post weld heat treatment procedures was not feasible. In this circumstances special care have to be taken in defining repair welding technology, process parameters and selection of filler materials. The shaft was made of the cast steel 20 GSL (~20Mn5) and presence damages in the form of cracks were identified by Non Destructive Testing (NDT). For

the repair welding a MMA (111) welding process is selected and two austenitic covered electrodes were analyzed as potential filler material for repairing. A series of trial welds with different welding conditions were welded in this investigation. Tensile tests, absorbed energies tests, banding tests and hardness measurements were performed on trial joins. Sensibility tests for crack forming as ”CTS”, ”Y” and ”Fisco” tests were applied for chosen filler materials. Obtained results were analyzed and compared and Ni based electrode was selected as most suitable for repair welding.

M. Arsić, S. Bošnjak, M. Rakin, Z. Odanović, Z. Savić

RELIABILITY ASSESSMENT OF THE GEARBOX OF THE BUCKET-WHEEL EXCAVATOR EXCAVATION SUBSYSTEM BASED ON FAILURE ANALYSIS

4th Balkan Mining Congress, 2011, Ljubljana, Slovenia, 103-111.

This paper presents a methodological approach to failure cause analysis for elements of the excavation subsystem of the bucket-wheel excavator SRs 470.20/3 „TAKRAF” (manufactured by Lauchhammer, Germany). Values of resistances to excavation have been obtained on the basis of measured actual currents at the drive of the excavation subsystem and recorded output values of changeable loads. Stresses and rotational torques at the drive shaft of the bucket-wheel have been determined through the use of tensometric deformation measurements. On the basis of relative contributions of failures of excavation subsystem assemblies, the Pareto (ABC) analysis for elements of the gearbox, braking device, drive shaft assembly, bucket-wheel shaft, elastic coupler, bucket-wheel structure and electric motor has been performed. In order to determine during which phase of production the error was made (during the design process, production or exploitation), failure analyses of elements of the gearbox have been performed through the use of following methods: FTA - Fault Tree Analysis and FMEA - Failure Mode and Effects Analysis. Through the use of the above mentioned procedures data necessary for the identification of most important elements for the analysis regarding the maintenance process and failure prevention measures have been collected.

Keywords: bucket-wheel excavator, gearbox, failure analysis, reliability.

M. Arsić, S. Bošnjak, N. Zrnić, Z. Petković, Z. Savić

ANALYSIS OF DYNAMIC LOADS OF THE BUCKET - WHEEL EXCAVATOR IN EXPLOITATION

4th Balkan Mining Congress, 2011, Ljubljana, Slovenia, 113-120.

In this paper results of tests and analyses of complex dynamic loads carried out on the bucket-wheel excavator SchRs 650/5x24 Krupp, which depend on conditions of exploitation and natural oscillations, are presented. Bucket-wheel excavator was built by „Thyssen Krupp“, Germany. Outer loads, or in other words excavation forces for the overburden and coal have been calculated on the basis of measured values of actual current intensity of the bucket-wheel drive and recorded output values of changeable loads. Correlations between the power of the bucket-wheel drive system N [Kw] and adequate hourly production Qe [m3/h], depending on the overall resistance to excavation Fk [kN] which affects the stress condition of the bucket-wheel, were also determined. Results of theoretical and experimental analyses of natural and forced oscillations of the support structure for various exploitation conditions are also presented in this paper. Deformations □i, determined by tensometric measurements on the rotating shaft of the bucket-wheel, were converted into tangential stresses through the introduction of the Modulus of Elasticity E and Poisson`s ratio ν, which, along with the polar moment of inertia of the cross-section Wp, define the moment of rotation Ti on the bucket-wheel shaft. Through the use of the load - strength comparison method (maximization of the ratio of load and strength indicators) the application factor of the gear with the largest number of turns KA has been determined.

Keywords: bucket-wheel excavator, experimental tests, resistance to excavation, oscillations, stress.

B. Katavić, B. Gligorljević, A. AIiI, Z. Odanović, M. Đurđević

PLASTIC DEFORMATION AND HEAT TREATMENT OF THIN WALLED CENTRIFUGALLY CAST HIGH STRENGTH CRMONB STEEL TUBES

43rd International October Confernce on Mining and Metallurgy, Kladovo, 2011, 333-337.

This work deals with effects of hot plastic deformation process and subsequent heat treatment on structure and mechanical properties of centrifugaliy cast (CC) high strength CrMoNb steel tubes. Plate samples, taken from CC tubes, were homogenized and subsequently hot rolled. One serie of samples was soft-annealed (SA) and other series oil-quenched and tempered (QT) between 373-923 K. Primary and secondary structures, non•metallic inclusions in radial direction and prior austenite grain size were analyzed using bright-field and polarized light microsopy. Experimental mechanical properties of SA and QT samples were modeled by Nans a/polynomial functions and correlated with structure properties.

S. Dević, M. Logar, M. Cocić

MINERALOGICAL CHEMICAL COMPOSITION OF SLAG FORMED IN TECHNOLOGICAL PROCESSES OF IRON AND STEEL PRODUCTION

II Međunarodni kongres „Inženjerstvo, materijali i menadžment u procesnoj industriji“, Jahorina, Bosna i Hercegovina, 2011, 126-134.

The aim of this paper is to present all slag which is formed in technological processes of iron and steel production. This paper shows and productive aggregates in which slag is formed. Slag formed in five technological processes of iron and steel production is chemically examined with XRF method, and mineralogically examined with optical method (microscopy of reflected or refracted lights). Choice of microscopy is definited by sort and nature of slag. All showed in this paper is result of big experience in slag formation and examination process [1]. This paper, as result of practice, is contribution to young explorers in the field of metallurgy and mineralogy of synthectilly minerals, so they can complete their knowledge about iron and steel production process.

S. Dević, M. Logar, M. Cocić

CHARACTERIZATION OF PARTICULAR MINERAL RAW MATERIALS OF SERBIAN DEPOSITS IN ORDER TO EXPAND THEIR APPLICATION,

43IOC, 2011, Kladovo, 71-74.

This paper presents the results of mineralogical and chemical examination of certain mineral raw of some deposits in Serbia. Examined mineral raw are clay from two deposits, a zeolitic tuff of one deposit and mineral raw of a carbonate deposit. Clay, zeolitic tuff and carbonate character is determined on the basis of these results. Representative samples of clay 1 and 2 originate from a single deposit, and sample 3 from the other deposits. Zeolitic tuff samples (blue - gray and white) belong to a single deposit, as well as samples of carbonates. Samples were researched with XRD, XRF method, microscopic method and DTA. The research results showed different character of clay from two different deposits; differences in blue-gray and white zeolitic tuff from the same deposit and dolomite domination in relation to the limestone in carbonate deposit. Based on these results, it can be recommended in which way their application could be extended in order to use potentials of these mineral raw.

Keywords: examination, deposits, clay, zeolitic tuff, mineral raw.

A. Mitrović, D. Jevtić, Lj. Miličić

METAKAOLIN-REACTIVE POZZOLANA FROM SERBIAN CLAYS

13th International Congress on the Chemistry of Cement, Madrid, Spain, 2011, CD.

Researches have been carried out to produce metakaolin (MK) - reactive pozzolana from two kaolinitic clays collected from different sources in Serbia. Starting clays, Vrbica and Miličnica, has significantly different chemical and mineralogical composition. According to kaolinite content and loss of ignitation, Vrbica clay may be classified as high quality starting material (kaolinite 80% and LOI 12.30%) and Miličnica clay as medium quality clay (kaolinite 52% and LOI 6.22%). The crystalline of the starting clays determined according to Aparacio-Galan-Ferrel index (AGF) showed that both clays might be classified as medium orderliness (AGF 0.8 and 0.9) on the scale were

commercial kaolinit have an AGF equal to1.3. In order to produce metakaolin with appropriate pozzolanic activity, clays were heated at different temperatures in the range 550 – 700oC within different time. The optimal parameters for transformation kaolinite to metakaolinite were chosen using degree of material dehydroxylation and process economy, 650oC and 90 min for Vrbica and 650oC and 120 min for Miličnica. The transformation was conformed by means of X-ray diffraction analysis, IR spectroscopy and thermogravimetric measurement. After calcinations, the lime reactivity of the metakaolin produced under optimal conditions was determined applying Chapelle method and according to Serbian standard SRPS B.C1.018. Values obtained by Chapelle method were 0.63 and 0.45 gCa(OH)2/gMK, and by standard 25.3 and 6.9 MPa, respectively for the clays Vrbica and Miličnica. Specific surface obtained by BET method were very high, 20 m2/g for Vrbica and 13 m2/g for Valjevo. Further optimization of the pozzolanic properties of the calcined clays was done by milling produced metakaolin. Our findings indicates that Serbia have quality clays for producing metkaolin without intermediate beneficiation stage. It is also find that clay with lower content of the kaolinit may be used for metakaolin production, giving satisfactory values for pozzolanic activity. Further investigations will be directed in order to investigate behavior of cement made with different quantities of metakaolin produced.

A. Mitrović, D. Nikolić

PROPERTIES OF PORTLAND-COMPOSITE CEMENTS WITH METAKAOLIN: COMMERCIAL AND MANUFACTURED BY THERMAL ACTIVATION OF SERBIAN KAOLIN CLAY

International seminar „Innovation & valorization in civil engineering and construction materials“, Rabat, Marocco, 2011, CD.

Portland-composite cements (CEM II) were prepared with addition of 5 to 35% of metakaolin (MK), manufactured by thermal activation/calcination of Serbian kaolin clay, and commercial matakaolin (CMK). Performance of the composite cements was evaluated, through the setting time (initial and final), compressive strengths (for ages 2, 7, 28, 90 and 180 days) and soundness, and compared with control cement (Portland cement – CEM I). Setting time (initial and final) is accelerated in Portland-composite cements, for both metakaolins used. The acceleration is higher in cement with addition of commercial metakaolin.

Lower compressive strength is obtained after 2 days of curing for all Portland-composite cements in comparison with control cement, since pozzolanic reaction still did not show its effect. After 7 days, pozzolanic reaction show its effect, manifested as compressive strength increase of Portland-composite cements with addition of up to 35% of CMK, and 25% in the case of cements with MK. After 28 days compressive strength was higher than that for control cement for cements prepared with addition of CMK, and with addition of up to 25% MK. After 90 days increased compressive strength was noticed with addition of 10 - 20% of CMK, and with 10 and 15% of MK, while after 180 days addition of both metakaolins influences compressive strength decrease. The results of the soundness, 0.5 mm for CEM I, and 1.0 mm in most Portland-composite cements indicate soundness increase with addition of metakaolins. Generally, better performance of Portland-composite cements was obtained with addition of commercial metakaolin, which may be attributed to the differences in the pozzolanic activity of the applied metakaolins, 20.5 MPa and 14.9 MPa for CMK and MK, respectively. By our previous findings pozzolanic activity of the thermally activated clay may be increased by subsequent milling of the metakaolin manufactured by thermal activation process.

Keywords: Portland-composite cements, metakaolin, setting time, compressive strength, soundness.

D. Momčilović, N. Hut, Lj. Milović, I. Atanasovska

FAILURE ANALYSIS OF CHAIN BRACKET

New Trends in Fatigue and Fracture, 2011, Polignano a Mare, Bari, Italy, 1-6.

In spite of numerous and expensive researches in the field of fatigue and fracture and regular control of end products, cracks occur every day in all fields of human activity. This paper describes failure analysis of chain brackets, used in conveyor systems for cement production. Chain type bucket elevators, utilize chain brackets for joining segments of chain as well as for attaching brackets for bulk material transport. Contact zone between chain link and bracket is one of the most stressed in this elevator system. During regular maintenance cracks were found on used and new brackets on case hardened zone. Case hardening on chain bracket is performed due to requirements for increased wear resistance in chain link contact. The occurrence of cracks in new brackets raised question

regarding origin of cracks and that is the main subject of this paper. This paper also suggest solution for avoidance of cracks on chain brackets, too.

V. Grabulov, Z. Burzić, T. Vuherer, M.Popović, E. Romhanji

MECHANICAL PROPERTIES OF DIFFERENT AL-MG BASED WELDED PLATES

International Congress on Advances in Welding Science and Technology for Construction, Energy & Transportation Systems, Antalia, Turkey, 2011, 163-167.

Three Al-Mg alloys: (I) AA5182, (II) AA5182 with Zn addition (□0.14 wt.%) and (III) AA5182 with Zn+Zr (□0.12 wt.% each) were processed to H116 and H321 marine grade plates with thickness of 6.5mm. They were welded by applying Metal Inert Gas – 131 (MIG) and MIG-Pulsed welding process (MIG-P), using AlMg4.5Mn and AlMg4.5MnZr fillers. Mechanical testing revealed that the after welding yield stress degradation was around 45-50%, independently on the welding conditions, and the fracture was always appeared in the weld metal (WM). The impact toughness as well as the fatigue threshold stress was found higher in the heat affected zone (HAZ) than in the WM in all the tested alloys. However, the fatigue crack growth rate da/dN was higher in the HAZ than in the WM.

Keywords: welding of Al-Mg-Mn alloys, welding technology, instrumented impact testing, fatigue crack growth rate.

G. Buyukyildirim, A. Sedmak, R. Prokić-Cvetković, O. Popović, V. Grabulov, R. Jovičić, M. Burzić

ADVANCED GMAW OF ALMG4.5MN ALLOY USING DIFFERENT MIXTURE OF GASES

The 3rd International Conference „Inovative Technologies for Joining Advanced Materials“, Timisoara, Romania, 2011, 71-74.

In this paper, the AlMg4.5Mn alloy has been welded by GMAW process using three different mixtures (Ar+ 0.0307%O2, Ar+30%He+0.0317%O2 and Ar+48%He+ 0.0290%O2), together with pure Ar, in order to investigate its influence to the quality of weldments. Testing plates, dimension

500x250x12mm, have been welded in horizontal position, using back-up plates, in 4 passes (1 root + 3 filler pass). Welding parameters have been chosen so that heat input was 6-12 kJ/cm. Tensile strength, hardness and other mechanical properties, as well as macro- and microstructure was examined. By comparing results of these testings for different gas mixtures the main conlusions are that oxygen does not have important effect on quality of metal weld, whereas increased helium content reduces porosity in metal weld and improves the appearance of weld metal, although its effect on mechanical properties is not significant.

Z. Burzić, D. Jaković

APPLICATION OF ACOUSTIC EMISSION IN MONITORING DEFORMATION PROCESSES

8th International Conference on Development and Modernization of Production „RIM 2011“, Velika Kladuša, Bosnia and Herzegovina, 2011, 133-138.

Applications of acoustic emission in testing materials and constructions has opened new possibilities in early detection of defect, which in the phase of exploitation may cause considerable decrease of reliability and safety of operation, including fracture. Deformation in material pro¬ne to acoustic emission is caused by plastic strain or crack initiation and growth. Acoustic emission belongs to the group of active methods for testing of materials and structures because its signal is generated during the deformation, defect initiation and its propagation.

Keywords: Acoustic emission, Deformation process, Senzors, Testing of materials

G. Mladenović, J. Ćirilović, C. Queiroz

OPTIMIZATION OF ROAD MAINTENANCE AND REHABILITATION ON SERBIAN TOLL ROADS

8th International Conference on Managing Pavement Assets, Santiago, Chile, 2011.

The paper presents the application of World Bank's model RONET to a strategic network level analysis of the Serbian toll road network. Tolls have been collected on these roads since the 1980s. Despite the toll revenues, the condition of this network deteriorated considerably during the 1990s. In recent years a more substantial part of the toll revenues has been applied to the toll roads, thus gradually improving the condition of such roads. The goals of the study are to obtain the optimum maintenance and rehabilitation (M&R) strategy and related budget, estimate the impact of different funding levels on the future quality, and estimate the economic consequences of budget constraints for maintenance and rehabilitation of the toll road network. The analysis shows that a substantial part of the toll revenues can be allocated to the non-tolled part of the Serbian road network without detrimental impact on the condition of the tolled network.

Application of the RONET model to the prevailing conditions on the Serbian toll road network led to an optimal M&R strategy with a good balance between rehabilitation, periodic and recurrent maintenance. Implementation of the "Optimal" M&R strategy would keep up the relatively good current condition of the toll road network. In other words, the current level of maintenance is close to the optimal. Implementation of higher than optimal M&R standards would lead to substantially higher road agency costs and consequently lower net benefits, while the implementation of lower than optimal M&R standards would lead to considerably worse network condition and higher vehicle operating costs.

B. Petrović, Lj. Radović, D.Vračarić,

EFFECT OF MICROSTRUCTURE ON METALLIC COATING MICROHARDNESS

43rd International October Conference on Mining and Metallurgy, Kladovo, 2011., 537-540.

The microstructure of the two types of metal coatings, the electrodeposited chromium and zinc hot dip galvanized have been investigated by means of optical microscopy (OM), scanning electron microscopy (SEM) and microhardness measurement. Coating thickness ranged from 80 to 100 □m. It was found that microstructures of the tested coatings have a significant influence on microhardness. Variations of deposition conditions of chromium

coatings resulted in different microstructures and related microhardness ranged from 700 to 1000 HV0.1. Zinc coatings consist of several layers. The microhardness of each layer is different. This behaviour is attributed to different chemical composition (Zn/Fe ratio) in each layer. The lowest microhardness has been measured in the layer with highest Zn/Fe ratio.

Keywords: metallic coatings, microstructure, microhardness, measurement.

T. Spasojević-Šantić, G. Dražić, B. Petrović,

SOME ASPECTS OF INDUSTRIAL WASTE DISPOSAL

ISWA BEACON 2011, „Waste-to-Energy and Packaging Waste“, Novi Sad, 2011, 103-110.

