

MODIFIED COAL MINING

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ABSTRACT. In recent years there have been significant changes in the mining industry, including in underground mining. These changes required, the introduction and use of advanced and new techniques and technologies. The report examines the impact of these changes on geometric solutions and system parameters and mining technology and justify the need to implement a new philosophy in the design, organization and management of mining sites and new approaches of training and qualification of personnel.

PROBLEMS IN THE DESIGN OF SINGLE SUPPORTING PILLARS ON THE EXAMPLE OF MINE "ERMA REKA" FIELD "SOUTH PETROVITSA" ("GYUDYURSKA").

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ABSTRACT. Methods for dimensioning pillars in continuous and room-pillar system development in the localities of our country is based primarily on the experience gained from practice. The lack of data about and properties structure of the array determines this heuristic approach etc. dimensioning. No possibility to take into account the strength, load and consequently the bearing capacity of the pillar makes it possible to observe these two phenomena in the pillar establishes a deficit of strength or pillar is oversized.

THE UNDERGROUND MINING INDUSTRY EMBRACES SYNTHETIC FIBRE REINFORCEMENT

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ABSTRACT. This paper examines the nature and usage of structural synthetic fibres in underground applications. Covered in the paper are references to areas of usage, fibre types and quality and performance testing options, as well as a discussion on issues surrounding different types of fibres and some of the health and safety aspects that have improved since the introduction of fibres into underground reinforcement of concrete.

GEOHERMAL RESEARCH PROJECT "ALGÄU 2.0" RESEARCH CONCEPTS, LABORATORY INVESTIGATIONS AND PLANNING OPERATIONS

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ABSTRACT. Planning the utilization of geothermal systems requires the quantification of rock mechanical properties of reservoir rock to secure safe and sustainable reservoir operation. This article outlines the engineering and geotechnical aspects in terms of reservoir enhanced production from Upper Jurassic carbonate rock in the southwest Bavarian Molasse Basin. Specifically, a well is drilled including sidetrack down to 4,000 m depth at the research site Mauerstetten, close to Kaufbeuren. Cuttings are intensively investigated for biostratigraphy whereas drill cores are not taken from the reservoir. Geomechanical tests were conducted on analogue rock material, sampled extensively on analogue outcrops in the Franconian Alp in the vicinity of Ingolstadt. Laboratory analysis on rock samples covers petrographical, petrophysical and geomechanical tests. In particular, the reservoir rock is located in 3600 m TVD and has an average density of $\rho=2.4 \text{ g/cm}^3$ causing an expected vertical stress $\sigma_v \sim 85 \text{ MPa}$. The methodological combination from hydraulic and structural geological characterisation followed by 3D geological-hydraulic modelling of the reservoir helps to understand the impact of distinct fracture populations during reservoir operation. Results indicate that shear fractures significantly increase the rock permeability hence reservoir production.

ALTERNATIVE GEOSTATISTICAL ANALYSIS OF THE NORTHERN SLOPE OF THE OPEN PIT MINE "ĆIRIKOVAC" IN THE ZONE OF THE LONGITUDINAL PROFILE No. 8

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ABSTRACT. Following the suspension of works on the coal exploitation at the open pit mine Ćirikovac, a landslide occurred on the northern slope which slowed down the adaptation of this area into the fly and bottom ash disposal site aimed to receive the waste material from Kostolac Power Plants. In order to provide the best possible technical solution for the accidental situation, where it was necessary to construct the retaining walls to repair the landslide by adding a weight to the foot of the slope, and to expand the area for disposing large quantities of ash, a stability analysis was performed and presented in this paper.

Keywords: OPM ĆIRIKOVAC, KOSTOLAC, LANDSLIDE, DISPOSAL SITE, FLY AND BOTTOM ASH, DISPOSAL, RETAINING WALL

COMPARISON BETWEEN METHODS FOR SLOPE STABILITY

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ABSTRACT. In this paper a comparison of the most used methods in practice for analysis slopes utilizing. It compares the equilibrium conditions underlying the methods, conditions for their implementation, assumptions and results of the different methods. A brief biography of the author.

WASTE DISPOSAL TECHNOLOGY FROM THE MUTALJ OPEN PIT MINE TO THE DISPOSAL SITE OF THE BELI KAMEN OPEN PIT MINE

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ABSTRACT. Limestone open pit mines, the active – Mutalj and the closed one – Beli Kamen are part of the Lafarge Beočin cement factory, located at the southern hillsides of the Fruška gora (Srbija) at approximately 19 km from the Beočin factory. This paper presents conditions and expansion technology of the existing internal disposal site at the open pit mine Beli Kamen by depositing the waste from the open pit mine Mutalj.

Key Words: OPEN PIT MINE, BELI KAMEN, MUTALJ, WASTE, DISPOSAL SITE.

EFFECTIVE WAY OF PRODUCING ENERGY QUALITATIVE COALS FROM WASTE

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ABSTRACT. It is presented the practical experience of the construction of an enrichment of waste from brown coal produced in the process of extraction and processing with particle size minus 3,00 mm. It was used hydrosizer TBS1800, operating on the principle of upward water flow. It is achieved a performance of coal concentration of 7-9 t/h at 20-25% ash content and calorific value 4100 - 4500 kcal / kg. The work of the hydrosizer is maintained automatically by using program control.

OPEN PIT MINE ATMOSPHERE REMOTE CONTROL SYSTEM

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ABSTRACT. Ventilation of open pit mines with great depth (more than 300m) is hardly controlled complicated process. It depends on several factors – mine location, meteorological conditions, technology, and objects location inside the mine. Asarel mine is a pioneer among open pit mines to install remote control system for CO, NO, NO₂, SO₂ and O₂ concentrations in four stations inside the mine. This paper presents the system, operating in the mine as well as the way of processing and presenting monitored data. Threshold limit values of traced gases concentrations for alarm announcement and accidental planning are analyzed. Some options to utilize the system in the planning process are proposed.

VENTILATION SCHEMES FOR ROAD TUNNELS

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ABSTRACT. Modern road communications more often come to utilization of transport tunnels. The recent adjustment of Bulgarian infrastructure to trans European one requires higher standards to these facilities. This paper presents main ventilation schemes to ensure normal atmosphere in the tunnel. Special attention is drawn to schemes' applicability in respect to tunnel operational parameters (one or two lanes, amount and type of traffic) as well as options to adapt for emergency ventilation. Each scheme requires special calculations and dimensioning. Expressions for ventilation system' dimensioning are object to the next paper.

OVERVIEW OF THE ISOLATING BREATHING APARATUSES WITH COMPRESSED OXYGEN USED IN THE MINING INDUSTRY

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ABSTRACT. Oxygen compressed gas insulating apparatus are general respiratory protection mean for specialized units from mine industry. These units include mine rescuers, performing preventive measures for overcoming of accidents, for surveillance and rescue operations in breathing harmful environment in order to eliminate accident consequences.

RISK MANAGEMENT OF DISASTROUS EVENTS ON FLOTATION TAILINGS IN "RTB BOR" SERBIA

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ABSTRACT. Flotation tailing dams are necessary mining facility from technological point of view, whereas in terms of environmental protection they are a real threat to humans and the environment, regardless of whether they are operational or the process of disposal has been completed. In southeastern Serbia, on the territory of Bor municipality, there are two active flotation tailings: Flotation Tailing RTH and Flotation Tailing Veliki Krivelj, which represent a potential threat of accidents. Occurrence of accidents should be the subject of research with the aim to recognize the mechanism of their generation, range and scope of environmental threat and risk assessment, in order to initiate the demands for the design and installation of safety systems with reliability that is higher than the total probability of danger.

This article presents a risk management system in emergency situations in Flotation Tailing RTH and Flotation Tailing Veliki Krivelj which are part of the company "RTB Bor". The organizational structure of the risk management system in emergency situations has been based on the model of an integrated protection and rescue system in emergency situations. The aim of this paper is to answer the question whether the development of safety in emergency situations in Flotation Tailing RTH and Flotation Tailing Veliki Krivelj created conditions for the construction of a disaster resistant system.