Industrial wastes in the Republic of Serbia has no defined centre for disposal or recovery and recycling. More specifically, the first centres will be opened but the problem of remediation of industrial waste landfills stayed. Past practise of delay is related to the use of small space operating facility and often small outbuilding. Since they are not adequate, remediation of industrial waste landfill receives a significant aspect in solving the area where the waste was disposed of.

Keywords: industrial waste, landfills, bioremediation.

N. Šušić, K. Đoković, D. Berisavljević

SPECIFIC GEOTECHNICAL INVESTIGATIONS OF THE NEW BRIDGE BEŠKA

14th International Symposium of MASE, CT-28, Struga, Macedonia, 2011, 621-626.

In order to determine the position of the sliding surfaces and defining the stability of the right bank of the Danube in the area of the old bridge Beška, in addition to the usual research, carried out and five exploratory shafts. Investigative shafts is rarely performed, represents an expensive and technically very demanding to perform investigative work. However, the obtained representative samples, and results of tests conducted on them represent the very fundamental to the rationalization of the remediation of landslides.

pecifically, in addition to determining the position of the layers and slip surfaces, they shall be taking large undisturbed samples from each observed sliding surface. On these samples investigations of residual shear strength parameters of soil.

Keywords: exploratory shafts, slip surfaces, residual shear strength parameters of soil.

K. Đoković, N. Šušić, D. Berisavljević

SOME EXPERIENCES IN COMPACTION AND BUILDING IN CLAYEY SOILS AT THE CORE OF EMBANKMENT DAMS

International Symposium "About research and application of Modern Achievements in Civil Enineering in the Field of Materials and Structures", Society for Materials and Structures Testing of Serbia, Tara, 2011, 305-310.

Embedding and suitability of materials for the building in and behavior of materials during compaction depends on the geomechanical properties of materials. Some materials, such as. sandy gravel is easier to compaction, while in clay, especially clay of high plasticity it is not. Difficulties in the compaction of clayey material are closely related to the size of the consistency index, where there is a dependency relationship of natural water content, plastic limit and liquid limits. This paper analyzes embedding clay materials (CH, CL and CI) obtained based on the results of laboratory tests conducted on samples of clay core earthfill dams : Rovni, Selova, Prvonek and Barje.

Keywords: earthfill dam, compaction, building in

D. Berisavljević, N. Šušić

PILE INTEGRITY TESTING (SIT) METHOD – CASE HISTORIES

International Symposium "About research and application of Modern Achievements in Civil Enineering in the Field of Materials and Structures", Society for Materials and Structures Testing of Serbia, Tara, 2011, 187-192.

This paper indicates the importance of quality control of installed piles using SIT method through several case histories. Limitations and equipment used for pile integrity testing by SIT method is also given in the paper.

Keywords: PIT, integrity, pile, signal.

D. Berisavljević, N. Šušić

PILE INTEGRITY TESTING (SIT METHOD) – THEORETHICAL BASIS

International Symposium: "About research and application of Modern Achievements in Civil Enineering in the Field of Materials and Structures", Society for Materials and Structures Testing of Serbia,, Tara, 2011, 179-186.

Different methods used for pile installation give rise to concern among engineers regarding the structural integrity of the piles. „Sonic Integrity Test" is reliable, inexpensive and little time consuming method for quality assurance of installed piles which gained great popularity in recent years on sites all over the country. This paper presents discussion on basis, theoretical aspects and mathematical formulation of Sonic method.

Keywords: SIT, integrity, pile, signal.

K. Đoković, N. Šušić

GEOMECHANICAL QUALITY CONTROL OF MATERIALS BUILDING IN EMBANKMENT DAM ROVNI

International Symposium „Dams-Recent Experiences on Research, Design, Construction and Service", Slovenian National Committee on Large Dams and Macedonian Committee on Large Dams, Skopje, Macedonia, 2011.

This paper presents the results of quality control geomechanical geological materials building in the embankment dams "Rovni" between the 2003-2009. year. Through a practical example given points out the importance and role of the geomechanical quality control materials in the construction of embankment dams.

D. Rakić, S. Ćorić, N. Šušić

GEOTECHNICAL EDUCATION IN THE FUNCTION OF SUSTAINABLE DEVELOPMENT - FOREIGN AND DOMESTIC EXPERIENCES

4th International Conference „Science and higher education in function of sustainable development SED“, Užice, 2011, 1-30-1-36.

The new law on high education started a process of reforms that has led to considerable changes in the universities of Serbia. The law is brought in line with the Bologna Declaration which implies introduction of new standards and norms into the process of study (length, instruction burden, work needed for acquisition of knowledge and skills, etc.). At the Belgrade Faculty of Mining and Geology, the Geotechnical Department started the reform in 2003, and received validation decision for the study programme of geotechnical engineering for graduate and post-graduate academic studies in 2008. The Bologna Process being essentially a reform of Syllabuses and Curricula, this paper presents a part of the studies' programme structure for geotechnical engineering and related sciences that have a function also in sustainable development. Some experience in geotechnical education is outlined in respect to sustainable development in the world.

Keywords: Bologna Declaration, gGeotechnical studies programme, vocations, sustainability in geotechnics.

Z. Kovačević, Z. Karastojković, R. Perić, Z. Odanović

ECOLOGICAL REASONS FOR APPLICATION OF LASER WELDING OF GOLD JEWELS

VI International „Safety engineering“ Conference, Kopaonik 2011, 417-421.

Laser welding is the latest method used in joining of metals, than in jewels. Before this technique is introduced, for jewel production over a centuries is applied a gas welding technique. Through the history, the jewel making from gold alloys was a serious job. But for gas welding different salts must be used from the group of: borides, cyanides, fluorides, nitrates, etc. Those substances are in chemical-metallurgical sence very active, and show pretty strong corrodive effect. The environment risk of using of those components becomes

very high. The corrodive effect after gas welding is fully visible after welding is finished, as a blackish surface, neither the gold alloys were used. The advantigies of gas welding are in efficiency, simplicity and in a low price of apparatus, but an undesirable consequence is great diameter of flame. When these active substances are combined with great heated surface, after welding is finished, the great amount of reacted substance is remained. Such residuals must be removed from the treated gold surface. But, when laser welding is applied all of those problems are not present. In this paper are shown examples of gas and laser welding of strips made from golden alloy 585.

Z. Kovačević, Z. Karastojković, M. Arsić

MATERIAL TESTING OF USED BOTTLES FOR TECHNICAL GASES IN ORDER TO PREVENT ENVIRONMENTAL EXCESS

VI International „Safety engineering“ Conference, Kopaonik 2011, 412-416.

For the best understanding the prevention of eventualy environmental excess when "old" bottles are in traffic or in usiness than only law or standard are not enough. The jurisdict regulations are clear: those bottles must be excluded from the traffic and usiness. For the better understanding the risk for further usage of old bottles, it is needed to make a closer look at the inside of material of a bottle, it means that the material testing should be provided for prevention any possible environmental excess. The material testing procedure must contain different methods, in this case were applied: tensile test, macro&microstructure and testing up to destroying the bottle. The very risk part of such testing is a moment of destroying the bottle under the high pressure. Here are shown both test procedures and results of material from used bottles for technical gases. Only by using such testings can be given an exactly answer for further using of bottles which were in service 30 years. After obtaining such testing and results, an adequate procedure for jurisdiction for prolongation the period of usiness could be provided.

Z. Kovačević, Z. Karastojković

CHANGES IN MICROSTRUCTURE OF STEEL ČSN 15223.9 FROM BOILER DRUM AT POWER STATION MONITORED THE REPLICA METHOD

II International Congress "Engineering, Ecology and Materials in the Processing Industry", Jahorina, Bosnia and Herzegovina, 2011, M-02, 1103-1110.

Boiler drum from a thermo-power generation plant is exposed to elevated temperatures (≈350°C) and relatively high pressure (up to 165 bar). Although the drum is made from a thick plate (over 80mm), some structural changes took place in a long servicing period. Here are monitored the micro structural changes in alloyed steel ČSN 15223.9 after approximately 15 years in service at elevated temperatures. The micro structural changes are monitored by using a replica method. A wide variety of changes or processes have registered in used steel during a periodically inspection of the boiler drum. Those changes are regarded as decarburization, graphitization, grain changes-usually growth, creep, corrosion damages, even appearance a few micro cracks. Micro cracks were shallow, trans crystalline and after their discovering they are immediately removed by grinding. Besides the micro cracks the creep behaviour is worthy for analysing the real state of the inspected material. The boiler drum is carefully monitored by taking the replicas both at base material (hot rolled plate) and in weldments. The results obtained by replica method are correlated to hardness values, which are measured at the same places where replica are taken. The coalescence of micro pores was found.

Z. Kova čević, Z. Karastojković

GRAPHITIC CORROSION IN WATER PIPES MADE FROM GRAY CAST IRON

II International Congress "Engineering, Ecology and Materials in the Processing Industry", Jahorina, Bosnia and Herzegovina, 2011, M-03, 1111-1116.

Gray iron castings usually posses a better corrosion resistance than almost low alloyed steels, and this is one reason for their wide application. Many of the

common causes of failures of iron castings are not foundry related. Failure of cast iron, as in other materials, could occured from one or more aspects of: design, casting imperfections, faulty processing, casting stresses, improper assembly or service conditions, which initially were not anticipated. The failure type in gray iron castings include mechanical, chemical attack, or combination of these. Failure analysis provided here shown that graphite corrosion at water pipes took place and as a result of it a remarkably degradation of hardness was found. The initail hardness values were in range 220-390 HV1 while in corroded parts was below 40 HV1. The microstructure examinations have approved that graphitic corrosion is developed after not so long period of time, less than 15 years in service.

Z. Janjušević, Z. Gulišija, A. Patarić, M. Mihailović, Z. Karastojković, Z. Kovačević

A CONTRIBUTION TO THE INVESTIGATION OF ADDITIVE COMPONENTS TO MOULD MIXTURE INFLUENCE ON THE CASTINGS SURFACE

II International Congress "Engineering, Ecology and Materials in the Processing Industry", Jahorina, Bosnia and Herzegovina, 2011, M-02, 1265-1269.

The intensity, and overall development of individual process on the metal-mould interface depend on the type and quality of mould mixture or its behaviour in contact with the melted metal in real conditions. Important role in interaction between foundry moulds and liquid metals, in addition to chemical and mineral composition of sand, and a type of binding material, play also additives for mould mixtures. These additives provided some changes at elevated temperatures inside the mixture, as well as its reaction with the surface layer of liquid metal. The aim of this investigation was to determine how the composition of the mould mixture with and without active components affect the surface of castings.

Z. Kovačević, Z. Karastojković, M. Mladenović

EVALUATION OF MICROSTRUCTURE QUALITY OF HIGH-PRESSURE STEAM TURBINE HOUSING MADE FROM G20MO5 STEEL

5th International Quality Conference, Kragujevac, 2011, 307-315.

In power plants as well as high temperature parts the microstructure will gradually decay. A housing from high-pressure steam turbine in power plant is projected in order to meet construction period 100000-200000 of working hour. Housing is produced by casting. Such after long-term servicing, the surface layer at housing is changed under the influence of pressure and temperature in creeping conditions. For improve the evaluation precision of creep damage of steam turbine casings at thermal power plants, the microstructures of casing materials are examined. The material from cast housing is observed metallographically by means of the replica technique. In this paper is presented an evaluation of quality the housing high-pressure steam turbine castings in viewing into the microstructure changes, according to the recommendations of the European Commission, using light microscopy. The paper also includes a short description of the replica method.

Z. Kovačević, Z. Karastojković, V. Aleksić

MICROSTRUCTURE AND CHARACTERISATION OF QUALITY WATER PIPES AFTER 50 YEARS IN SERVICE

5th International Quality Conference, Kragujevac, 345-351.

Grey cast iron is the most common material used in-service water pipes and water distribution in Serbia. It is also a material which has the largest number of damages and failures per kilometer of pipeline per year. However, during a long service period, because of the surrounding environment (soil), decreases the quality and reliability of this material, so that after fifty years of work, the pipe is damaged, and the usefulness of reduced or completely eliminated. It was found that the graphitization, ie. graphitic corrosion in those pipes, is the most responsible for their degradation, with the entire water system in the city is becoming unreliable. In this paper is presented metallographic view of graphitization, ie. graphite corrosion of water pipes after 50 years in-service.

The form of graphitization can be identified as the structural changes and the reduction of mechanical properties. In real terms the changes were observed in the hardness of the initial value of about 220-390 HV to 40 HV. Macro and micro structural analysis were performed to identify the cause of failure tubes.

Z. Karastojković, R. Perić, Z. Kovačević, Z. Janjušević, I. Perić, M. Srećković

CHANGING IN GOLD JEWEL ALLOY QUALITY DURING GAS AND LASER WELDING

5th International Quality Conference, Kragujevac, 2011, 325-331.

The gas welding technique is in application for gold jewel production over millenniums, while the laser technique only few decades. The comparisons of properties which were changed during gas or laser welding technique is applied, still are not fully defined. Here are discussed the most important demands from gold jewels: aesthetic appearance, min. gold content into alloy, mechanical properties, risk of damage, etc. It is expected that nozzle diameter shows a remarkable influence on heat input during gas welding, and than many properties of gold alloy to be welded are undergoing to changing. Main properties which will be changed belong to an aesthetic group of properties (shining, polishing properties, etc.) and even failure of joined parts. During the gas welding the wide area of gold jewel is heated up, it means that most of properties of gold alloy also are changed, more precisely the quality is lowered. The laser welding technique used in gold jewel production has shown less risk on failure in comparison to gas welding [1]. After the laser welding is provided, the clean surface remains unchanged.

Z. Karastojković, Z. Kovačević, Z. Janjušević, A. Raković

SURFACE QUALITY OF STEEL TUBES AND THEIR BEHAVIOR DURING SERVICING IN BOILERS

5th International Quality Conference, Kragujevac, 351-357.

The quality of seamless steel tubes usually is concerned on geometrical measurements, mechanical testing and rarely on checking the chemical composition. After a years in service, many kinds of damages on steel boiler tubes are available. The servicing conditions at a boiler plant (temperature,

pressure, water quality, etc.) certainly have an important influence on the behavior of seamless tubes, so many parameters have to be controled, but the surface state of used tubes does not is concerned on an adequate manner. It is registered that frequently the surface of boiler tubes are responsible for metal degradation, it means that boiler is failed, and production process is stopped. Here are shown and discussed some examples of surface quality of steel boiler tubes before the damage has happened, when the smooth surface is changed into rough one, with a lot of striations. An increasing of surface roughness means that damage will occured pretty soon. The investigation of surface changes is provided by using a metallographic analysis. Thermal fatigue of boiler tubes also shows an influence on increasing the surface roughness of used steel boiler tubes.

Z. Kovačević, Z. Karastojković

EVALUATION OF QUALITY THE SUPERHEATER TUBES MADE OF STEEL 14 MOV 6 3 IN VIEW OF MICROSTRUCTURE

7th Research/Expert Conference with International Participations „QUALITY 2011“, Neum, Bosnia and Herzegovina, 2011, 557-562.

In power plants as well as high temperature parts the microstructure will gradually decay. Superheater tubes in power plants are projected in order to meet their construction period 100000-200000 exploitation of working hour. After long time the surface layer of superheater tube materials microstructural changes are observed that occur under the influence of pressure and temperature in creeping conditions. In this paper, presented evaluation of quality the superheater tubes in in view of microstructure, according to the recommendations of the European Commission, using light microscopy. The paper includes a short description the replica method.

Z. Kovačević, Z. Karastojković

MICROSTRUCTURE QUALITY MONITORING IN ČSN 15 223 STEEL IN EXPLOATATION AT ELEVATED TEMPERATURES BY REPLICA METHOD

7th Research/Expert Conference with International Participations „QUALITY 2011“, Neum, Bosnia and Herzegovina, 2011, 563-568.

Non-destructive testing is of particular interest when the evaluation of the microstructure quality is possible, especially in field applications. Method of replicating the surface state by using a thin foil offers an advantage: the testing component should not be taken off from the original position of structure assembly. This fact is of a great importance for boiler tubes, from piping system in thermo-power generators or similar equipment. After replicating the surface, than foils could be carefully analyzed in the laboratory at every desired time. By using the replica method the different processes are available to control: many types of corrosion attack, decarburization, graphitization, grain growth, pores, fine changes in micro-structures as a result of creep process, and also a crack(s) appearance. Those changes in quality of tested material could not be successfully controlled by other testing methods, as like gamma-radiography, x-ray testing, ultra-sound, magnetic particles, or similar. The structure changes monitored by replica's method are available in testing either of parent or weld metal.

V. Aleksić, D. Jaković, Z. Kovačević

SOLIDWORKS USED FOR THE PROCESS OF OPTIMIZATION OF SUPPORTING STRUCTURE OF A PRESSURE VESSEL

VIII International Congress „Machines, Technologies, Materials“, Varna, Bulgaria, Vol. 8-128, 2011, 190-193.

According to the new regulations of the European Community (Directive 97/23/EC, design and manufacture of the pressure vessels (PV) shall be in accordance with legal and technical regulations stating the application of harmonized standards to be optional for a manufacturer of the equipment. Increased responsibility of the manufacturers gives more freedom in selection of the methods, design, calculation and optimization in order to provide safety.

In this paper, using a liquid CO2-containing vessel as an example, a survey of the process of optimization of a supporting structure has been presented. For parametric design, construction and calculation the SolidWorks programme has been used, taking into consideration the regulations and standards in effect, and in accordance with new and general approach to pressure equipment (Pressure Equipment Directive – PED) relating to structural integrity, i.e. fundamental requirements in terms of safety, calculation, design and testing of strength.

Z. Kovačević, Z. Karastojković, Z. Janjušević, M. Mladenović

MICROSTRUCTURE ANALYSIS OF HIGH-PRESSURE STEAM TURBINE HOUSING AFTER MORE THAN 100000 HOURS OF CREEP EXPOSURE

43rd International October Conference on Mining and Metallurgy, Kladovo, 2011, 31-34.

Thermal power plants around the world have typically been in operation for many years and are approaching, or have exceeded, their design life. Their components such as boiler tubes, steam pipes and high-pressure steam turbine housing operate in a complex environment involving high temperature, pressure and corrosive atmosphere. Several damage mechanisms such as creep, fatigue, corrosion, occur depending on the operating conditions. Beyond a critical temperature, creep acts as the dominant damage mechanism. In many service conditions, creep damage may occur at critical positions such as high-pressure steam turbine housing, which can result in failures at these locations. In this paper, a high - pressure steam turbine housing was investigated in viewing into the microstructure changes, using light microscopy.

R. Perić, Z. Karastojković, Z. Kovačević, D. Gusković

HARDNESS CHANGES IN AG925CU75 JEWEL ALLOY AFTER TEMPERING OF AS-CASTED, ROLLED AND QUENCHED STATES

43rd International October Conference on Mining and Metallurgy, Kladovo, 2011, 171-174.

The jewel's production, beside modern design and shining properties, requires good mechanical or metallurgical properties, but also good

chemical&technological characteristics. During wearing, the jewels are in direct contact with the sweat, etc. The jewels are also used for holding of different kinds of clothes: brooches, tiepins, shirt buttons, etc. In Serbia, as in other countries, very popular is silver alloy Ag925Cu75, and it is estimated that over 95% production belongs to this alloy. In provided examinations samples in as-cast and cold rolled conditions were used. The production schedule of this alloy still does not fully examined. Here are studied characteristics of hardness changes after casting, quenching and rolling the strips from this alloy. For the rolling production, always is important to know in what conditions the recrystallization is provided or not.

Z. Janjušević, Z. Gulišija, M. Mihailović, A. Patarić, Z. Aćimović-Pavlović, Z. Karastojković, Z. Kovačević

THE INFLUENCE OF ANNEALING PARAMETERS ON MICROSTRUCTURE OF A HSLA STEEL

43rd International October Conference on Mining and Metallurgy, Kladovo, 2011, 529-532.

The results of metallographic characterization of HSLA grade 30 steels, after hardening and annealing are presented in this paper. This steel achieves its full mechanical properties after hardening and annealing. Investigation of structural changes after austenization, with varying and annealing parameters, temperature and time, is presented here. It has been detected that the growth of carbide particles was hindered even at the highest observed temperature, which was a consequence of influences of the alloying elements in steel.

V. Aleksić

COMPRESS U FUNKCIJI OCENE INTEGRITETA OPREME POD PRITISKOM

II Međunarodni kongres „Inženjerstvo, ekologija i materijali u procesnoj industriji“, Jahorina, Bosna i Hercegovina, 2011, CD, 272-279.

Oprema pod pritiskom mora biti projektovana, proizvedena i proverena, prema novoj regulativi Evropske unije (Direktiva 97/23/EC), a opremljena i instalisana na takav način da osigurava bezbednost kad se uvede u eksploataciju. Njom se

rukuje u skladu sa uputstvima proizvođača ili prema propisanim radnim uslovima. Ocena integriteta opreme pod pritiskom, posle određenog vremena provedenog u eksploataciji, obavlja se u saglasnosti sa pravnom i tehničkom regulativom, prema kojoj je primena usaglašenih standarda za ocenjivača opreme neobavezna. Povećana odgovornost ispitivača i ocenjivača, kao i projektanta i proizvođača, daje veću slobodu u izboru metoda za ocenu integriteta opreme, a u funkciji sigurnosti i bezbednosti u eksploataciji. U radu je dat metodološki pristup modeliranju i oceni integriteta posude pod pritiskom pomoću kompjuterskog programa COMPRESS, saglasno novom i opštem pristupu za opremu pod pritiskom (Pressure Equipment Directive – PED), koji se odnose na osnovne zahteve sigurnosti, ispitivanja i kontrolne proračune.

V. Aleksić

MODELIRANJE I PROCENA PREOSTALE ČVRSTOĆE KOROZIJOM OŠTEĆENIH ČELIČNIH SFERNIH REZERVOARA

XIII YUCORR, Međunarodna konferencija „Razmena iskustava u oblasti korozije, materijala i zaštite životne sredine“, Tara, 2011, 163-168.

Ovaj rad koristi napredne tehnike modeliranja korodiranih površina čeličnih sfernih rezervoara, bazirane na Metodi konačnih elemenata (MKE), sa ciljem razvoja procedure za procenu preostale čvrstoće sfernih rezervoara koji rade u uslovima sredine industrije hemijskih proizvoda. U radu je dat i prikaz mogućih oštećenja i posledica izazvanih korozijom čeličnih sfernih rezervoara u industriji hemijskih proizvoda, a razmotrena je i mogućnost preduzimanja mera da se takve pojave preventivno spreče.

V. Aleksić

ESTABLISHMENT AND QUANTIFICATION OF CORROSION-INDUCED DAMAGES OF PROTECTIVE STEEL PIPES IN OIL INDUSTRY

IV Balkan Mining Congress, Ljubljana, Slovenija, 2011, 441-445.

In present paper, the methodological approach to establishment and quantification of intensity of corrosion-induced damages of protective pipes used for piping of the oil wells in oil industry as well as a presentation of

possible damages and corrosion-induced consequences with the examples from practice have been given. The possibility of taking measures to prevent such phenomena has also been considered.

S. Koprivica, A. Terzić, S. Petrović

THE LOAD-DISPLACEMENT RELATION FOR ANCHORS

14th International Symposium MASE, Struga, Macedonia, 2011, CT-9, 497-502.

While performing experiments and defining pullout load limit, the explorers found it interesting to define displacements that appear in such conditions as well. The formed diagrams revealed that in case of shallow anchors the relationship between pullout load and displacement load is similar to stress-strain curve for dense sand, and in case of deep anchors the performance is similar to stress-strain curve for loose sand. Since the calculation of anchors fundaments can be carried out in accordance with displacements or pullout loads, it is also possible to define a dimension if another dimension is known.

Keywords: anchors, pullout load, load-displacement relation, stress-strain relation, sand.

A. Terzić, Lj. Pavlović, S. Koprivica, S. Petrović

INFLUENCE OF MICROSTRUCTURE ON PROPERTIES OF HIGH-TEMPERATURE CONCRETE

14th International Symposium MASE, Struga, Makedonija, 2011, BK-16, 147-152.

Aim of this paper is to establish the correlation between mechanical properties and characteristics of microstructure using non-destructive testing method on corundum and bauxite based refractory concretes. Compressive strength of concrete samples after thermal treatment at various temperatures was investigated using standard laboratory procedure. Level of surface deterioration after thermal treatment was determined using Image Pro Plus, program for image analysis. Nondestructive ultrasonic measurement was used as a means of monitoring of increasing porosity in refractory specimens. Ultrasonic pulse

velocity technique and image analysis can be useful when type of refractory concrete is to be chosen for an application.

Keywords: refractory concrete, metallurgy plants, porosity, mechanical strength, image analysis.

A. Terzić, Lj. Pavlović, Z. Radojević, Lj. Miličić

CONSTRUCTION MATERIALS WITH FLY ASH MANUFACTURING AND PROCESS ENVIRONMENTAL EFFECT

International conference „Process Technology and Environmental Protection PTZS“, University of Novi Sad - Technical Faculty „Mihailo Pupin“, Zrenjanin, 2011.

Fly ash, as one of main residues in coal combustion in thermal-plants, represents high threat and can be hazardous for environment. High production of the fly ash, also, opens question of problematic storage of such waste material. Recycling and application of fly ash in industry of construction materials is, probably, the best and the most economic solution for previously mentioned problems. Fly ash can be used as component in manufacturing of following construction materials: cement, mortar, concrete, bricks, floor and wall tiles and various other types of construction ceramics. In such materials, fly ash is used as either substitution for bonding agent (due to its pouzzolanic behavior) or as replacement for fine fractions of aggregates. Replacement coefficient in a fly ash based construction material depends on fly ash chemical composition and grain size distribution, but commonly used replacement coefficient is between 20 and 40%. Investigation conducted in this paper is concerned with dependence of mechanical properties and quality of fly ash based construction materials in correlation with chemical composition, grain size distribution and replacement coefficient of fly ash.

Keywords: fly ash, recycling, construction ceramics, mechanical properties, replacement coefficient.

A. Terzić, Lj. Pavlović, S. Koprivica, S. Petrović

CONCRETES WITH RECYCLED AGGREGATES AS SOLUTION FOR WASTE CONCRETE DISPOSAL PROBLEM

5th International Scientific Conference „Architecture, Civil Engineering – Modernity“, 2011, Varna, Bulgaria, 461-465.

Aspects of environmental safety, sustainable development and proper disposal of natural resources impose recycling as one of the main methods in manufacturing of the construction materials. Concrete based on recycled aggregate has been successfully applied in various areas of civil engineering. It is obtained with utter or partial replacement of natural aggregate with recycled concrete. Such concrete has different properties than concrete based on natural aggregate. Different properties are consequence of difference in chemical composition and hardness of aggregates and of transition zone which occurs on contact of old cement paste and newly formed one. Secondary, recycled concrete is ideal substitute for natural aggregates because its application is economic, cheap, and because it is environmental safe.

Keywords: concrete based on recycled aggregates, microscopic methods, transition zone, environmental safety.

S. Koprivica, M. Brković, A. Terzić, S. Petrović

DESIGN OF HORIZONTAL SOIL ANCHORS

5th International Scientific Conference „Architecture, Civil Engineering – Modernity“, 2011, Varna, Bulgaria, 400-407.

Soil anchors are commonly used as foundation systems for structures requiring uplift resistance such as transmission towers. Until now, the design of these anchors has been largely based on empiricism. This paper suggests a possible theoretical and numerical method by relatively simple calculation, and determines the uplift behavior of horizontal soil anchors plates subjected to tensile loading. Results are presented bearing capacity of shallow anchors in sand and in clay, and are compared with existing numerical and empirical solutions. The conclusion is that the bearing capacity of anchors in sand depends on the friction angle, anchor embedment, dilatancy and the relative density, while in saturated clay depends only on embedment depth.

Keywords: soil anchors, pullout load, bearing capacity, sand, clay.

A. Terzić, N. Obradović, Lj. Pavlović, Z. Radojević

INVESTIGATION OF LOW CEMENT CONTENT REFRACTORY CONCRETE SINTERING PROCESS USING DTA METHOD

43rd International October Conference on Mining and Metallurgy, IOC, 2011, Kladovo, 232-235.

The base mix refractory concrete is corundum based, containing corundum as refractory aggregate and CAC as hydraulic binder, with a spinel as an additive. The dehydration reactions were investigated. Dehydration reactions occur from the moment when water is added to the moment when installed refractory concrete lining is put into the service. Sintering process kinetic of low-cement content refractory concrete was investigated by means of differential thermal analysis (DTA) at four different heating rates (5, 10, 20 and 30 ˚C/min). Thus, temperature was increased from 20 to 1100 ˚C. Activation energy during sintering process was determined by Kissinger method. Obtained values of activation energies were: 52.859 kJ/mol; 172.107 kJ/mol and 77.304 kJ/mol for T1, T2 and T4, respectively.

Keywords: refractory concrete, sintering kinetics, DTA.

K. Đoković, N. Šušić

SOME EXPERIENCES IN GEOMECHANICAL CONTROL OF QUALITY OF MATERIAL DURING CONSTRUCTION ON EARTHFILL DAMS

5th International Scientific Conference „Architecture, Civil Engineering – Modernity“, 2011, Varna, Bulgaria.

Abstract: Earthfill dams are technically very demanding objects throughout the building process, especially the performance require constant control. How are performed mainly or entirely of natural materials and thus the task of monitoring more complicated and complex. Technical conditions prescribed by the designer: a way of building the material, method of testing properties of materials embedded in different zones of the earthfill dam and defines criteria

for assessing the quality of the material. Therefore, detailed program geomechanical quality control is a key step in the process control. Detailed geomechanical quality control program, is to define requirements and create a detailed plan for quality assurance, all in order to ensure stability and durability of the building as a whole.

Keywords: earthfill dams, geomechanical controls of qualities.

SAOPŠTENJE SA MEĐUNARODNOG SKUPA M34

Z. Odanović, M. Đurđević, B. Katavić, M. Arsić

SOME APPLICATIONS OF THE IMAGE ANALYSIS IN THE METAL MATERIAL SCIENCE

Advances in Applied Physics & Materials Science Congress - APMAS, 2011, Antalya, Turkey, Vol. II, 359.

In different areas of science such as medicine, biology and engineering the Image analysis (IA) is widely used. Quantitative measuring by the IA has also found application in metal materials science, especially in metallographic microstructure analysis. The measuring of the linear and area dimensions of the microconstituents in the metal material structure performed by the image analysis is presented in the paper. The effects of the heat treatment temperature on the brittle phase content in the structure of the heat resistant Ni-Cr-Co-W alloy were analysed. Investigation of the influence of the alloying elements content in the Al alloys for automotive application, on dendrite arm spacing in the cast structure are also presented. Obtained results of the quantitative measured dimensions have shown direct impact of the process parameters on the analysed metals microstructure characteristics. All tests were performed by the light optical microscope with automatic image analyser. Presented experimental results are based of a large number of measurements. A statistical analysis was performed and a high correlation of the results was obtained. For the each of the presented investigations and analyzed phenomenon, a statistical mathematical model is suggested with the boundary conditions defined by the investigated intervals of variables.

A. Mitrović

POZZOLAN OBTAINED BY MECHANOCHEMICAL TREATMENT OF KAOLINITE CLAY

Advances in Applied Physics and Materials Science Congress- APMAS, 2011, Antalya, Turkey, Vol. II, 49.

Pozzolans are supplementary materials added to Portland cement in order to increase the mechanical strength and durability of concrete structures. A number of thermal, mechanical and chemical methods have been used to activate the reactive potential of pozzolanic materials. The aim of the study is to obtain pozzolana, from Serbian kaolinite clay by mechanochemical treatment. Kaolinite clay Garaši were subjected to mechanical treatment during different times of milling. The changes were monitored using particle size distribution (PSD) analyses, thermal methods [thermogravimetric analysis (TGA), and differential thermal analysis (DTA)] and X-ray diffraction methods (XRD). The pozzolanic activity were determined using Chapelle method. Milling withing 20 min influences particle size decrease and after that time continuous increase. XDR analysis indicates gradual decrease of cristallinity with prolonged milling time. The higher values for pozzolanic activitie, expressed throught consumption of gCa(OH)2 per gPozzolana are 0.78 and 0.77, and they were obtained for milling times 20 and 40 min, respectivelly. The values are comparable with commercial pozzolan – metakaolin. The results indicates that milling has caused the disintegration of particles and the consequent formation of new active surfaces in addition to changes in its physico-chemical properties that decrease its crystallinity (through amorphization) and increase it reactivity.

Keywords: pozzolan, mechanochemical treatment, amorphous kaolin.

J. Ćirilović, G. Mladenović, C. Queiroz

STRATEGIC NETWORK-LEVEL PAVEMENT MANAGEMENT ANALYSIS: THE CASE OF SERBIAN ROAD NETWORK

5th International conference bituminous mixtures and pavements, Thessaloniki, Greece, 2011, 201.

The paper presents the application of World Bank's model RONET to strategic network level analysis of the Serbian state road network. The condition of this

network deteriorated considerably during the 1990s due to under-financing of operations and maintenance. In recent years financing for the road sector has gradually increased focusing on the most hazardous and highly trafficked parts of the road network. However, the overall budget allocated to the sector remains inadequate to maintain the entire state road network in stable condition. The goals of the presented study are to obtain the optimum maintenance and rehabilitation (M&R) strategy and related budget, estimate the impact of different funding levels on the future quality, and estimate the economic consequences of budget constraints. Application of the RONET model led to an optimal M&R strategy with a good balance between rehabilitation, periodic and recurrent maintenance. Implementation of the "Optimal" M&R strategy would cause major improvement compared to the current condition of the network. Implementation of higher than optimal M&R standards would lead to substantially higher road agency costs and consequently lower net benefits, while the implementation of lower than optimal M&R standards would lead to considerably worse network condition for slightly lower agency costs. This means that even minor budget constraints would result in considerably higher total road transport costs for the country's economy.

M. Arsenović, Z. Radojević

ENCAPSULATING SLUDGES IN BRICK STRUCTURE

The Nineth Students' Meeting „Processing and Application of Ceramics", 2011, Novi Sad, 102.

Abstract: Taking into account the sustainable development requirements in the production of heavy clay bricks, the possibility of using waste in composites based on clay has been recently increasingly explored. Traditional building materials on the basis of clay raw materials allow combining with different wastes or secondary materials without significant modification of the process of production or use of such products. The introduction of industrial waste in brick products becomes common practice.The purpose of this study is to test utilization possibilities of industrial sludges as additives in the production of heavy clay bricks. These arise as waste sludges during the neutralization of waste water in the process of hot dip galvanizing. Research included the study of the composition, structure and properties of laboratory samples prepared from pure heavy clay and a mixture of clay and waste sludge. Change in the

structure and properties of samples are determined, depending on the composition of the sludge, their share in the mixture and firing temperature. During the experimental work the following methods of characterization were applied: X-ray analysis (XRD), simultaneous differential and thermal analysis (DTA / TG), scanning electron microscopy (SEM) and mercury porosimetry. The chemical composition was determined by energy-dispersive X-ray fluorescence spectrometry (EDXRF) and heavy metals content after leaching in distilled water is measured using inductively coupled plasma (ICP). Physical and mechanical properties of samples were also observed, such as water absorption, porosity and pore distribution, volume mass and compressive strength.