RISK ASSESSMENT IN MINING INDUSTRY ARISING FROM HAND-ARM VIBRATION

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ABSTRACT. The risk from injuries and occupational diseases arising from vibration can be identified in many industries and occupations, especially in mining industry. The risk is greatly increased with use of higher vibration equipment and with prolonged and regular use of the equipment. However, investigation have shown that the vibration hazards can be controlled and risk reduced by good management system. Because of that it is necessary to follow out the procedure of risk assessment in the working environment for the work places exposed to vibration. The results of risk assessment in mining industry based on European Directive 2002/44/EC on the minimum health and safety requirements regarding the exposure of workers to vibration are shown in this paper.

CHANGE OF THE STRESS STATE OF THE SOIL, BY STRENGTHENING BEFORE THE TUNNEL BORING MACHINE CROSSES THE GROUND UNDER BUILDINGS AND FACILITIES

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ABSTRACT. One of the safest technologies of tunneling, as far as the deformation of the surface and insurance the security in the vicinity of buildings and structures is concerned, is called "Shield method". However, due to the poor condition of some of these old buildings and facilities, and the fact that often there isn't enough information about their structure and way of foundation, deformation of only a few millimeters would have a serious negative effect on them. For this reason it is often necessary to develop specific technical solutions to limit the influence of the change of the stress state and deformable soil above the tunnel. One method is the strengthening of soils. By this strengthening improvement of certain properties of the stress state of the soil is achieved, which in turn leads to a reduction of deformations and is a prerequisite for the security of near facilities. The influence of variation of the stress and strain state of the array of soils with different methods of strengthening, respectively, improving the physical and mechanical properties of soils is discussed.

STUDY TO DETERMINE THE TECHNICAL SOLUTIONS TO LIMIT DISTORTIONS TUNNELING UNDER EXISTING BUILDINGS AND FACILITIES

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ABSTRACT. An important point in the design and construction of tunnels is the correct determination of deformations in their area of influence. This applies mostly to tunnels built in dense cities where the route of the tunnel in plan and profile often goes a short distance from existing buildings and structures. There are many cases when, due to the fact that no adequate measures are taken to limit these deformations, buildings and facilities have received serious structural problems. For these reasons, the determination and implementation of optimal technology to reduce deformations in some key places along the route of the tunnel, appears to be one of the main prerequisites for the realization of the project safely and at the desired time. Possible technical solutions to limit the influence of the construction of tunnels, deformations of the soil massif and respectively their impact on nearby buildings and facilities are discussed.

IMPROVING THE EFFICIENCY OF GROUND-FREEZING SHAFT SINKING METHOD

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ABSTRACT. The article discusses the main aspects of vertical shaft sinking by artificial ground freezing method. A new method to determine the strength of the ice wall is proposed, taking into account the weakening of the rock mass in the vicinity of drill holes. A new method to increase the strength of drilling mud is proposed.

SUBSIDENCE OF THE EARTH'S SURFACE BY THE CONSTRUCTION OF THE METROPOLITAN'S UNDERGROUND TUNNELS IN SOFIA – III

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ABSTRACT. The study is focused on ways to improve the methods for determining of the earth's surface subsidence caused by underground construction of transport tunnels for the subway in Sofia. In the second part of the paper, using measurements conducted by tunneling and applying the new taxonomy a new formula for determination of the vertical ground displacements is proposed. The influence function is determined theoretically and the reaction function of the rock mass is constructed after measurement data. By using the newly obtained formula the subsidence through is determined. An analysis of the results is carried out and the forecasting possibilities of the new method are demonstrated. The work also presents recommendations for the practical implementation of the new relationship.