Keywords: industrial sludge, clay bricks.

A. Terzić, Lj. Pavlović, V. Mitić

DETERMINATION OF APPARENT POROSITY LEVEL OF REFRACTORY CONCRETE USING ULTRASONIC PULSE VELOCITY TECHNIQUE AND IMAGE ANALYSIS

35th International Conference and Exposition on Advanced Ceramics and Composites ICACC, The American Ceramic Society, 2011, Daytona Beach, Florida, ICACC-S1-PO20-2011.

Aim of this paper is to establish the correlation between sintering process, porosity and important thermo-mechanical property of refractory concrete, i.e. creep. Creep deformation was investigated according to standard laboratory procedure applied at three temperatures: 1200, 1300 and 1400ºC. Corundum and bauxite based refractory concretes were investigated. The concretes are varying in chemical and mineralogical composition. Both loss of strength and degradation of material occur when refractory concrete is subjected to increased temperature and compressive static load. Measuring of thermo-mechanical properties can indicate and monitor the changes within microstructure. Variation of refractory concrete microstructure, as a consequence of sintering process, during exposure to constant compressive load and constant elevated temperature during certain time-intervals was investigated using scanning electron microscope and Image Pro Plus program for image analysis. Obtained results of the investigation proved that creep can be useful method when type of refractory concrete is to be chosen for an application.

Keywords: creep, concrete, image analysis, pore size distribution, microstructure.

V. Kocić, V. Paunović, A. Terzić, P. Petković

BATIO3 CERAMICS DOPED BY RARE EARTH ADDITIVES INTERGRANULAR MICRO ELECTRONIC PROPERTIES STRUCTURAL FRACTAL ANALYSIS

35th International Conference and Exposition on Advanced Ceramics and Composites ICACC, The American Ceramic Society, 2011. Daytona Beach, Florida, ICACC-S8-053-2011.

Ferrolectric BaTiO3 as one of the most important ceramic materials in electronic, used in a wide range of applications, can be modified via deformation of solid solutions with various dopant ions. In this paper, the influence of Er2O3, Yb2O3 and Ho2O3 on microstructure, microelectronic and dielectric properties of BaTiO3 –ceramics has been investigated. The solid solubility of rare earth ions in the BaTiO3 perovskite structure has been studied by different methods of structural analysis including SEM-JEOL 3000 and energy dispersive spectrometer (EDS) system. BaTiO3 –ceramics doped with 0.01 up to 0.5 wt% of rare earth additives were prepared by conventional solid state procedure and sintered up to 1380C for two hours. We also applied the fractal method in miscrostructure analysis of sintered ceramics, especially as influence on intergranular capacitor and dielectric properties of BaTiO3 – ceramics. This fractal nature effect has been used for better understanding integrated microelectronic characteristic and circuit.

Keywords: BaTiO3-ceramics, intergranular impedance model, correlation synthesis-structure-property.

4. ČASOPISI NACIONALNOG ZNAČAJA (M50)

RAD U ČASOPISU NACIONALNOG ZNAČAJA (M52)

B. Katavić, B. Gligorijević, Z. Odanović, M. Đurđević

PROPERTIES OF HEAT TREATED CENTRIFUGALLY CAST HIGH STRENGTH STEEL TUBES

Metalurgija - MJoM, Vol 17 (4) 2011, 221-230

The effects of heat treatment on structural and mechanical properties of the centrifugally cast (CC) CrMo and CrMoNb high strength steel tubes of different diameters and wall thicknesses are presented in this paper. Centrifugal casting process was performed at mould rotation speeds ranging from 1320 to 1562 rpm. Specimens were annealed at 1323 K, annealed at 1143 K and subsequently tempered (refined by heat-treatment) between 473 K and 923 K. The results of tensile and toughness tests have shown intensive increase in ductility and toughness at temperatures above 823 K, while strength decreases gradually by increasing the temperature. Variations of the mechanical properties with temperature were modeled by means of polynomial equations.

D. Berisavljević, N. Šušić

PROCENA OPASNOSTI OD LIKVEFAKCIJE ANALIZOM IN SITU CPT OPITA I INDEKSNIH POKAZATELJA TLA

Put i saobraćaj, LVII, br.1, januar 2011, 38-43.

Procena seizmičkog ponašanja zasićenog tla u uslovima zemljotresa zasniva se na geotehničkim istraživanjima i ispitivanjima i poznavanju seizmičkog režima izučavanog područja. Likvefakcija se obično pripisuje rastresitom, sitnozrnom, jednoličnom pesku bez sadržaja plastične frakcije. Međutim, novija iskustva ukazuju da i sitnozrna i krupnozrna tla mogu pretrpeti značajne deformacije nastale kao posledica delovanja cikličnih napona indukovanih zemljotresom. U

radu je analizirana podložnost tla na pojavu likvefakcije na primeru reyervoara (R-27) za skladištenje nafte u Smederevu.

Ključne reči: likvefakcija, zemljotres, CPT, plastičnost, vlažnost, granulacija.

M. Vasić, Z. Radojević

PRIMENA POSTUPKA MEHANIČKE AKTIVACIJE U PROCESU PRIPREME NEPLASTIČNIH OPEKARSKIH SIROVINA

IZGRADNJA 65 (2011) 9-10, 499-503

U radu je dat uporedni prikaz eksperimentalno utvrđenih rezultata svojstava opekarske sirovine, koja je bila pripremljena standardnim postupkom prerade i postupkom mehaničke aktivacije. Uobičajeni standardni postupak prerade podrazumeva sušenje gline na 600C, usitnjavanje na laboratorijskom kolnom mlinu, vlaženje i mlevenje uzorka na laboratorijskom diferencijalnom mlinu pri zazoru od 3 mm, a potom pri zazoru od 1mm. Mehanička aktivacija opekarske sirovine izvršena je u laboratorijskom mlinu model: ″Pulverisette 6″ proizvođača: Fritsch – Nemačka, u trajanju od 30, 60, 90 i 120 minuta. Na neaktiviranom uzorku i mehanički aktiviranim uzorcima izvršena su ispitivanja tehnoloških svojstava bitnih za proces oblikovanja, sušenja i pečenja opekarskih proizvoda. Dobijeni rezultati ukazuju na promenu svojstva aktiviranih uzoraka u odnosu na ne aktivirane uzorke.

M. Vasić, Z. Radojević

ODREĐIVANJE KOEFICIJENTA PRENOSA TOPLOTE PRILIKOM SUŠENJA OPEKARSKIH PROIZVODA

IZGRADNJA 65 (2011) 9-10, 515-518

Određivanje koeficijenata prenosa toplote prilikom sušenja opekarskih proizvoda izvršena su na uzorcima pločica od gline sa lokaliteta „Banatski Karlovac“ dimenzija (120 x 50 x 14mm). Ispitivanja su sprovedena u laboratorijskoj recirkulacionoj sušnici, koja obezbeđuje preciznu regulaciju i kontrolu unapred postavljenih vrednosti parametara (temperature, vlažnosti i brzine) vazduha za sušenje. Na bazi eksperimentalnih istraživanja uspostavljene

su zavisnosti koeficijenata prenosa toplote karakterističnog za tu opekarsku sirovinu u funkciji temperature, vlažnosti i brzine vazduha za sušenje.

M. Vasić, Z. Radojević, R. Vasić

BITNE KARAKTERISTIKE GRAĐEVINSKIH PROIZVODA I INTERPRETATIVNI DOKUMENTI PROISTEKLI IZ DIREKTIVE CPD 89/106/EEC I UREDBE 305/2011

IZGRADNJA 65 (2011) 9-10, 576-579

Direktiva CPD 89/106/EEC i Uredbe P6-TA (2009)0320 i 305/2011 regulišu oblast usaglašenosti plasmana građevinskih konstrukcionih materijala na teritoriji zemalja članica evropske zajednice. Da bi se to postiglo, bilo je neophodno doneti harmonizovane evropske standarde za većinu građevinskih proizvoda, obezbediti visok stepen ujednačenosti kvaliteta proizvoda i predvideti različite nivoe odnosno klase perfomansi građevinskih proizvoda. Uloga interpretativnih dokumenata, je shodno članu 3 Direktive CPD 89/106/EEC, da daju konkretne formulacije bitnih zahteva u pogledu perfomansi proizvoda kao i da uspostave neophodne veze između bitnih zahteva navedenih u Aneksu I Direktive i mandata za pripremu harmonizovanih standarda i smernica za evropske tehničke saglasnosti. Interpretativna dokumenta se bave aspektom „nameravnog korišćenja“ i ukazuju na sve detalje koje je nophodno ispitati i odrediti pre stavljanja proizvoda u promet.

J. Balint, M. Vasić

NOVA ISPITNA METODA E ZA ISPITIVANJE OTPORNOSTI PREMA MRAZU CREPOVA OD GLINE – EN 539-2:2009

IZGRADNJA 65 (2011) 9-10, 580-583

Ispitne metode za određivanje otpornosti crepova od gline prikazane u novom evropskom standardu EN 539-2 iz 2009 se veoma malo razlikuju od ispitnih metoda u postojećem važećem standardu EN 539-2 iz 2005 godine, sa izuzetkom nove ispitne metode E. U ovom radu, u kratkim crtama objašnjen je postupak pripreme crepova za ispitivanje i sam tok ispitivanja. Obzirom da je na teritoriji Republike Srbije važeća metoda B za ispitivanje otpo- rnosti prema mrazu, u radu će biti ukazano i na sličnosti i razlike između ove dve metode

R. Vasić, M. Vasić

USAGLAŠENI USLOVI ZA PLASMAN GRAĐEVINSKIH PROIZVODA – UREDBA P6-TA(2009)0320

IZGRADNJA 65 (2011) 9-10, 613-617

U radu je u kratkim crtama dat prikaz Uredbe P6-Ta(2009)0320 o usaglašenim uslovima plasmana građevinskih proizvoda na tržištu evropske ekonomske yajednice. Ova uredba zamenjuje postojeću direktivu za graševinske proizvode CPD /89/106/EEC, odnosno pojašnjava, unapređuje i pojednostavljuje određene procedure iz važeće direktive. Evropski parlament je stao na stanovište da se uklanjanje tehničkih barijera u oblasti građevinarstva može postići uspostavljanjem jedinstvenog tehničkog jezika, za potrebe ocenjivanja performansi građevinskih proizvoda, odnosno uz pomoć usaglašenih tehničkih specifikacija. Usaglašene tehničke specifikacije obuhvataju: Ispitivanja, proračune i druge metode u vezi sa bitnim karakteristikama građevinskih proizvoda, koje su definisane u okviru harmonizovanih standarda i Evropskih dokumenata za ocenu performansi (EAD). U radu je dat pregled osnovnih principa koji su prihvaćeni od strane evropskog parlamenta 24. aprila 2009. godine u cilju prihvatanja Uredbe.

M. Arsenović, Lj. Miličić, Z. Radojević, M. Savić, N. Mijatović,

ISTRAŽIVANJE SADRŽAJA TEŠKIH METALA U OPEKARSKIM PROIZVODIMA NA BAZI GLINA I SEKUNDARNIH SIROVINA

Izgradnja, 9-10, str. 587 -590

Teški metali spadaju u najopasnije zagađujuće supstance životne sredine. Usled razvoja industrije dolazi do nekontrolisane emisije metala u atmosferu i hidorsferu, kao i kasnije akumulacije u sedimentima i zemljištu. Cilj ovog istraživanja je utvrđivanje ukupnog sadržaja teških metala u laboratorijskim uzorcima sa dodatkom sekundarnih sirovina i u proizvodima iz 12 ciglana u Srbiji. Određivan je ukupni sadržaj Cr, Cu, Ni, Mo, Zn, Co, Cd, Sb, Hg, As i Pb, kao indikator mogućnosti izluživanja u okolinu dejstvom atmosferilija.

Ključne reči: teški metali, opekarski proizvodi, životna sredina.

Z. Radojević, M. Arsenović

PRIMENA POSTUPAKA POROZIRANJA OPEKARSKIH PROIZVODA SEKUNDARNIM SIROVINAMA

Izgradnja, 9-10, 540-544

Uvažavajući zahteve održivog razvoja u ciglarskoj industriji poslednjih godina se sve više istražuje mogućnost upotrebe otpada u kompozitima na bazi gline, u cilju očuvanja prirodnih resursa, sirovina i energije. U ovom radu dati su rezultati istraživanja postupka poroziranja opekarskih proizvoda primenom sledećih sekundarnih sirovina: mlevenih suncokretovih ljuspica, drvene piljevine, mlevenih sojinih ljuspica, elektrofilterskog pepela iz dve termoelektrane i mulja koji nastaje u procesu toplog cinkovanja, odnosno nakon neutralizacije otpadnih voda. Praćena je promena tehnoloških karakteristika sirovinskih mešavina: plastičnost masa za oblikovanje ekstruzijom, skupljanje i osetljivost u sušenju. Efekat poroziranja je praćen određivanjem upijanja vode i zapreminske mase pečenih proizvoda. Mehaničke karakteristike pečenih proizvoda određivane su merenjem pritisne čvrstoće. Uzet je u obzir i uticaj temperature pečenja na efekat poroziranja i mehaničke karakteristike pečenih proizvoda.

Ključne reči: opekarski proizvodi, sekundarne sirovine, porozirani opekarski proizvodi.

V. Milošević, M. Maričić, M. Arsenović, D. Stanković

ODREĐIVANJE PRECIZNOSTI METODA ISPITIVANJA MEHANIČKIH KARAKTERISTIKA OPEKARSKIH PROIZVODA I CREPOVA OD GLINE UPOREDNIM ISPITIVANJEM

Izgradnja br 9-10, str. 584-586, 2011.

U okviru standarda SRPS ISO/IEC 17025:2006 - Opšti zahtevi za kompetentnost laboratorija za ispitivanje i laboratorija za etaloniranje, pod tačkom 5.9 postoji zahtev koji se odnosi na obezbeđenje poverenja u kvalitet rezultata ispitivanja. Jedan od načina da se obezbedi poverenje u kvalitet rezultata ispitivanja ostvaruje se realizacijom uporednih ispitivanja. U laboratoriji Instituta IMS organizovana su uporedna ispitivanja mehaničkih karakteristika opekarskih proizvoda i crepova od gline. Preciznost, kao i

potvrda pravilne primene standardnih metoda posredno se potvrđuje, između ostalog, i proverom odgovarajuće merne opreme.

Ključne reči: preciznost, uporedna ispitivanja, mehaničke karakteristike, opekarski proizvodi, crepovi od gline.

T. Čurović, J. Ćirilović, G. Mladenović

MERNA NESIGURNOST-POJAM I PROCEDURALNI KORACI PRI KVANTIFIKACIJI

2010, Put i saobraćaj, broj IV, 90-96

U radu je prikazan postupak analize merne nesigurnosti prilikom sprovođenja laboratorijskih merenja, što predstavlja jedan od osnovnih zahteva standarda SRPS ISO/IEC 17025 za akreditovane laboratorije za ispitivanje i etaloniranje. Data je definicija pojma merne nesigurnosti, kao i osnovna načela za njenu analizu. Detaljno je prikazan postupak proračuna merne nesigurnosti, počev od specifikacije mernih veličina i identifikacije izvora nesigurnosti do kvantifikacije komponenata i izračunavanja ukupne merne nesigurnosti. Postupak je ilustrovan na primeru određivanja zapreminske mase uzorka iz izvedenog sloja.

Ključne reči: merenje, merna nesigurnost, SRPS ISO/IEC 17025, uputstvo ILAC G17.

RAD U NAUČNOM ČASOPISU (M53)

M. Vasić, Z, Radojević

CALCULATION OF THE EFFECTIVE DIFFUSION COEFFICIENT

International Journal of Modern Manufacturing Technologies, III, No. 1 /2011, strane 93-98.

The aim of this paper is to calculate the effective diffusion coefficient for typical masonry clay on the base of experimentally recorded drying curves. Two computer programs for calculation of diffusion coefficient, which are based on mathematical calculation of Fick's and Cranck's diffusion equations, were developed. First program did not include shrinkage effect during drying into the computation algorithm while the second one has included it. Results presented in this study have show that the values of effective diffusion coefficient determined by designed computer programs have similar values as literature available values of the same coefficient for different clays. The presented models witch include shrinkage effect corresponds with experimental data well.

Keywords: drying, mathematical model, effective diffusion coefficient.

M. Arsić, Z. Odanović, M. Mladenović, Z. Savić, N. Milovanović, Ž. Šarkoćević

KOMPLEKSNOST IZRADE PROJEKTA REVITALIZACIJE TUBINSKE I HIDROMEHANIČKE OPREME HIDROELEKTRANA

Međunarodno Savetovanje Energetika 2011, Energija, ekonomija, ekologija, 2011, Vol.13, br.2, str. 73-78

Projektovanje i puštanje u rad hidroelektrana (HE) obuhvata kompleksne zadatke. Veliki broj detalja mora biti preciziran, dobro osmišljen, pažljivo razmotren i koordinisano izvršen u cilju sigurnosti i ekonomičnosti. Ukoliko se samo neki od njih previde, podcene ili nepravilno sagledaju mogu nastati značajni problemi. Isto važi i za projekat revitalizacije HE „Đerdap“, na čijim su hidroagregatima ugrađene vertikalne i horizontalne Kaplan-ove cevne

turbine, nominalne snage 200 MW (6 kom.) i 28 MW (10 kom.), izrađene u Rusiji. Indentične turbine su ugrađene i na Rumunskoj stani HE.

Ispitivanja opreme i konstrukcija, kao i baze podataka omogućavaju ocenu njihovog stanje u potpunosti. Na taj način se dobijaju neophodni podaci za utvrđivanje stanja i uzroka degradacije materijala i zavarenih spojeva, za ocenu međusobnog uticaja prostornog rada pojedinih delova opreme, kao i za određivanje funkcionalnosti i pouzdanosti rada pogonskih sistema i opreme kao celina. Na osnovu naših i svetskih iskustva, stečenih dugogodišnjim ispitivanjima i utvrđivanjem stanja opreme hidroelektrana, osnovni uzroci degradacije materijala su zamor, korozija (uključujući eroziju) i kavitacija.

Nakon ispitivanja i proračuna dobiće se elemenati za ekspertsko odlučivenje o metologiji koju treba primeniti za revitalizaciju delova turbinske i hidromehaničke opreme HE „Đerdap“ da bi se poboljšale njihove tehničke karakteristike, povećala snaga, efektivnost i produžio radni vek hidroagregata, uz smanjenje troškova eksploatacije hidroenergije.

Ključne reči: projekat revitalizacije, turbinska oprema, hidromehanička oprema, tehnička dijagnostika.

5. ZBORNICI SKUPOVA NACIONALNOG ZNAČAJA (M60)

SAOPŠTENJE SA SKUPA NACIONALNOG ZNAČAJA ŠTAMPANO U CELINI (M63)

D. Nikolić, D. Bojović, K. Janković, Lj. Lončar

MOGUĆNOST OJAČANJA GREDNIH NOSAČA PRIMENOM BETONA ULTRA VISOKIH ČVRSTOĆA

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 295-300.

U radu je prikazana mogućnost ojačanja mikroarmiranih greda, napregnutih na savijanje, dodavanjem sloja betona ultra visokih čvrstoća (UHPC) sa samougrađujućim svojstvima. Od ukupno dvanaest eksperimentalnih uzoraka - greda, šest greda su nakon pojave prsline rasterećene, a potom ojačane dodavanjem sloja UHPC na zategnutoj strani grede. Prikazani su rezultati nosivosti pri pojavi prsline odnosno pri lomu grede i upoređeni su sa rezultatima dobijenim na gredama bez primene ojačanja.

Ključne reči: ojačanje greda, beton ultra visokih čvrstoća.

K. Đoković, N. Šušić, Ž. Mirčetić, O. Mažibrada

KONTROLA KVALITETA UGRAĐENIH MATERIJALA U NASUTU BRANU ROVNI

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 307-312.

U radu su prikazani rezultati geomehaničke kontrole kvaliteta geoloških materijala ugrađenih u telo nasute brane „Rovni“ u periodu izgradnje brane od 2003-2009. godine.

Ključne reči: nasuta brana, kontrola kvaliteta.

D. Berisavljević, N. Šušić, K. Đoković

ZNAČAJ GEOTEHNIČKIH ISTRAŽIVANJA ZA POTREBE IZGRADNJE I SANACIJE GRAĐEVINSKIH OBJEKATA

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 247-249.

Svrha geotehničkih istražnih radova je da se obezbede pouzdane informacije o tlu u području građenja. Pažljivo planirana i izvedena istraživanja omogućuju racionalnije projektovanje objekata. Pravilna interpretacija rezultata geotehničkih istraživanja je osnova za sigurnu i stabilnu konstrukciju. Rad prikazuje rezultate geotehničkih istraživanja terena na lokaciji rezervoara R-27 za skladištenje nafte u Smederevu sa osvrtom na njihov značaj.

Ključne reči: geotehnička istraživanja, rezervoar R-27.

D. Berisavljević, N. Šušić, Č. Laslo, K. Đoković

ISTRAŽNA OKNA ZA POTREBE SANACIJE KLIZIŠTA BEŠKA

Četvrto naučno-stručno savetovanje „Geotehnički aspekti građevinarstva“, Savez građevinskih inženjera Srbije, Zlatibor, 2011, 141-146.

U radu se daje pregled terenskih istraživanja izvedenih u cilju utvrđivanja prostornog položaja kliznih površi i dubine postojeće dijafragme na desnoj obali u zoni starog mosta preko Dunava kod Beške. Posebna pažnja posvećena je iskopu pet istražnih okana kao istražnom radu koji se retko izvodi, a podaci dobijeni iz njih o terenu su od izuzetnog značaja za racionalnu sanaciju klizišta

Ključne reči: klizna površ, geotehnička istraživanja terena, istražno okno.

N. Šušić, D. Berisavljević, D. Rakić

NEKOLIKO PRIMERA IZ PRAKSE KONTROLE KVALITETA ŠIPOVA SIT METODOM

Četrvrto naučno-stručno savetovanje „Geotehnički aspekti građevinarstva“, Savez građevinskih inženjera Srbije, Zlatibor, 2011, 389-394.

Prikazan je značaj kontrole kvaliteta izvedenih šipova SIT metodom kroz nekoliko slučajeva iz prakse. U radu su data ograničenja i oprema za ispitivanje integriteta šipova SIT (Sonic integrity test) metodom.

Ključne reči: SIT, kvalitet, šip, reflektogram.

D. Berisavljević, N. Šušić, L. Čaki

TEORIJSKE OSNOVE ISPITIVANJA INTEGRITETA ŠIPOVA

Četrvrto naučno-stručno savetovanje – Geotehnički aspekti građevinarstva, Savez građevinskih inženjera Srbije, Zlatibor, 2011., 381-388

Poslednjih nekoliko godina ispitivanje integriteta ugrađenih šipova steklo je veliku popularnost na gradilištima u našoj zemlji. Posebno mesto zauzima zvučna metoda. „Sonic Integrity Test“ kao pouzdana, jeftina i vremenski malo zahtevna metoda za ispitivanje kvaliteta izvedenih šipova. Rad prikazuje osnove metode, teorijske postavke i matematičku formulaciju.

Ključne reči: SIT, integritet, šip, signal.

D. Berisavljević, G. Hadži-Niković, N. Šušić

LIKVEFAKCIJA KAO FENOMEN

Četrvrto naučno-stručno savetovanje „Geotehnički aspekti građevinarstva“, Savez građevinskih inženjera Srbije, Zlatibor, 2011, 147-152.

Procena seizmičkog ponašanja zasićenog tla u uslovima zemljotresa zasniva se na geotehničkim istraživanjima i ispitivanjima i poznavanju seizmičkog režima izučavanog područja. Likvefakcija se obično pripisuje rastresitom, sitnozrnom, jednoličnom pesku bez sadržaja plastične frakcije. Međutim, novija iskustva ukazuju da i sitnozrna i krupnozrna tla mogu pretrpeti značajne deformacije nastale kao posledica delovanja cikličnih napona indukovanih zemljotresom. U radu su prikazani faktori koji utiču na pojavu likvefakcije i neki najčešće korišćeni kriterijumi za procenu ovog fenomena.

Ključne reči: Likvefakcija, zemljotres, plastičnost, vlažnost, granulacija.

N. Milovanović, M. Todorović, B. Ivanković

SANACIJA AB GREDA PRIMENOM KARBONSKIH TRAKA U ULICI ZELENI VENAC BR.18 U BEOGRADU

Međunarodni simpozijum o istraživanjima i primeni savremenih dostignuća u građevinarstvu u oblasti materijala i konstrukcija, Društvo za ispitivanje i istraživanje materijala i konstrukcija Srbije, Tara, 2011, 373-380.

Za potrebe Ministarstva pravde Republike Srbije, nakon odluke o uklanjanju stare fasade i postavljanju nove, koja je pored drugačijeg načina oslanjanja takođe posedovala i veću sopstvenu težinu, pristupilo se izradi sanacije armiranobetonskih ivičnih greda. Postojeće grede nisu posedovale odgovarajuću nosivost koja bi prihvatila uticaje od nove fasade, tako da je u tom smislu bilo neophodno ojačanje / sanacija postojećih armiranobetonskih greda. Arhitektura unutrašnjeg dela objekta u tom trenutku nije bila razrađena. Svako povećanje visine greda bilo dodavanjem novog sloja betona sa armaturom koja nedostaje ili postavljanjem čeličnih profila nije bilo moguće uraditi zbog smanjenja visine korisnog prostora. Karbonske trake (CFRP Laminates) su odgovarale za bilo koji zahtev Investitora, pa je samim tim to i bilo rešenje sanacije. Buduća administrativna zgrada Investitora je spratnosti P0+Pr+13. Ukupna visina objekta iznosi 52.73 m. Za potrebe sanacije celog objekta, sprovedena je i detaljna analiza vetra. Urađeni su obimni istražni radovi na konstrukciji kompletnog objekta.

Ključne reči: administrativna zgrada, sanacija, karbonske trake, analiza vetra.

M. Bešević, N. Milovanović, M. Todorović, B. Ivanković

SANACIJA KONSTRUKCIJE RADI OBEZBEĐENJA STABILNOSTI OBJEKTA ZA UTICAJE OD SEIZMIČKIH DEJSTAVA U ULICI ZELENI VENAC BR.18 U BEOGRADU

Međunarodni simpozijum o istraživanjima i primeni savremenih dostignuća u građevinarstvu u oblasti materijala i konstrukcija, Društvo za ispitivanje i istraživanje materijala i konstrukcija Srbije, Tara, 2011, 389-396.

Budući da se projekat konstrukcije objekta u većem delu razlikovao od izvedenog stanja, veoma obimni istražni radovi su bili prvi sledeći korak. Oni su obuhvatali između ostalog proveru geometrije svakog konstruktivnog

elementa, utvrđivanje marke betona (klase betona), detektovanje ugrađene armature, proveru stabilnosti objekta postojećeg stanja za prihvatanje seizmičkih dejstava. Imajući u vidu da je objekat sagrađen u periodu između 1957-1960 god. do tada se seizmika kao dominantno horizontalno opterećenje na konstrukciju nije razmatrala na način na koji se to danas radi. Otuda je i logično da posmatrani armiranobetonski objekat nije imao u sastavu niti jedan konstruktivni element koji bi prihvatio seizmičke uticaje po trenutno važećim propisima u našoj zemlji. Objekat je spratnosti Po+Pr+13, od čega su poslednja dva sprata nadograđena u periodu oko 1963 god. Objekat je visine 52,73 m. Čelični spregovi, u vidu obrnutih „V" ispuna postavljeni su kao rešenje za horizontalno ukrućenje objekta.

Ključne reči: Sanacija, seizmika, ab. konstrukcija, čelični spregovi.

M. Bešević, N. Milovanović, M. Todorović, D. Kukaras.

SANACIJA KONSTRUKTIVNIH ELEMENATA ZA PRIHVATANJE NOVE FASADE U ULICI ZELENI VENAC BR.18 U BEOGRADU

Zbornik 20, Građevinski fakultet Subotica, 2011.

Poslovni objekat je spratnosti P0+Pr+13 spratova i nalazi se u Beogradu u ulici Zeleni Venac br.18. Noseća konstrukcija objekta je armiranobetonska do 12. sprata, dok su poslednje dve međuspratne konstrukcije zajedno sa stubovima izvedene kao čelična konstrukcija. Ukupna visina objekta iznosi 52.73 m. Na zahtev Investitora i na osnovu arhitektonskog rešenja, urađen je projekat nove fasade, koji po svom izgledu zadržava oblik stare fasade, dok se u konstruktivnom smislu oslanjanje fasade znatno razlikuje u odnosu na staro rešenje i kao takvo rešenje, uslovilo je da postojeći armiranobetonski elementi koji prihvataju uticaje od fasade moraju pretrpeti određena sanaciona rešenja. Pre usvajanja sanacionog rešenja sprovedena je detaljna analiza uticaja od vetra i težine nove viseće fasade, a izvršeno je i ispitivanje kvaliteta ugrađenih materijala u konstrukciji za nošenje fasade, (uzimanjem cilindričnih uzoraka). Sanacija se sprovodi u vidu karbonskih traka,(CFRP Laminates),uzimajući u obzir nesmetano postavljanje novih anker nosača za vezu AL-nosača.

Ključne reči: uzorci, sanacija, karbonske trake, analiza opterećenja, uticaji vetra, ispitivanja materijala, nosivost.

M. Arsić, Z. Odanović, B. Vistać, M. Burzić Z. Savić

ANALIZA MEHANIČKIH OSOBINA MATERIJALA VRATILA TURBINE AGREGATA A6 NA HIDROELEKTRANI ĐERDAP II

XVI Savetovanje KOMIM, Jagodina, 2011, 58-62.

U cilju utvrđivanja uzroka loma vratila turbine agregata A6 na hidroelektrani „ĐERDAP II“, kao polazna istraživanja, izvršena su ispitianja hemijskog sastava i mehaničkih osobina uzoraka prelomljenog dela. Vratilo turbine izrađeno je zavarivanjem, iz tri dela, od čeličnog liva oznake 20GSL, prema GOST 977-88. Utvrđeno je, da hemijski sastav i pored određenih odstupanja odgovara zahtevima GOST 380-94, da zatezne osobine, ispitane prema zahtevima SRPS EN 10002-1 i GOST 1497-84 ne zadovoljavaju i da energije udara u uzdužnom i poprečnom pravcu odlivka, ispitane prema zahtevima SRPS EN 10045-1 (Šarpi epruvete sa V zarezom) i GOST 9454-78 (Šarpi epruvete sa U zarezom) su veće od minimalno propisane vrednosti.

Ključne reči: vratilo turbine, čelični liv 20GSL, mehaničke osobine.

M. Arsić, Z. Odanović, M. Mladenović, Ž. Šarkoćević, D. Karišić

UTVRĐIVANJA UZROKA DEGRADACIJE MATERIJALA GORNJEG PRSTENA USMERNOG APARATA AGREGATA A6 NA HIDROELEKTRANI ĐERDAP I

XVI Savetovanje KOMIM, Jagodina, 2011, 63-68.

U cilju utvrđivanja uzroka degradacije osnovnog materijala, u zoni zavarenih spojeva, gornjeg prstena usmernog aparata na agregatu A6 hidroelektrane „Đerdap I”, izrađenog od čelika St 3, prema GOST 977-88, izvršena su ispitivanja hemijskog sastava i mehaničkih osobina. Utvrđeno je da hemijski sastav ispitaih uzoraka odgovara zahtevima GOST 380-94, da energije udara u poprečnom pravcu, ispitane prema zahtevima SRPS EN 10045-1 i GOST 9454-78, imaju značajno rasipanje po debljini uzoraka i da zatezne osobine u udužnom i poprečnom pravcu odgovaraju zahtevima GOST 1497-84, a da u „Z” pravcu vrednosti kontrakcije-suženja poprečnog preseka znatno odstupaju od minimalno propisanih, što ukazuje da osnovni materijal nije otporan na stvaranje lamelarnih prslina.

Ključne reči: čelik St 3, degradacija materijala, mehaničke osobine, lamelarne prsline.

D. Boljević, D. Savković

PODZAKONSKA AKTA I STANDARDI ZA MERENJE BUKE – PRIMEDBE I DILEME

ETRAN, Banja Vrućica, 2011, AK1.6-1-4.

Metodologija merenja buke u životnoj sredini u Republici Srbiji propisana novim podzakonskim aktima svakako je bolja od prethodne, ali ni izbliza ne rešava probleme koji se javljaju na terenu. Gorući problemi sa bukom kafića, restorana, zanatskih radnji i sl. ne mogu serešiti primenom novog zakona niti novih podzakonskih akata,ali ni standarda iz ove oblasti kod nas. U radu su date nekeprimedbe i dileme na nova podzakonska akta. Primedbe na novi zakon su date u okviru drugog rada izloženog na ovoj konferenciji.

A. Milenković, B. Budisavljević, D. Savković, D. Boljević

NEKI PROBLEMI SA ZAKONOM O ZAŠTITI OD BUKE U ŽIVOTNOJ SREDINI

ETRAN, Banja Vrućica, 2011, AK1.5-1-4.

U radu su obrađeni problemi sa Zakonom o zaštitiod buke u životnoj sredini u cilju da posluže kao inicijativaza izradu i korekciju postojeće zakonske regulative. Ovim radom nisu obuhvaćene sve greške koje ovaj Zakon sadrži,već one koje, po mišljenju autora rada, unose najvišeproblema.

S. Baralić, B. Budisavljević, A. Milenković

PRIKAZ ZAKONA O ZAŠTITI OD BUKE U ŽIVOTNOJ SREDINI

ETRAN, Banja Vrućica, 2011, AK1.4-1-4.

Zakon o zaštiti od buke u životnoj sredini stupio jena snagu maja 2009. godine, a ubrzo potom i Zakon oizmenama i dopunama zakona o zaštiti od buke novembra 2010. godine.U radu su dati komentari na primenu ovog Zakona u praksi, gde je ovaj jedini domaći propis koji rešava pitanje bukep raktično

neprimenljiv. Zakonom ne možemo biti zadovoljni ipotrebno je pokrenuti široku stručnu i društvenu akciju da seon hitno doradi i dovede u formu koja će postati primenjiva iefikasna.

G. Maletić, J. Ćirilović, A. Đorđević

METODA ZA OCENU PODUŽNE RAVNOSTI KOLOVOZA UPOTREBOM INERCIJALNOG PROFILOMETRA

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 79-84.

Praćenje i ocena stanja kolovoza su važne aktivnosti u procesu upravljanja kolovozima. Ovaj rad opisuje proceduru za ocenu podužne ravnosti kolovoza upotrebom inercijalnog profilometra. Analizom prikupljenih podataka dolazi se do vrednosti indikatora stanja kolovoza na osnovu kojih se donose odluke da li je potrebno intervenisati na kolovozu. Na ovaj način, moguće je odrediti neophodnu visinu budžeta za održavanje mreže u analiziranom periodu, na programskom nivou daje se mogućnost utvrđivanja prioritetnih aktivnosti, dok se na nivou projekta može precizno utvrditi način održavanja puta.