OPTIMAL DIMENSION OF INFLUENCE ZONE AROUND CIRCULAR WORKING, EMEDED BY ANCHORS

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ABSTRACT: The theory of elasticity and approximate variational method of Vlassov are applied to express the components of stress tensor, around circular working, emeded by anchors. In these analytical expressions an unknown parameter is the thickness of the influence zone. For it determination an algorithm is proposed. It's based on Mohr hypothesis for fragile rock. In the article are presented two solutions. First is given the optimal distance between the two forces, which is required by the variational method. Then is received the optimal radius of the influence zone of anchors.

Key words: theory of elasticity, method of Vlassov, circular pipe, influence zone of anchors.

PROJECTS AND PASSPORTS FOR BLASTING - REQUIREMENTS DEVELOPMENT PASSPORTS WITH COMPUTER-ASSISTED

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ABSTRACT. The report is a brief overview of how the methodology for project preparation and Passports for blasting. The report is an example of the development of Passport Program, which was developed based on modern scientific concepts to perform blasting.

SAFETY DISTANCES FOR BLAST WORKS

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ABSTRACT. One of the basic questions about securing some safe work during execution of some explosions is for defining the safe distances. The report examined how to calculate safety distances, as required under occupational safety in blasting, are given specific values for safety distances.

THE RISK MAGNITUDE IN MAJOR INCIDENTS IN BLASTING AND PRODUCTION ACTIVITIES AND THE CONSEQUENCES FROM THEM

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ABSTRACT. The present paper is instigated by the so-called "major incidents" which recently happened in blasting and production processes. The "framework" for the imperative need for analysis, assessment and management of the risk, which is a magnitude formed by two development stages, is described. The potential dangers in the two stages predetermine the methodological instructions for elimination or reduction of the risk levels.

ANALYSIS OF THE IMPACT OF THE AIRBLAST IN OPEN PIT "TSELOVIZHDA"

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ABSTRACT. The paper presents an analysis of data from measurements made in noise and vibration assessment for blasting in open pit "Tselovizhda". The reported values on the level of air overpressure is a prerequisite to take into account the degree of disturbance in air and what would the impact be at the designated point of measurement /protection of an industrial plant/. The analysis presents the significance of the blast scheme and as a major factor that affects the degree of disturbance of the air environment is taken the initial blast quantity of explosive. The method of determining the impact of the shock wave in air depending on the initial blast quantity of explosive at a distance measuring point is applicable to forecast the level of overpressure at the safe area zone. Respectively, the impact on the glazing of buildings and facilities located near the populated area /village Opitsvet/ and the perception of the shock wave from the residents could be provided depending on the predicted degree of impact load in the air.

COMPARISON OF THE IMPACT OF UNCONFINED TNT CHARGE AND A TNT CHARGE IN A BLAST HOLE WITH A STEMMING

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ABSTRACT. The impact of the blast wave in the study of TNT charge placed on the ground /unconfined/ and in a blast hole with a stemming /limited charge/ are distinguishable by the value of the overpressure at the front of the blast wave propagating in air. For determining the impact of the air blast wave on different media is used the biparametric value "scaled distance", which represents the behavior of a charge with certain weight at a certain distance.

The article presents a study on the values of the overpressure caused by unconfined TNT charge and identical charge placed in a blast hole with a stemming. Processing of a number of values a regression line characterizing the overpressure profile is received. This line represents the trend of the propagation of the air blast front according to a certain scaled distance.

Comparison based on scaled distance is a reason to draw conclusions about the conditions in which the blasting is carried out and define expected levels of overpressure in air.

HIGH QUALITY KAOLIN PRODUCED BY MICROBIAL TREATMENT

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ABSTRACT. Different strains of "silicate" bacteria were used to improve the quality of kaolin by different ways of treatment. All strains formed large slimy capsules consisting of exopolysaccharides and were related to different species of the genus *Bacillus*, mainly to *B. circulans* and *B. mucilaginosus*. It was found that even a short contact of some hours of well developed cultures of these bacteria resulted in improvement of the bending strength and the other ceramic properties of the kaolin. The improvement was connected with the action of some secreted metabolites such as soluble heteropolysaccharides, monosugars and organic acids. The best results were achieved by continuous cultivation of bacteria in the presence of kaolin with a high relative humidity and subjected to periodic stirring.