Ključne reči: podužni profil, inercijalni profilometar, ravnost kolovoza.

V. Jokić, A. Đorđević, J. Ćirilović

POREĐENJE METODA ZA VIZUELNO UTVRĐIVANJE STEPENA OBAVIJENOSTI I SKIDANJA UGLJOVODONIČNIH VEZIVA S KAMENIH MATERIJALA PO EN I SRPS STANDARDIMA

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 539-544.

U ovom radu data je uporedna analiza laboratorijskih metoda za vizuelno utvrđivanje stepena obavijenosti ukupne površine zrna agregata ugljovodoničnim vezivom prema evropskom standardu EN 12697-11(Deo A) i standardu SRPS U.M8.096. Iako je princip određivanja isti, zaključeno je da postoje brojne razlike koje se tiču: veličine frakcije kamenog agregata, količine uzoraka kamenog agregata i veziva, broja probnih uzoraka, načina mešanja, vremena ispitivanja i broja ispitivača koji vrše ocenu stepena obavijenosti.

Osnovna prednost evropske metode se ogleda u primeni mašine za automatsko mešanje, u odnosu na srpski standard gde se mešanje izvodi ručno, kao i u većem broju probnih uzoraka na kojima se utvrđuje stepen obavijenosti.

Ključne reči: uporedna anliza, vizuelno utvrđivanje, obavijenost i skidanje.

B. Petrović, T. Spasojević, O. Vušović.

NEKI ASPEKTI UPRAVLJANJA GRAĐEVINSKIM OTPADOM KOJI SADRŽI AZBEST, RECIKLAŽNE TEHNOLOGIJE I ODRŽIVI RAZVOJ

6. SRTOR, Soko Banja, 2011, 109-114.

U ovom radu su prikazana neka naša zapažanja uočena tokom rada na karakterizaciji građevinskog otpada koji sadrži azbest, a koji nastaje rušenjem ili sanacijom građevinskih objekata. Prisustvo azbesta u otpadu u postupku karakterizacije dokazuje se standardnim akreditovanim metodama. Azbest je kancerogen, pa njegovo prisustvo u otpadu čini otpad opasnim. Zakonska regulativa podržava pitanje upravljanja otpadom kako u Srbiji, tako i u svetu. U ovom radu biće prikazano naše iskustvo u radu na karakterizaciji građevinskog otpada koji sadrži azbest i preporuke za tretman takvog otpada.

Ključne reči: građevinski otpad, upravljanje, azbest, karakterizacija, odlaganje.

T. Spasojević-Šantić, G. Dražić, B. Petrović

ANALIZA STANJA UPRAVLJANJA INDUSTRIJSKIM OTPADOM U REPUBLICI SRBIJI SA ASPEKTA BIOREMEDIJACIJE ODLAGALIŠTA

Treća regionalna naučno-stručna konferencija o upravljanju industrijskim otpadom u sferi održivog razvoja, IWM 3, Kopaonik, 2011.

U ovom radu je predstavljena analiza stanja upravljanja industrijskim otpadom u Republici Srbiji sa posebnim osvrtom na opasan industrijski otpad. Suština problema se ogleda u činjenici da u Republici Srbiji ne postoji ni jedna lokacija za odlaganje opasnog industrijskog otpada i da se on godinama, uglavnom nepropisno skladišti unutar fabričkih krugova.Usled toga dolazi do kontinuirane kontaminacije zemljišta i podzemnih voda teškim metalima.Sve to utiče na

smanjenje funkcije ekosistema industrijske zone i onemogućavanja sposobnosti samoprečišćavanja životne sredine. Cilj rada je da se ukaže na značaj bioremedijacije odlagališta industrijskog otpada kako bi se izvršila revitalizacija degradiranih područja i povećala stabilnost ekosistema.

Ključne reči: industrijski otpad, odlagališta, bioremedijacija

Z. Jakovljev, S. Spasić, T. Spasojević

EKONOMSKO-FINANSIJSKI INSTRUMENTI EKOLOŠKE POLITIKE RACIONALNOG KORIŠĆENJA MINERALNIH RESURSA

Stanje i perspektive u rudarstvu i održivi razvoj, „RUDARSTVO 2011“, Vrnjačka Banja, 2011, 438-444.

Mineralni resursi pripadaju širokoj grupi neobnovljivih resursa, prvenstveno zbog toga što je za njihovo stvaranje potrebno više miliona godina. S obzirom da prilikom eksploatacije i procesiranja mineralnih resursa dolazi do emisije polutanata u životnu sredinu, degradacije prostora, kao i iscrpljivanja prirodnih sirovina racionalno korišćenje mineralnih i drugih resursa postavlja se kao imperativ u kreiranju ekoloških politika u razvijenim zemljama. Ovaj rad je pokušaj sagledavanja mogućnosti primene kako konvencionalnih fiskalnih instrumenata, tako i modernih mera poput reciklaže ili supstitucije. Poseban osvrt biće dat analizi uloge naknade za korišćenje mineralnih sirovina u domenu valorizacije i očuvanja prirodnog kapitala.

Ključne reči: Ekološka ekonomija, neobnovljivi resursi, prirodni kapital.

A. Terzić, Lj. Pavlović, Z. Radojević, Lj. Miličić

RECIKLAŽA ELEKTROFILTERSKOG PEPELA I PRIMENA U PROIZVODNJI GRAĐEVINSKIH MATERIJALA

Treća regionalna naučno-stručna konferencija o upravljanju industrijskim otpadom - IMW3, Forum Kvaliteta, Kopaonik, 2011, 165-174.

Elektofilterski pepeo, koji nastaje kao nus-produkat sagorevanja uglja u termo-elektranama, predstavlja veliku opasnost za životnu sredinu. Velika produkcija elektrofilterskog pepela, takođe, otvara pitanje problema skladištenja. Reciklaža i upotreba elektrofilterskog pepela u proizvodnji građevinskih materijala danas

predstavlja najbolje i najekonomičnije rešenje za prethodno pomenute probleme. Elektrofilterski pepeo se može koristiti kao komponenta za proizvodnju: cementa, maltera, betona, opeka, pločica i drugih vrsta građevinske keramike, pri čemu se elektrofilterski pepeo može koristi kao zamena za vezivo (zbog pucolanskih svojstava) ili zamena za sitni agregat. Zavisno od sastava i finoće elektrofilterskog pepela koeficijent zamene u građevinskom materijalu se kreće obično između 20 i 40%. U ovom radu su ispitivana mehanička svojstva građevinskih materijala zavisno od hemijskog sastava, granulometrijskog sastava i koeficijenta zamene.

Ključne reči: elektrofilterski pepeo, reciklaža, građevinska keramika, mehanička svojstva, koeficijent zamene.

M. Arsenović, Lj. Miličić, Z. Radojević

THE INFLUENCE OF WASTE MATERIAL ADDITION ON BRICK PRODUCTS TECHNOLOGICAL PROPERTIES

Treća regionalna naučno-stručna konferencija o upravljanju industrijskim otpadom - IMW3, Forum Kvaliteta, Kopaonik, 2011, 157-164.

Abstract: The purpose of this study is to utilize industrial sludges as additives in the production of clay bricks. Incorporation of several industrial wastes in ceramic masses is used as a method for solving hazardous waste problem and reducing the production costs. The effect of sludges with different replacing ratios on firing parameters and properties of laboratory samples were studied. Samples were subjected to different tests concerning mineralogy, chemical content, mechanical properties etc, in order to determine the applicability of the procedure, as well as optimal sludge content.

Keywords: industrial sludge, clay brick, heavy metals, porosity, sintering process

Lj. Pavlović, A. Terzić, Z. Radojević, Lj. Miličić

ELEKTROFILTERSKI PEPEO KAO POTENCIJALNA SIROVINA ZA PROIZVODNJU GRAĐEVINSKIH MATERIJALA I KERAMIKE

SRTOR VI 6th Symposium „Recycling Technologies and Sustainable Development with International Participation“, Soko Banja, 2011, 115-120.

U ovom radu je dat pregled ispitivanja mogućnosti primene elektrofilterskog pepela, sekundarne sirovine, kao vredne komponente za proizvodnju građevinskih materijala i keramike. Rezultati ispitivanja su pokazali da se uz neophodnu korekciju hemijskog sastava elektrofilterskog pepela može se dobiti dobar keramički kompozit od koga se mogu oblikovati proizvodi građevinske keramike: cigla, crep i podne pločice.

Ključne reči: elektrofilterski pepeo, sekundarna sirovina, reciklaža, cigla, pločice.

Z. Radojević, I. Delić-Nikolić, Lj. Miličić, A. Terzić

ODRŽIVO KORIŠĆENJE MINERALNIH SIROVINA U PROIZVODNJI GRAĐEVINSKIH MATERIJALA U SRBIJI

SRTOR VI 6th Symposium „Recycling Technologies and Sustainable Development with International Participation“, Soko Banja, 2011, 102-108.

U Nacionalnoj strategiji održivog razvoja Republike Srbije značajno mesto je posvećeno mineralnim sirovinama i njihovom održivom razvoju. Industrija građevinskih materijala koristi velike količine primarnih mineralnih sirovina. Proizvodnja građevinskih materijala na bazi nemetaličnih mineralnih sirovina doprinosi održivom razvoju: smanjenjem potrošnje prirodnih sirovina, primenom otpadnih materijala, smanjenjem potrošnje energije, manjom emisijom materijala štetnih po okolinu. U radu je prikazano stanje primene mineralnih sirovina u Srbiji pri proizvodnji građevinskih materijala. Kako u svim fazama istraživanja, pripreme, prerade, transporta i korišćenja mineralnih sirovina do finalnog proizvoda, dolazi do negativnog uticaja na životnu sredinu, predložene su određena svođenja na prihvatljive granice. Na primeru proizvodnje opekarskih proizvoda i cementa objašnjeni su doprinosi održivom razvoju.

Ključne reči: održivi razvoj, mineralne sirovine, opekarski proizvodi, zaštita životne sredine.

Z. Radojević, A. Terzić, Lj. Miličić, I. Delić Nikolić

TEXTURAL CHARACTERISTICS OF BRICK PREVIOUSLY BUILT-IN GOTHIC-ROMANIC MONASTERY OF NOVI RAKOVAC, GRADINA

DIMK, XXV Kongres i Međunarodni simpozijum o istraživanjima i primeni savremenih dostignuća u građevinarstvu u oblasti materijala i konstrukcija, Tara, 2011, 51-58.

This paper reflects on investigation of brick textural characteristics, which was originally built-in Gothic-Romanic monastery on location of Novi Rakovac, Gradina. Importance of preservation of cultural heritage of Serbia is hereafter highlighted. Chemical and physico-mechanical properties of brick samples were investigated in order to determine cause and level of degradation. In this paper, results and short description of used methods of sampling and testing were given, as well as conclusions about prevention of further deterioration.

Keywords: brick, properties, investigation methods, cultural heritage

I. Delić-Nikolić, B. Ivović, L. Kurešević

OCENA STANJA FASADNE OBLOGE OD KAMENA NAKON 25 GODINA OD UGRADNJE, PRIMER ZGRADE U BEOGRADU

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 401-406.

Oblaganje zgrada pločama od prirodnog kamena uz estetski doživljaj posmatrača, što je najčešće i osnov za izbor ove vrste obloge, obično garantuje i dugovečnost fasade. Da li se obloga od kamenih ploča menja tokom vremena i koliko, ispitivano je na jednom reprezentativnom objektu, koji se nalazi u centru Beograda, u ulici Kneza Miloša, dvadeset pet godina nakon njegove ugradnje.

Ključne reči: Prirodni kamen, ploče od prirodnog kamena, krečnjak

L. Kurešević, B. Ivović, I. Delić-Nikolić

OCENA STANJA KAMENA UGRAĐENOG U SOKLU ŠKOLE NIKOLA TESLA U BEOGRADU

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 385-390.

Ispitano je stanje blokova od prirodnog kamena koji su ugrađeni u soklu zgrade Elektrotehničke škole "Nikola Tesla" u Beogradu. Investitor se iz nepoznatih razloga odlučio da izvor kamena bude piroklastična stena, koja se inače ne koristi za ove namene zbog brojnih loših svojstava sa aspekta građevinskog kamena. Utvrđeno je da su blokovi završno obrađeni klesanjem relativno očuvani i u zadovoljavajućem stanju. Blokovi završno obrađeni štokovanjem pokazuju karakteristično korasto raspadanje uz tlo pod uticajem vlage i soli. Blokovi koji su nakon klesanja brazdani su propali u različitom stepenu – od inicijalnog konturnog korastog raspadanja do potpunog sprašivanja.

Ključne reči: blokovi prirodnog kamena, sokla, piroklastične stene.

I. Delić Nikolić, O. Vušović, B. Ivović, A. Jeličić

PRILOG ISTRAŽIVANJU I ISPITIVANJU ISTORIJSKIH MALTERA, MINERALOŠKO-PETROGRAFSKA ISPITIVANJA AGREGATA U MALTERU SA MANASTIRA GRADAC

Međunarodni simpozijum o istraživanjima i primeni savremenih dostignuća u građevinarstvu u oblasti materijala i konstrukcija, Tara, 2011, 37-42.

Cilj definisanja originalnih receptura istorijskih maltera jeste obezbedjivanje kvalitetne osnove za rekonstrukciju kulturno-istorijskih spomenika. Ispitivanje mineraloško-petrografskog sastava agregata jedan je od prvih koraka u sistematskom pristupu ovoj problematici. U radu su prezentovani rezultati ispitivanja sprovedenih na malteru sa manastira Gradac.

Ključne reči: istorijski malter, spomenici kulture, agregat.

S. Miletić, Lj. Miličić, A. Terzić

LETEĆI PEOPEO KAO NEOPHODNA SIROVINA ZA ODRŽIVU PROIZVODNJU GRAĐEVINSKIH MATERIJALA

„Izgradnja“ 9-10, septembar - oktobar 2011.

Nagomilavanje otpada predstavlja jedan od velikih problema moderne civilizacije, kako sa komunalnog tako i sa ekološkog, tehnološkog, urbanističkog, građevinskog i energetskog stanovišta. Raspoloživi podatci o proizvodnji elektrofilterskog pepela u našim termoelektranama upućuju na problem deponovanja velikih količina ovog materijala. Upravo takve deponije su jedan od uzroka zagađenja okoline u kojoj se leteći pepeo proizvodi i deponuje. Aktuelna istraživanja upućuju na činjenicu da je jedino efikasno rešenje ovog problema upotreba letećeg pepela u industriji građevinskih materijala. Ovaj rad prikazuje pregled različitih mogučnosti upotrebe letećeg pepela.

Ključne reči: leteći pepeo, građevinski materijali, putna privreda, cement, beton, reciklaža.

G. Maletić, J. Ćirilović, A. Đorđević

METODA ZA OCENU PODUŽNE RAVNOSTI KOLOVOZA UPOTREBOM INERCIJALNOG PROFILOMETRA

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Ključne reči: podužni profil, inercijalni profilometar, ravnost kolovoza.

V. Jokić, A. Đorđević, J. Ćirilović

POREĐENJE METODA ZA VIZUELNO UTVRĐIVANJE STEPENA OBAVIJENOSTI I SKIDANJA UGLJOVODONIČNIH VEZIVA S KAMENIH MATERIJALA PO EN I SRPS STANDARDIMA

SGIS, Sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, Zlatibor, 2011, 539-544.

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Ključne reči: uporedna anliza, vizuelno utvrđivanje, obavijenost i skidanje.

Ž. Flajs, N. Milovanović, B. Ivanković

PROCENA EFEKTIVNOSTI RADOVA NA REHABILITACIJI I SANACIJI MOSTOVSKE KONSTRUKCIJE PREKO REKE ARNAUTE

VII Nauučno-stručno savetovanje SGIS, Zlatibor, 2011, 153-158.

Glavni projekat rehabilitacije/sanacije mostovskih konstrukcija na magistralnom putu M-5, deonica Paraćin – Zaječar započet je krajem 2007. god od strane JP Puteva Srbije. Projektom je bilo obuhvaćeno 25 mostovskih konstrukcija na toj deonici. Projektni zadatak zahtevao je rehabilitaciju i sanaciju mostovskih konstrukcija kako bi bile u stanju da prihvate saobraćajno opterećenje prema važećem Pravilniku o tehničkim normativima za određivanje veličine opterećenja mostova iz 1990. god. Kao procena efektivnosti primenjenih radova, u ovom radu će se razmatrati izmerene vrednosti vertikalnih pomeranja dobijenih prilikom ispitivanja mostovske konstrukcije probnim opterećenjem, pre i nakon izvršenih radova.

Ključne reči: mostovska konstrukcija, ispitivanje probnim opterećenjem.

N. Milovanović, Ž. Flajs, Z. Hriberšek, B. Ivanković

PROVERA NOSIVOSTI PROBNIM OPTEREĆENJEM MEĐUSPRATNE KONSTRUKCIJE KC NIŠ, IZVEDENE U IMS SISTEMU

VII Nauučno-stručno savetovanje SGIS, Zlatibor, 2011, 415-420.

Projektom rekonstrukcije postojećeg objekta Kliničkog centra u Nišu, čija je gradnja započeta pre 30 god. i nije u potpunosti završena, predviđena je nova organizacija i prenamena prostora. Novim projektnim zadatkom, definisanim od strane Ministarstva zdravlja, bilo je potrebno ispitivanje probnim opterećenjem unapred definisanih tavanica, radi provere nosivosti istih. S'obzirom da se radi o promeni opterećenja koje je definisano novim projektnim zadatkom i koje je većeg inteziteta u odnosu na opterećenje po prvobitnom projektu, ovakav zahtev je opravdan. Laboratorija za ispitivanje konstrukcija INSTITUTA IMS obavila je ispitivanje probnim statičkim opterećenjem međuspratne konstrukcije izvedene u IMS sistemu.