DESORPTION OF COPPER FROM LOADED ION-EXCHANGE RESIN LEWATIT AS A STAGE OF PROCESSING OF RICH-IN-COPPER BIOLEACHING SOLUTIONS

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ABSTRACT. The desorption of copper from loaded ion exchange resin LEWATIT into acidic solution was studied by means of batch and continuous mode experiments. Batch mode kinetics and isotherm studies were carried out to evaluate the effects of the initial concentration of sulfuric acid and temperature on the copper desorption. First order and second order equations rate were used to fit the experimental data. Langmuir desorption equation was employed to analyze the equilibrium data. The optimal conditions of copper desorption from the ion exchange resin LEWATIT were 120 g/l diluted sulfuric acid solution as desorption agent, aqueous: resin (A/R) ratio of 1:5, 30°C, and agitation time of 10 minutes. The desorption of copper from loaded resin with diluted sulfuric acid (100 g/l) under continuous flow regime was studied at 2, 4, and 6 bed volume velocity (BVV/h). The breakthrough curves revealed as higher was the applied flow rate during the elution as lower was the copper desorption.

Keywords: copper, solvent extraction, stripping, kinetic, Kd

STRUCTURAL INFLUENCE OF SPHALERITE ON THEIR LEACHING FROM COMPLEX CONCENTRATE BY SODIUM NITRATE IN SULPHURIC ACID

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ABSTRACT. During the sphalerite leaching by sodium nitrate and sulfuric acid solution from complex concentrate, leaching rate of zinc decreases with increasing the time and a part of sphalerite mineral grains remains in the leach residue. In complex concentrate, 59.3 % of sphalerite mineral occurs as in liberated grains, and the rest is in association with other sulphide and gangue minerals, which is very favorably from the aspect of hydrometallurgical treatment. After experiments carried out, leaching of zinc achieved 93,3 % at temperature 80 °C and time 240 min. In the leach residue, 21,8 % sphalerite mineral grains occur as liberated with highly corroded surfaces. Therefore, the structural assembly of chalcopyrite grains is relatively favorable and no reason to reduce the leaching rate in the final stage of reaction. Reason for this is elemental sulfur, which was formed during the leaching, precipitated at the particle surfaces, and slowed down the leaching rate in the final stage of leaching process.

BIOTECHNOLOGICAL PROCESSING OF A GOLD-BEARING PYRITE CONCENTRATE

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ABSTRACT. A gold-bearing pyrite concentrate containing 10.4 g/t gold and 18.5 g/t silver finely disseminated in the sulphide matrix was subjected to a prior oxidation by a mixed culture of extremely thermophilic chemolithotrophic archaea to liberate and expose these precious metals. The oxidation was carried out in a system of four agitated bioreactors at 75 °C under continuous-flow conditions. The exposed gold and silver were then efficiently extracted from the pretreated concentrate by means of solution containing thiosulphate and amino acids as complexing agents. The dissolved precious metals were recovered from the pregnant solutions by means of solvent extraction plus electrowinning. This treatment resulted in the precipitation of gold and silver as the alloy doré.

BIOREMEDIATION OF POLLUTED WATERS IN A URANIUM DEPOSIT BY MEANS OF PASSIVE SYSTEM

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ABSTRACT. Acid drainage waters generated in the uranium deposit Curilo, Bulgaria, and containing radionuclides, several heavy metals and arsenic as the main pollutants, were treated by means of a passive system consisting of an alkalizing limestone drain, a constructed wetland and a rock filter, consecutively arranged in a series. An efficient removal of pollutants was achieved by this system, even during the cold winter months, at temperatures close to the water freezing point. The removal of pollutants was due to different mechanisms such as chemical neutralization, microbial dissimilatory sulphate reduction, sorption and accumulation by means of living and dead plant and microbial biomass, sorption by the inorganic sorbents such as clays, hydroxides, carbonates, etc., as well as by the bacterial oxidation of Fe^{2+} and Mn^{2+} , followed by the precipitation of the oxidation forms Fe^{3+} and Mn^{4+} , mainly as $\text{Fe}(\text{OH})_3$ and MnO_2 .