Ključne reči: provera nosivosti, statičko probno opterećenje, ispitivanje IMS tavanice.

Ž. Flajs, N. Milovanović

ISPITIVANJE STATIČKIM OPTEREĆENJEM AB STUBA ELEKTROENERGETSKE MREŽE U CILJU UTVRĐIVANJA NJEGOVE NOSIVOSTI

Kongres metrologa, 2011, str. 9-15.

U cilju utvrđivanja nosivosti armiranobetonskog stuba elektroenergetske mreže 110kV, izvedeno je ispitivanje probnim opterećenjem i ispitivanje do loma konstrukcije stuba. Ispitivanje je obavljeno na uzorku koji je ugrađen u sistem energetske mreže pre više od 30 godina. Postojeća energetska mreža je trenutno van upotrebe sa planom da se izvrši njena prenamena. Rezultati ispitivanja korišćeni su u cilju utvrđivanja nosivosti stuba, kao i mogućnosti za prihvatanje novog opterećenja.

Ključne reči: ispitivanje probnim statičkim opterećenjem, ispitivanje do loma, AB stub.

6. DOKTORSKE DISERTACIJE I MAGISTARSKI RADOVI (M70)

Dragan Bojović

MAGISTARSKI RAD

OPTIMIZACIJA PRETHODNIH LABORATORIJSKIH ISPITIVANJA BETONA PRIMENOM NEURONSKIH MREŽA

Građevinski fakultet univerziteta u Beogradu

Izvođenje prethodnih laboratorijskih ispitivanja betona je veoma dug proces. Ovaj proces je sastavni deo pripremnih radova svakog velikog projekta, a prema trenutno važećim propisima i projekti sa dosta manjim obimom radova zahtevaju ovakav vid pripremnih radova.

U doba masovne i brze izgradnje, smanjenje rokova je od velikog značaja za dobijanje i ugovaranje posla. Pred izvođačem radova je veoma kratak period od momenta dobijanja posla do početka izgradnje, pa je stoga vreme pripremnih radova svedeno na minimum.

Bez nedovoljno opsežnih prethodnih laboratorijskih ispitivanja betona izvođač radova preuzima na sebe veliki rizik kvaliteta ugrađenog betona. Čest je slučaj da se prethodna laboratorijska ispitivanja betona vrše neposredno pred početak betonskih radova, a projektant betonskih mešavina je u veoma nezahvalnoj poziciji. Od njega se očekuje da da projekat betonskih mešavina izvođaču radova bez temeljnih ispitivanja, a čest je slučaj da se u takvim situacijama pribegava nepotrebno visokim količinama cementa što dodatno može povećati troškove izvođaču radova.

Do sada je, na osnovu klasičnih statističkih metoda, bilo pokušaja da se utvrde zakonitosti između karakteristika komponentnih materijala i karakteristika očvrslog betona. Ove zakonitosti su se zasnivale kako na teorijskim tako i na empirijskim zaključcima. One se danas koriste kao polazna tačka u projektovanju betonskih mešavina u prethodnim laboratorijskim ispitivanjima. Zajedničko za sve ove pokušaje je da su u vezi sa nekom karakteristikom betona korišćena dva do tri parametra u betonu što je i krajnja granica klasičnih statističkih metoda.

Pojavom optimizacionih tehnika mekog programiranja (neuronskih mreža, genetskih algoritama, grubih skupova i slično) u stanju smo da aproksimiramo skoro svaku funkciju nezavisno od broja ulaznih parametara. Navedene optimizacione tehnike i meko programiranje zahtevaju dovoljno dobre i velike baze podataka, a kroz iterativne postupke u modelima dolazi se do aproksimacija koje nam omogućavaju predviđanje karakteristika. Na osnovu ovoga lako je zaključiti kakve se sve nove mogućnosti otvaraju primenom tehnika mekog programiranja, pogotovu na polju betona kao kompozitnog i anizotropnog materijala.

Rad ima za cilj da se, na osnovu dosadašnjeg iskustva prilikom izrade prethodnih laboratorijskih ispitivanja betona, i novih tehnika mekog programiranja, neuronskih mreža, napravi procedura kojom bi se optimizovao proces prethodnih laboratorijskih ispitivanja betona. Optimizacija bi se odnosila na trajanje procesa, a u toku tog procesa vršiće se ujedno i optimizacija sastava betona. Tim postupkom bi se vršilo skraćenje rokova, optimizovanje sastava betona i smanjilo koštanje procesa izrade prethodnih laboratorijskih ispitivanja betona.

U prvom teorijskom delu biće naveden prikaz glavnih parametara koji utiču na kvalitet betona, odnosno na pritisnu čvrstoću betona u starosti od 28 dana. Zatim sledi kratak opis neuronskih mreža kroz istorijski prikaz, vrste, načine rada i glavne algoritme učenja neuronskih mreža. U drugom praktičnom delu, biće prikazani način formiranja baze podataka, bez koje nema ni primene tehnika mekog programiranja, i formirana baza podataka prethodnih laboratorijskih ispitivanja betona. Nakon toga sledi prikaz formiranih modela neuronskih mreža i izvršena analiza istih na formiranoj bazi podataka. Zatim će kroz eksperimentalni primer biti pokazani mogući načini primene usvojenog modela neuronske mreže. Cilj, odnosno, zaključak ovog rada biće pokušaj formiranja procedure za optimizaciju prethodnih laboratorijskih ispitivanja betona ili predloga kako u budućnosti doći do nje primenom neuronskih mreža.

Ključne reči: beton, komponentni materijali, čvrstoća pri pritisku, projektovanje sastava, neuronske mreže, optimizacija procesa.

7.TEHNIČKA I RAZVOJNA REŠENJA (M80)

NOVI TEHNOLOŠKI POSTUPAK (M 83)

R. Vasić, B. Vitas, M. Vasić

LABORATORIJSKA RECIRKULACIONA SUŠARA SA MOGUĆNOŠĆU KOMPJUTERSKOG UPRAVLJANJA SUŠENJEM

Verifikovano u kategoriji tehničko razvojna rešenja M 83 – Novo laboratorijsko postrojenje.

Suština ovog tehničkog rešenja odnosno poboljšane laboratorijske sušare je što ona u laboratorijskim uslovima rada omogućava definisanje najkraćeg vremena sušenja opekarskih proizvoda u zavisnosti od svojstava sirovine u industrijskoj tunelskoj sušari, pri ćemu se sva istraživanja rade u laboratorijskim uslovima rada. Optimalno vođenje procesa sušenja opekarskih proizvoda omogućava: značajno skraćenje vremena sušenja opekarskih proizvoda, povećanje kapaciteta sušara, smanjenje škarta u proizvodnji, poboljšanje kvaliteta proizvoda i povećanje energetske efikasnosti proizvodnje opekarskih proizvoda.

8. ORGANIZACIJA NAUČNO-STRUČNIH SKUPOVA

NAUČNO-STRUČNI SKUP SA MEĐUNARODNIM UČEŠĆEM

VI KONGRES CIGLARSKE INDUSTRIJE SRBIJE SA MEĐUNARODNIM UČEŠĆEM

U organizaciji Instituta za ispitivanje materijala a.d., u saradnji sa suorganizatorom – Udruženjem savremene industrije glinenih proizvoda (SIGP), održan je naučno-stručni skup sa međunarodnim učešćem pod nazivom „VI Kongres ciglarske industrije Srbije sa međunarodnim učešćem“. Skup je održan u periodu od 21. do 23. septembra 2011. u Soko Banji (hotel „Zdravljak), uz učešće najuglednijih predstavnika struke.

Radovi predstavljeni na skupu publikovani su u specijalnom izdanju časopisa Udruženja inženjera građevinarstva, geotehnike, arhitekture i urbanista „Izgradnja“ (br. 9-10, septembar - oktobar 2011, Izgradnja 65(2011), UDK 624+71-72 (05), ISSN 0350-5421).

Ukupan broj učesnika na skupu je bio 110 (80 učesnika iz zemlje i 30 iz inostranstva). Teme skupa su bile:

1. Sirovinska baza;

2. Savremena proizvodnja i tehnološki razvoj;

3. Standardizacija, kvalitet i tehnička regulativa;

4. Zaštita životne sredine i energetska efikasnost;

5. Primena i mogućnosti šire primene proizvoda od gline.

U okviru 5 tematskih oblasti prezentovano je ukupno 27 radova.

MEĐUNARODNI NAUČNO-STRUČNI SKUP

XXV KONGRES I MEĐUNARODNI SIMPOZIJUM O ISTRAŽIVANJIMA I PRIMENI SAVREMENIH DOSTIGNUĆA U GRAĐEVINARSTVU U OBLASTI MATERIJALA I KONSTRUKCIJA

U organizaciji Instituta za ispitivanje materijala a.d., u saradnji sa suorganizatorom – Društvom za ispitivanje i istraživanje materijala i konstrukcija Srbije – DIMK, održan je međunarodni naučno-stručni skup „XXV Kongres i Međunarodni simpozijum o istraživanjima i primeni savremenih dostignuća u građevinarstvu u oblasti materijala i konstrukcija (25^{th} Congress and international symposium about research and application of modern achievements in civil engineering in the field of materials and structures)“. Skup je održan u periodu od 19. do 21. oktobra 2011. na Tari (hotel „Omorika“) uz učešće najuglednijih predstavnika struke.

Radovi predstavljeni na skupu publikovani su u zborniku radova (Zbornik radova „XXV Kongres i Međunarodni simpozijum o istraživanjima i primeni savremenih dostignuća u građevinarstvu u oblasti materijala i konstrukcija“ ISBN 978-86-87615-02-1 COBISS.SR-ID 186877196).

Teme skupa su bile:

1. Istraživanje na području materijala i njihove primene;
2. Teorijska i eksperimentalna analiza konstrukcija;
3. Projektovanje i građenje objekata;
4. Aseizmičko projektovanje i građenje;
5. Održavanje i sanacija građevinskih obejekata;
6. Materijali, konstrukcije i životna sredina;
7. Energetska efikasnost građevinskih objekata;
8. Građevinsko-tehnička regulativa i sistem kvaliteta;
9. Menadžment u građevinarstvu.

U okviru 9 tematskih oblasti prezentovano je ukupno 64 rada.

DOMAĆI NAUČNO-STRUČNI SKUPOVI SA MEĐUNARODNIM UČEŠĆEM

VII NAUČNO-STRUČNO SAVETOVANJE OCENA STANJA, ODRŽAVANJE I SANACIJA GRAĐEVINSKIH OBJEKATA I NASELJA

Savez građevinskih inženjera Srbije, u saradnji sa Institutom IMS a.d., Saobraćajnim institutom CIP d.o.o. i preduzećem Putevi a.d. Užice, organizovao je sedmo naučno-stručno savetovanje „Ocena stanja, održavanje i sanacija građevinskih objekata i naselja“, na Zlatiboru, u hotelu „Palisad“, u periodu od 9. do 12. maja 2011. godine.

Institut IMS je bio zastupljen u programskom odboru savetovanja sa dva člana, a u organizacionom odboru sa pet članova, svi iz Centra za konstrukcije i prednaprezanje.

Istraživači Instituta IMS su na savetovanju prikazali jedanaest radova iz oblasti sanacije mostova, od elemenata konstrukcije do specijalnih sistema konstrukcije. Svojom nesvakidašnjom tematikom i specifičnom prezentacijom izdvaja se rad „Rušenje i/ili uklanjanje objekata“ Miroljuba Todorovića, odlično prihvaćen od prisutnih na savetovanju.

Radovi predstavljeni na skupu su publikovani u zborniku radova ISBN 978-86-904089-9-3.

ČETVRTO NAUČNO-STRUČNO SAVETOVANJE GEOTEHNIČKI ASPEKTI GRAĐEVINARSTVA

Savez građevinskih inženjera Srbije i Srpsko društvo za mehaniku tla i geotehničko inženjerstvo, u saradnji sa Institutom IMS, Saobraćajnim institutom CIP i preduzećem Putevi Užice, organizovalo je četvrto naučno stručno savetovanje „Geotehnički aspekti građevinarstva“, na Zlatiboru, u hotelu „Palisad“, u periodu od 31. oktobra do 3. novembra 2011. godine.

Kao potpredsednik organizacionog odbora savetovanja, u organizaciji i radu savetovanja učestvovao je i generalni direktor Instituta IMS dr Vencislav Grabulov, koji je i otvorio savetovanje. U radu organizacionog odbora savetovanja učestvovalo je još troje saradnika Instituta IMS.

Istraživači Instituta IMS su na savetovanju prikazali četiri rada, od kojih se svojom specifičnom tematikoma izdvaja rad „Istražna okna za potrebe sanacije klizišta Beška“. Vrlo uspešnu prezentaciju rada prikazao je dr Nenad Šušić.

9. NAUČNI PROJEKTI FINANSIRANI OD STRANE MINISTARSTVA PROSVETE I NAUKE

Ev. broj	Naziv projekta
	Tehnološki razvoj
35002	Razvoj novih metodologija revitalizacje turbinske i hidromehaničke opreme hidroelektrana u zavisnosti od uzroka degradacije materijala
36014	Geotehnički aspekti istraživanja i razvoja savremenih tehnologija građenja i sanacija deponija komunalnog otpada
36017	Istraživanje mogućnosti primene otpadnih i recikliranih materijala u betonskim kompozitima, sa ocenom uticaja na životnu sredinu, u cilju promocije održivog građevinarstva u Srbiji
35011	Integritet opreme pod pritiskom pri istovremenom delovanju zamarajućeg opterećenja i temperature
35006	Održivost i unapređenje mašinskih sistema u energetici i transportu primenom forenzičkog inženjerstva, eko i robust dizajna
35029	Razvoj metodologija za povećanje radne sposobnosti, pouzdanosti i energetske efikasnosti mašinskih sistema u energetici
35040	Razvoj savremenih metoda dijagnostike i ispitivanja mašinskih struktura
34024	Razvoj tehnologija za reciklažu plemenitih, retkihi pratećih metala iz čvrstog otpada Srbije do visokokvalitetnih proizvoda

Ev. broj	Naziv projekta
	Integralna I interdisciplinarna istraživanja
45008	Razvoj i primena multifunkcionalnih materijala na bazi domaćih sirovina modernizacijom tradicionalnih tehnologija
42012	Poboljšanje energetske efikasnosti zgrada u Srbiji i unapređenje nacionalnih regulativnih kapaciteta za njihovu sertifikaciju
	Osnovna istraživanja
186010	Minerali Srbije: sastav, struktura, geneza, primena i doprinos održanju životne sredine
172005	Uticaj nano i mikrostrukturnih konstituenata na sintezu i karakteristike savremenih kompozitnih materijala sa metalnom osnovom
174004	Mikromehanički kriterijumi oštećenja i loma
172057	Usmerena sinteza, struktura i svojstva multifunkcionalnih materijala

ODABRANE STRUČNE REFERENCE

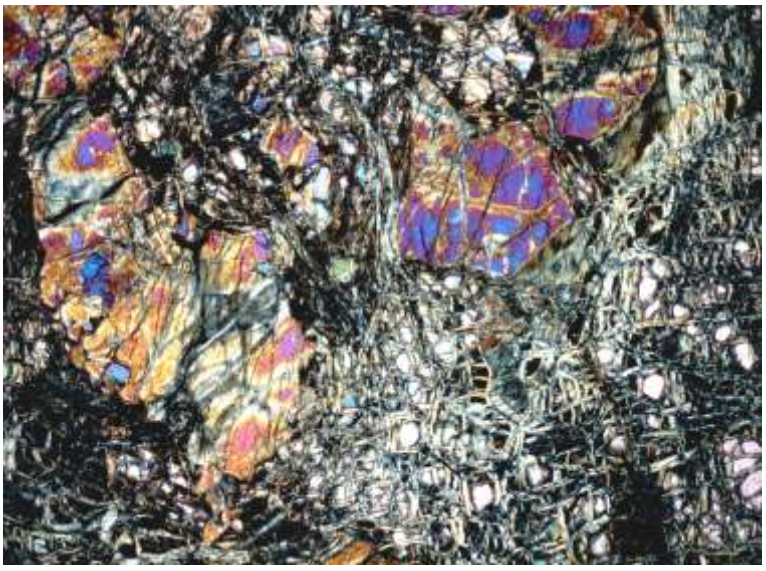
ODABRANE STRUČNE REFERENCE

U ovom odeljku dat je pregled ključnih usluga koje je Institut IMS izvršio u 2010. godini. U skladu sa multidisciplinarnom organizacijom Instituta, usluge obuhvataju izradu investiciono-tehničke dokumentacije, ispitivanja na terenu i u laboratorijama, stručni nadzor nad izvođenjem radova, studije, ekspertize i drugo u praktično svim oblastima građevinarstva i energetike. Pregled referenci dat je po organizacionim celinama.

CENTAR ZA MATERIJALE

R.b.	Referenca
	Laboratorija za kamen i agregat
1.	Ispitivanje kamena za realizaciju geoloških istražnih radova i izradu podloga Idejnih projekata za hidroelektrane na Ibru (HE Gradina, HE Cerje, HE Glavica, HE Ušće, HE Gokčanica, HE Bojanići).
2.	Laboratorijsko ispitivanje u cilju realizacije geoloških istraživanja ležišta kamena, šljunka i peska (ležišta u Srbiji i Crnoj Gori).
3.	Ispitivanje istorijskih maltera (manastir Dombo-Novi Rakovac, Viminacijum, Pećka Patrijaršija, manastir u Baču, Manastir u Velikoj Hoči, Rogljevačke pivnice).
4.	Brojne analize kamena i kamenog agregata.
	Laboratorija za građevinsku keramiku
5.	Elaborat o oceni kvaliteta opekarske sirovine sa ležišta ciglane IGM „KUBRŠNICA“ Aranđelovac.
6.	Studija o projektovanju optimalne mešavine za proizvodnju opekarskih proizvoda u ciglani IGM „MLADOST TMP“ Mala Plana.