MINE WATERS CLEANING CONNECTED WITH ELECTRICITY GENERATION

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ABSTRACT. Acid mine drainage waters containing heavy metals (Cu, Zn, Cd, Fe, Mn) and sulphates as the main pollutants were efficiently treated by a lab-scale passive system consisting of an alkaline limestone drain and permeable reactive multibarrier connected in a series. The multibarrier was filled by a mixture of solid-biodegradable organic substrates (mainly of plant biomass) and was inhabited by sulphate-reducing bacteria and other metabolically connected anaerobic microorganisms. The effluents from this system were riched in soluble organic compounds and were treated in a microbial fuel cell in which consortium of electrochemically active heterotrophic microorganisms used these compounds as donors of electrons and protons for electricity generation.

TOXICOLOGICAL ASSESSMENT OF PHOTOCATALYTICALLY DESTROYED MIXED AZO DYES BY *CHLORELLA VULGARIS*

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ABSTRACT. The study aims to evaluate the toxic effects photocatalytically destroyed mixed azo dyes on the growth of *Chlorella vulgaris* and to assess its bioaccumulation capacity as a function of the dye concentration and the time of contact with the xenobiotic. The assays were accomplished in a set of miniaturized tests, which contains the bioindicator. The exponentially growing algae cultures were exposed to various concentrations of model solution before and after photooxidation treatment. The toxicological effect of the dyes was determined by measuring of the grown inhibition over a fixed period. The toxicity to *Chlorella vulgaris*, expressed as $\log(1/EC_{50})$ of xenobiotics has been examined. All data demonstrate that the growth inhibition was greater with untreated azo dyes than the destroyed reaction mixture. The final dye concentration in the supernatant was measured spectrophotometrically in the presence of microalgae. The data demonstrated the efficiency of *Chlorella vulgaris* to remove the dye from wastewaters.

INFLUENCE OF THE NITRATES IN THE ANOLYTE ON THE MFC PERFORMANCE

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ABSTRACT. Microbial Fuel Cells (MFCs) are considered as one of the alternative energy sources from renewable materials. For the purpose of this study it was designed a two-chambered MFC, as it was used membrane type CMI-7000S. In the anodic chamber were treated waters, containing organic compounds in high concentration in presence or in absence of nitrates. The cathodic chamber was filled up with 100 mM $\text{K}_3[\text{Fe}(\text{CN})_6]$ in 67 mM phosphate buffer with pH 7.0. It was found that the presence of nitrates in the waters resulted in a rapid consumption of a part of the donors of electrons, i.e. the denitrification had a negative effect on the performance of the fuel cell. On the other hand, this process had resulted in a higher rate of oxidation of organic substances in water and their removal of nitrate nitrogen. The data obtained showed that a significant number of physico-chemical, technological and microbiological factors had an influence on the efficiency of the process.

QUANTITATIVE DETERMINATION OF XANTHATES BY TITRATION WITH LEAD IONS

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ABSTRACT. Xanthates are reagents widely used for processing of sulfide ores. Monitoring of their purity and composition are important for proper technological regime in flotation factories. For this purpose variety of titration methods such as iodometric, acid-base, precipitation or potentiometric titration are often carried out. In this paper the procedure and analytical results for determination of xanthate purity of industrial grade samples by titration with lead ions are reported. The method is based on precipitation of lead xanthate by reaction between aqueous solution of sodium/potassium xanthate and standard solution of lead acetate in the presence of sodium rodizonate as indicator.

INFLUENCE OF grinding of POLIGRADIENT Hydroxide magnetic CONCENTRATE ON Iron distribution in classes

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ABSTRACT. The work presents a study on poligradient magnetic concentrate, obtained by magnetic separation, and containing about 42% iron. Additional enrichment is needed, in order to obtain sealable technical product. The paper presents results from experiments, carried out with the aim to determine the impact of grinding on the iron distribution in classes. The results will be used in further flotation experiments.

COBALT AND TRANSITION TO A SUSTAINABLE ENERGY FUTURE

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ABSTRACT. Recently cobalt is classified as one of the critical supply bottlenecks materials for the world transition to sustainable energy future. The paper presents the use, current and future demand of cobalt, resources, reserves, production ways, as well as possibilities for its recycling and substitution.

LOW TEMPERATURE SYNTHESIS OF SILVER NANOPARTICLES

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ABSTRACT. Metal nanoparticles are of great importance for modern science. With their numerous applications in many different areas of technology they have attracted a great deal of interest in their direction. Nobel metals nanoparticles such as silver (Ag NP) and gold (Au NP) in particular have been intensively studied due to their stability and interesting and unique physical and optical properties. Due to them they have been engaged in wide areas of research including photocatalysis and biotechnology. This fact is pushing scientists into developing new and cost effective methods for metal nanoparticle synthesis. The key component here is "cost effective". If metal nanoparticles are to be applied in large scale production their preparation have to be relatively cheap. Here we present a low temperature synthesis of silver nanoparticles which is a precondition for their potential large scale production.

Keywords: nanotechnology, metal nanoparticles, synthesis.

OPTIMIZING THE RE-USE OF URANIUM CONTAMINATED WATER FROM A FLOODED MINE

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ABSTRACT. The uranium deposit at Olší – Drahonín was mined between 1959 and 1989. At the time of exploitation of deposits ceased, mining operations were at depths less than 467 m below ground level and the deposit was opened by a blind shaft as deep as 859 m below ground level. Since 1997, the mine water level has been maintained by pumping at levels of 1.5–7.0 m below the overflow level (the floor of the drainage adit), i.e. at depths less than 35 m below ground level. After flooding the circulation of water in the shallow zone controlled by infiltration of precipitation was observed and geochemical equilibrium in the deeper parts was analyzed.

Groundwater flow model and dissolved species transport was realized in FEFLOW environment (<http://www.feflow.com>). Geochemical model of dissolved substances equilibrium with the rock environment was created in Geochemist's Workbench (GWB, <http://www.gwb.com>). For the connection between both numerical simulation engines The Communicator module was programmed, which is using XML files fully configurable to manage the coupling of the two model systems.

The Communicator module allows to store pre-calculated GWB situation in PostgreSQL database and using similarity algorithms to select these results during a call from the transport model. It also allows further analysis of times and time periods consumed in individual phases of calculation or operations in a database system. The aim is to reduce the total time of numerical simulations.

Basic points: 1. Introduction – history of deposits exploitation, flooding time, water resources, chemistry; 2. FEFLOW model of the deep mine presentation; 3. Main geochemical components; 4. FEFLOW and geochemical code coupling; 5. Conclusion – optimizing of pumping wells net.

FACTORS IMPACTING THE ADSORPTION OF MANGANESE WITH THE USE NATURAL ZEOLITES

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ABSTRACT. Zeolites are widely used sorbents in the purification of water polluted with heavy metal ions. Their effectiveness in different technological processes depends on their physical-chemical properties that are related to their geological deposits. This report presents the results of experiments for the immobilization of manganese from model wastewater using natural zeolite (clinoptilolite) from the "Beli plast" deposit, Kardzhali. The influence of: the Ca²⁺ and Mg²⁺, presenting in the water; the ratio "solid / liquid" phase; and the particle's size on the removal efficiency of manganese from water has been studied.

PHOTOCATALYTIC DECOLORIZATION OF MIXED DYE SOLUTION AS A MODEL POLLUTANT OF NATURAL WATERS

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ABSTRACT. Water pollution is one of the most serious ecological concerns of our modern society. With the development of the technology and industry this problem is becoming more and more pressing. There are regions on Earth where drinking water is scarce and providing an efficient and cheap method for purification could turn vital. Photocatalysis is regarded as a method which can provide a solution to this particular problem. Intensively studied and improved during the past two decades it has now become one of the most promising modern methods for water treatment. This method proves to be perspective and advantageous among others due to its high efficiency, low cost and easy utilization in different types of water purifying devices. Nanostructured titania (TiO₂) is one of the most widely applied photocatalysts in this kind of devices. As we all well know water pollution seldom involves only one component. That is the reason why in this study we investigate the photocatalytic decomposition of complex solution of dyes as model water pollutant which will reveal the interaction between different pollutants and their rate of degradation.