7.	Elaborat o oceni kvaliteta opekarske sirovine sa ležišta ciglane IGM „SLOGA“ Novi Pazar.
8.	Studija o rezultatima dijagnosticiranja temperaturnog režima rada tunelske peći sa preporukama za optimizaciju procesa pečenja u crepani IGM „MLADOST“, Leskovac, faza I i II.
9.	Elaborat o oceni kvaliteta opekarske sirovine sa ležišta Slatina u Kaću.
10.	Elaborat o oceni kvaliteta opekarske sirovine sa ležišta ciglane „MAŠINAC KRALJEVO“ RJ Ciglana Svilajnac, Svilajnac.
11.	Elaborat o oceni kvaliteta opekarske sirovine sa ležišta Grabovnica za potrebe crepane IGM „MLADOST“, Leskovac.
12.	Elaborat o oceni kvaliteta opekarske sirovine sa ležišta Čiker u Novom Orahovu.



	Laboratorija za beton
13.	Početni nadzor fabrike i fabričke kontrole proizvodnje za „SC Europrefabricate“, Sofija, Bugarska, 2011.
14.	Prethodna ispitivanja, kontrola kvaliteta betona i sastavnih delova betona na izvođenju radova na projektu: Obilaznica oko Beograda, deonica Dobanovci-Bubanj Potok, za „Energoprojekt-Niskogradnja“, Beograd, 2011.
15.	Kontrola kvaliteta betona na mostu preko reke Pek u selu Miljevići za „PZP Požarevac“, Požarevac, 2011.
16.	Kontrola kvaliteta betona na mostu preko reke Pek u selu Miljevići za „Ingrap-omni“, Valjevo, 2011.
17.	Kontrola kvaliteta betona na Autoputu E 75 Novi Sad-Subotica, za „PZP Beograd“, Beograd, 2011.
18.	Isptivanja sastavnih delova betona i betona za betonsku bazu u Preševu, na deonici Autoputa Levosoje-granica BRJ Makedonija, za „Puteve“, Užice, 2011.
19.	Projekat betona za fabriku betona „TRADE EXPRESS“, Kragujevac, 2011.
20.	Veštačenje kvaliteta ferobetonske podloge garaže hotelsko-poslovnog kompleksa „Galerija“, Subotica.
21.	Projektovanje betonskih mešavina u skladu sa ACI 318, za „TKK“, Srpenica, Slovenija, 2011.
22.	Naknadno utvrđivanje kvaliteta betona u konstrukciji za objekat „URO“, Zeleni Venac 18, Beograd, 2011.
23.	Proizvodna sposobnost fabrike betona za d.o.o. „Kutko“, Pančevo, 2011.

24.	Završne ocene kvaliteta betona za objekte izvedene u Srbiji za firmu „Širbegović grupa – GMT Konstrukcije“, Gračanica, BiH, 2011.
25.	Kontrola kvaliteta betona projektu: Most Zemun-Borča, za China Road and Bridge Corporation – Serbia, 2011.
	Laboratorija za veziva, hemiju i maltere
26.	Studija „Primena i plasman pepela nastalog u elektranama EPS-a“.
27.	**Laboratorija za akustiku i vibracije**
28.	Monitoring buke u životnoj sredini u gradu Boru.

CENTAR ZA PUTEVE I GEOTEHNIKU

R.b.	Referenca
	Ispitivanje šipova
	Kontrola kvaliteta ugrađenih šipova metodom SIT (ispitivanje integriteta i dužine šipova)
1.	Stambeni kompleks Stepa Stepanović na građevinskoj parceli GP4, ispitano oko 800 šipova.
2.	LOT A2 – most br. 18, autoput E75, Novi Sad – Beograd – Niš, ispitana 32 šipa.
3.	Most na km:194+649.45, lokalni put 7, nadvožnjak na km:191+795.20 i nadvožnjak na km:0+310.58 (17 šipova), most na km:192+050.23 i km:192+052.09 i most na km:3+295.98 lokalnog puta br. 6 (15 šipova).
4.	Modernizacija Rafinerije Nafte Pančevo.
	Ispitivanje nosivosti šipova na vertikalnu i horizontalnu silu primenom opita statičkog probnog opterećenja
1.	Modernizacija Rafinerije nafte Pančevo: ispitivanje franki šipova , ispitivanje mikrošipa na vertikalnu silu, statičko ispitivanje CFA šipa na vertikalnu silu, ispitivanje grupe DSM šipova na vertikalnu silu na pritisak, ispitivanje mikrošipa na horizontalnu silu.
2.	Stambeni kompleks Stepa Stepanović - ispitivanja statičkog probnog opterećenja bušenih šipova na vertikalnu silu.

	Geotehnički elaborati
	Geotehnička istraživanja za potrebe izrade tehničke dokumentacije o uslovima fundiranja, izgradnje i sanacije objekata različite namene
1.	Izveštaj o ispitivanju vodopropustljivosti stenske mase, brana i retenzija na reci Darosavici.
2.	Geotehnički elaborat za potrebe izgradnje bloka A-3 u sklopu T.E. Nikola Tesla u Obrenovcu.
3.	Geotehnički elaborat za potrebe fundiranja elektrofiltera u sklopu T.E. Morava u Svilajncu.
4.	Geotehnički elaborat o rezultatima geotehničkih istraživanja terena za potrebe izrade projektne dokumentacije za Novo Izvorište – Ostrvo 7000*-I faza, nivo glavnog projekta.
5.	Tehnički izveštaj o rezultatima istražnih radova na odlagalištu pepela u sklopu Termoelektrane TENT-B u Obranovcu.
6.	Tehnički izveštaj o rezultatima istražnih radova na odlagalištu pepela (kaseta B) u sklopu Termoelektrane TEKO u Kostolcu.
7.	Izveštaj o pregledu i sintezi geološko-geotehničkih istraživanja izvršenih u toku prethodnih decenija rađenih za potrebe GUP-a i potrebe izgradnje objekata u zoni GUP-a, Kraljevo .
8.	Tehnički izveštaj o rezultatima istražnih radova na odlagalištu pepela u sklopu Termoelektrane TENT-A u Obranovcu.
9.	Elaborat o geotehničkim uslovima rekonstrukcije objekta Ministarstva pravde Srbije, spratnosti Po+Pr+13 u ul. Zeleni venac br. 18 u Beogradu.
10.	Izveštaj o dadatnim geotehničkim rezultatima ispitivanja terena za potrebe izgradnje transformatorske stanice T.S. Vranje 4.

11.	Tehnički izveštaj o rezultatima istražnih radova na odlagalištu pepela u sklopu T.E. Kolubara A-Veliki Crljeni.
12.	Dokumentacioni elaborat o rezultatima geotehničkih istraživanja terena za potrebe izgradnje cevnog mosta 23008 u aveniji A u krugu Rafinerije nafte u Pančevu.
13.	Izveštaj o rezultatima merenja nivoa podzemne vode u pijezometarskim konstrukcijama za potrebe shopping centre Ušće na N. Beogradu.
14.	Kontrolna geomehanička ispitivanja za objekat Modernizacija nafte Pančevo (110 izveštaja).
15.	Elaborat o geotehničkim istraživanjima za potrebe rekonstrukcije rezervoara R-27 u Smederevu.
16.	Dokumentacioni elaborat o rezultatima geotehničkih istraživanja terena za potrebe izgradnje retenzionog objekta za prihvat atmosferskih voda na deonici autoputa E75 Beograd – N. Sad, most Beška.
17.	Elaborat o geotehničkim uslovima sanacije nasipa pristupnih saobraćajnica starom drumskom mostu preko reke Tamiš u Pančevu.

	Projekti sanacije klizišta
	Geotehnička istraživanja i izrada glavnih projekata
1.	Regionalni put R-221, Vukanja-Prokuplje, km:30+865.
2.	Regionalni put R-214, Predejane-Vladičin Han, km:284+516.
3.	Regionalni put R-234, Novi Pazar-Rajetiće, km:4+900.
4.	Magistralni put M-9, Medveđa-Lebane, km:285+300.
5.	Regionalni put R-236 , Novi Pazar-Sopoćani, km:2+100.
6.	Regionalni put R-122 , Svođe-Crna Trava, km:24+800.
7.	Magistralni put M-8, Aljinovići-Novi Pazar, km:17+500.
8.	Državni put prvog reda M-4, Očage-Lazarevac, km:1+025.
9.	Dopuna glavnog projekta poboljšanja magistralnog puta M-25.1 H.E.Đerdap-Golubac (Boljetinsko brdo), sa sanacijom klizišta HLADNE VODE, km:63+200.
10.	Regionalni put R236, Pazarište - Melaja, km 7+600.
11.	Projekat sanacije nasipa pristupnih saobraćajnica starog drumskog mosta preko reke Tamiš u Pančevu.

CENTAR ZA METALE I ENERGETIKU

R.b.	Referenca	Investitor
1.	Ispitivanje i ocena stanja turbinske i hidromehaničke opreme agregata A6 i A4. IBR (VT, VTδ, MT, PT UT, RT, HT, Replika). IR (mehaničko-tehnološke osobine, hemijski sastav, metalografija). Prijem opreme i kontrola tehničke dokumentacije hidroagregata i generatora u fabrikama u Srbiji i Ruskoj federaciji. Izrada tehnologije zavarivanja, izbor elektrode i ispitivanje metala šava, ispitivanje za WPS. Procena preostalog veka. Konsalting usluge .	PD HE Đerdap d.o.o. HE Đerdap 1, Kladovo
2.	Reparacija – popravka prelaznog radijusa turbinskih vratila A9 i A10. Reparaturno zavarivanje turbinskog vratila. Kaplan turbine, sa IBR ispitivanjem (VT, VTδ, MT, PT, UT, HT, Replika).	PD HE Đerdap d.o.o. HE Đerdap 2, Negotin
3.	Ispitivanja metodama bez razaranja (VT, VTδ, MT, PT, UT) na opremi turboagregata TENT A na blokovima A1, A2, A3, A4, A5.	PD TE Nikola Tesla d.o.o., ogranak A Obrenovac
4.	Ispitivanje zavarenih spojeva i cevnih lukova metodama bez razaranja (VT, VTδ, MT, PT, UT) na parovodima sveže (RA) i međupregrejane pare (RB) na blokovima A3, A4, A5 i A6.	PD TE Nikola Tesla d.o.o., ogranak A Obrenovac

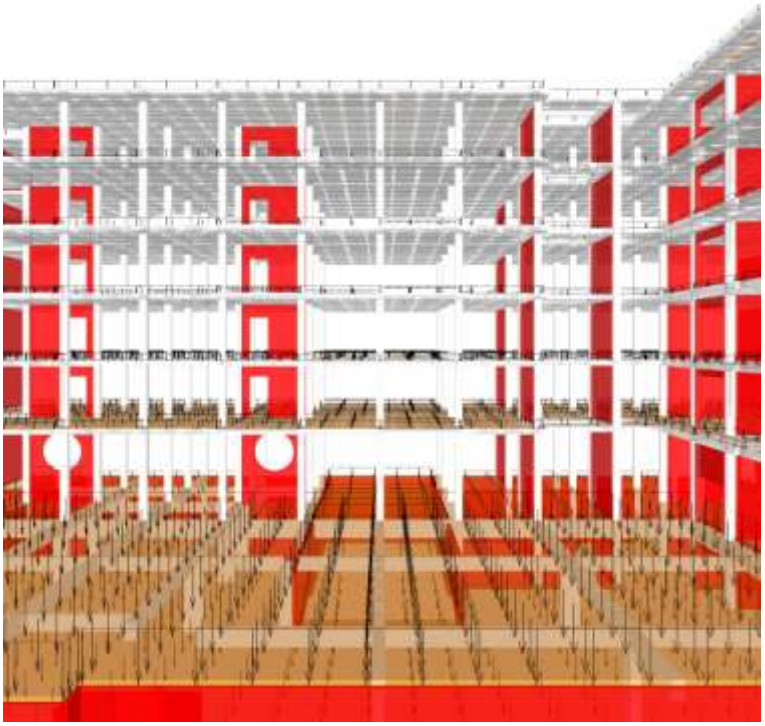
5.	Ispitivanje i ocena stanja turbinske i hidromehaničke opreme agregata A1 i A2. IBR (VT, VTδ, MT, PT UT, RT, HT, Replika). Ispitivanje i ocena stanja dovodnog cevovoda.	PD HE Đerdap d.o.o. HE Pirot, Pirot
6.	Ispitivanje metala metodama sa i bez razaranja opreme, parovoda, lopatičnog materijala za izradu lopatica T3. IBR (VT, VTδ, MT, PT, UT, RT, HT, Replika). IR (mehaničko tehnološke osobine, hemijski sastav, metalografija). Prijem opreme i kontrola tehničke dokumentacije.	PD TE Nikola Tesla d.o.o., TE Kolubara A, Veliki Crljeni
7.	Parovod (RA, RB, RC), napojna voda (RL), međupovezni parovodi (MP1-MP2 i P2-P3), CSK, (Kostolac B) i stop ventil, ležajevi turboagragata (Kostolac A) . IBR (VT, VTδ, MT, PT, UT, RT, HT, Replika). IR (mehaničko tehnološke osobine, hemijski sastav, metalografija).	PD TE KO Kostolac d.o.o., TE Kostolac A, Kostolac i TE Kostolac B, Drmno

8.	Izrada atestno-tehničke dokumentacije izmenjivača za grejanje Požarevca (posude za vazduh). IBR (VT, VTδ, MT, PT, UT, RT, HT, Replika). Izrada i kontrola tehničke dokumentacije.	PD TE KO Kostolac d.o.o., TE Kostolac A, Kostolac
9.	Ispitivanje metodama bez razaranja opreme rotornih bagera i ispitivanje metodama sa razaranjem po dostavljenom uzorku na PK Drmno. IBR (VT, VTδ, MT, PT, UT, RT, HT, Replika). IR (mehaničko tehnološke osobine, hemijski sastav, metalografija). Prijem opreme i kontrola tehn.dokumentacije.	PD TE KO Kostolac d.o.o., TE Kostolac A, Kostolac
10.	IBR (VT,MT,PT, UT) i nadzor pri zavarivanju pri izradi gornjeg prstena usmernog aparata agregata A4 za HE Đerdap 1.	DSD Noell – Vircburg, Nemačka
11.	IBR (VT,MT,PT,UT) i IR (mehaničko-tehnološke osobine) pri izradi lopatica radnog kola i lopatica usmernog aparata agregata A4 u Litostroju, Ljubljana, Slovenija.	PD HE Đerdap d.o.o., HE Đerdap 1, Kladovo
12.	Utvrđivanje stanja račve cevovoda na HE Perućica. IBR (VT, MT, PT, UT, RT). Procena preostalog veka.	EP CG, HE Perućica, Nikšić, Crna Gora

CENTAR ZA KONSTRUKCIJE I PREDNAPREZANJE

	Odeljenje za prednaprezanje	
R.b.	**Referenca**	**Investitor**
1.	Izvršeni radovi prednaprezanja	
	Mahovljanska petlja, Laktaši, BIH	GP Gradip, Prnjavor
	Internacionalna škola, Beograd	Gemax, Beograd
	Geotehnička sidra na desnoj strani izlaznog portala tunela „Straževica“, obilaznica oko Beograda, sektor 5	Maxpro, Beograd
	Nadvožnjak br. 25, obilaznica oko Beograda, sektor 5	Energoprojekt Niskogradnja, Beograd
	Sanacija garaže Obilićev venac, Beograd	Tri omega inženjering, Beograd
	Nadvožnjaci na koridoru X, deonica Pirot – Sukovo	Alpine d.o.o. Beograd
	Most preko reke Mlave u Kamenovu, Petrovac na Mlavi	Dak, Beočin
2.	Primena sistema prednaprezanja Instituta IMS	
	Sanacija mosta Gazela sa prilaznim konstrukcijama	Mostogradnja, Beograd
	Petlja Careva Ćuprija, Beograd	MBA Miljković, Beograd
	Mostovi i nadvožnjaci na koridoru X, deonica Horgoš – Novi Sad	Putevi Užice, Inter-kop, Šabac
	Koridor XI, deonica Ub – Lajkovac	Putevi Užice

	Odeljenje za arhitektonsko i građevinsko projektovanje	
R.b.	**Referenca**	**Investitor**
1.	Glavni projekat građevinske konstrukcije stambeno-poslovnog kompleksa na uglu ulica Štrossmayerove i Ćićarijske u Osijeku, Republika Hrvatska (primena IMS tehnologije građenja)	Gradnja Osijek



Odeljenje za sanaciju konstrukcija

R.b.	Referenca	Investitor
1.	Glavni projekat sanacije konstrukcije zgrade Ministarstva pravde RS u Beogradu, Zeleni venac br. 18, radi obezbeđenja stabilnosti objekta	Ministarstvo pravde Republike Srbije

Laboratorija za ispitivanje konstrukcija

R.b.	Referenca	Investitor
1.	Ispitivanje probnim opterećenjem svih prilaznih konstrukcija i konstrukcija betonskih mostova na glavnom pravcu u sklopu mosta Gazela na auto-putu E-75	JP Putevi Srbije Strabag AG Mostogradnja
2.	Ispitivanje i kontrola geotehničkih ankera na HE Trebinje	HET, Trebinje
3.	Glavni pregled mosta preko HE Đerdap 1	PD HE Đerdap 1