Keywords: nanotechnology, water purification, photocatalysis

REMOVAL OF TSS AND COD FROM MINERAL PROCESSING WASTEWATER BY FLOCCULATION PROCESS

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ABSTRACT. Commercial cationic, anionic and non-ionic flocculants were studied for their ability to remove turbidity, total solids - residue on evaporation at 105 °C, and chemical oxygen demand (COD, measured as permanganate oxidation) from model mineral-processing wastewater. It has been found that for the studied type of wastewater cationic flocculating reagents with low charge density appeared to be the most suitable, at flocculant concentrations in the range of 2.5 - 5 ppm. Practically no residual organics were found in the treated water which is a prerequisite for the water re-use in the mineral processing.

TECHNOLOGY FOR EXTRACTING GOLD FROM LOW-GRADE OXIDIZED CLAY ORES BY USING COMBINED METHODS

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РЕЗЮМЕ. Проблема переработки бедных золотосодержащих руд с высоким содержанием глины в руде в последние годы встает все более остро, особенно в условиях колебаний цен на золото. Опыт показывает, что при фабричной переработке такой руды более 30% от эксплуатационных затрат приходится на рудоподготовительные операции. Для оптимизации расходов на переработку требуется сокращение прежде всего затрат на рудоподготовку и окомкование. Успешность реализации данной технологии будет определяться качеством разделения материала на фракции, а узел разделения руды на отдельные составляющие будет являться определяющим звеном технологической схемы производства золота.

CUPRITE LEACHING AND COPPER ELECTROEXTRACTION FROM SECONDARY PRODUCTS OF HYDROMETALLURGY

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ABSTRACT. This survey presents the opportunity for the hydrometallurgical treatment of wastes containing significant amounts of copper components in the form of mineral cuprite. The purpose of this study is the dissolution of copper (I) oxide by means of 12% sulphuric acid and the preparation of industrial sulphate electrolytes suitable for electroextraction of copper ions in the form of pure cathodic copper. Initially chemical, phase and morphological analyses of the two major type waste copper cakes from zinc production in KCM - Plovdiv have been performed. The results on the characterization of the cakes show that they contain a significant amount of copper in the form of fine cuprite microparticles. A major problem during the recovery of copper components of this type of waste is the slow dissolution rate of cuprite resulting in the formation of electrolytes with a low concentration of copper sulphate and as a consequence is the deterioration of the electrolysis process. In order to accelerate the dissolution of the studied solid-waste particles, both the leaching and electrolysis processes in sulphuric acid medium have been combined in only one step. As a result on the working cathodes have been deposited pure copper films and from the working electrolyte has been separated insoluble rest sediment. The copper utilization from cake products contributes to the waste volume reduction as well as the insoluble residue is more suitable for oxidation-reduction treatment in the same establishment where the waste cakes have been produced.

RESEARCH AND RECOVERY OF LANDS DAMAGED BY INDUSTRIAL ACTIVITY

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ABSTRACT. Research has been carried out in the former workshop for production of sulfuric acid situated at the industrial site of NEOHIM JSC in Dimitrovgrad. It has been found out that its territory is characterized by a content of heavy metals which exceeds the upper limit according to the requirements of the Dutch list of standards for soils and underground waters with regard to copper. Some measures for overcoming the negative characteristics of the soils are foreseen: clearing the site of the industrial workshop; fertilization of the soil with calcium fertilizers; filling in of the cleared areas with geological materials from the region of “New pits” which are characterized by sandy-clay mechanical content, neutral reaction of the medium and low content of the main nutritious elements for the plants – nitrogen, phosphorus and potassium; spreading of a humus layer with a thickness of 40 cm; sowing of grass which will be done with grass mixtures.