ADVANTAGES OF MODERN AUTOMATED MINERALOGY APPROACH FOR FEASIBILITY STUDIES SUPPORT ON EXAMPLE OF KARAKUL POLYMETALLIC DEPOSIT (RUSSIA)

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ABSTRACT

The main aim of the study was to show a modern mineralogical approach in mineral processing studies on the example of Karakul polymetallic deposit (Russia). Initial question of the study was to quantitatively evaluate Co, Bi, W and Cu mineralogy, association, distribution and granulometry. The study was performed by using the modern approaches of automated mineralogy, particularly MLA (Mineral Liberation Analyser). Within the study the Co, Bi, W and Cu phases of ore from Karakul deposit were studied from the beneficiation point of view (phase's occurrence, quantity, association, liberation and grain size distribution). As well the recommendations for the beneficiation process workflow were stated on the bases of the study results. The study showed that automated mineralogy approach in addition to the main mineralogical data gives quantitative statistic information on commodity minerals, with varying composition, quantitative characteristics of liberation, grain sizes and shapes. However, the approach is only the tool in specialist hands, without which the results could be contradictory.

Keywords: Karakul, automated, technological, mineralogy, MLA.

ANALYSIS AND DETERMINATION OF MECHANISMS OF BOILER SYSTEM PIPES DAMAGING

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ABSTRACT

A common cause of shutdown of long-term operated boiler systems are leaks on pipes of individual equipment parts. The unscheduled shutdowns of boilers cause shutdowns of production facilities and interrupt the production flow continuity. Determination of the pipe damaging mechanism is important for designing the reconstruction of pipeline system within the analyzed system component.

Keywords: wet bottom boiler, emission limits, corrosion, erosion, creep

APPLICATION OF FLOTATION IN SEPARATING PLASTIC MATERIALS

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ABSTRACT

This paper deals with the issue of separation of PLA from PET (polyethylene terephthalate). The currently implemented research at the Institute of Environmental Engineering at the Faculty of Mining and Geology, VŠB - Technical University of Ostrava, examines the possibilities of separating two materials by means of flotation.
Flotation efficiency in relation to changes in the flotation parameters (NaOH concentration, heating time and temperature) was observed in the flotation process of PET and PLA.
The experiments implemented to identify the floatability of PLA and PET proved that making use of a suitable concentration of NaOH solution and suitable temperature, it is possible to achieve separation of the two types of plastics.

Keywords: Flotation, PLA, PET, biodegradable plastics

APPLICATION OF MATHEMATICAL STATISTICS METHODS TO CORRELATION OF MINERALOGICAL AND CHEMICAL ROCK COMPOSITION, THE TECHNOLOGICAL PROPERTIES OF MINERALS AND ENRICHMENT INDICES

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ABSTRACT

As high-quality raw material reserves are being exhausted nowadays, more attention is given to deposits which contain low-grade ores. This type of raw material is difficult to enrich. To precisely evaluate the quality of initial raw material, the typomorphic characteristics (mineralogical composition, crystallochemical and physico-mechanical characteristics) of individual minerals from the apatite-bearing carbonatites of the Tikshozero massif of alkaline pyroxenite-gabbro-carbonatite formation, North Karelia, Russia, were studied. Carbonatites were analyzed using statistical methods. To study this location using the factor analysis method, the percentages of rock-forming oxides in initial and enriched samples and technological indices were included into the initial database. Statistically significant quality prediction models of enrichment products were constructed. An optimum complex enrichment scheme for the production of apatite, calcite, magnetite and mica concentrates was selected.

Keywords: enrichment, technological properties, statistical analysis

APPLICATION OF SENSOR BASED SORTING FOR BENEFICIATION OF LOW GRADE MINERAL RESOURCES

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ABSTRACT

Decline in the quality of raw materials mined mining industry is the most common trend which characterizes of condition and changes occurring in the the national and world mineral resource base. Thus it is necessary to speak not only about reducing the content of useful components, but also the complication of the whole chemical and mineralogical composition of the raw material supplied to the enrichment and subsequent processing. Even more difficult with these items are out of balance ores and raw materials of anthropogenic origin, including overburden and industrial wastes of various origins, the recycling of which is becoming increasingly apparent.

Significant contribution to improving the quality of raw materials makes the improvement of methods pre-concentration (preliminary) useful components that provides increased efficiency of operations and the subsequent technological processing. From this perspective, special attention should be paid to dry contactless enrichment technologies using electronic signals proportional to the content of minerals in the ore lumps. High separation performance among other methods of classification has modern contactless optoelectronic sorting.

Results of a pilot research of separation performance of materials from 45 to 8 mm by the sensor based sorting are presented in article. A color, transparency and degree of a whiteness of minerals were chosen as selectivity indices. High efficiency of optoelectronic sorting for preconcentration of raw materials at a stage of small crushing is shown. It is established that pressure (consumption) of technological air in combination with a size of a raw material is a factor defining efficiency of preliminary concentration of minerals and a basis for optimization of an oper The results obtained suggest high efficiency separation process optoelectronic material for preconcentration stage fine crushing, which reduces power consumption by overgrinding useful components and gangue minerals.ating mode of sensor based separator.

Keywords: sensor based separation, low-grade mineral resources, pre-concentration, indicators.

CATHODOLUMINESCENCE APPLIED TO THE STUDY OF APATITES RELATED TO GOLD AND ANTIMONY DEPOSITS OF NORTHWESTERN PORTUGAL

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ABSTRACT

The Cathodoluminescence (CL) has proved to be an important tool in geological research with a varied spectrum of applications (mineralogy, gemmology, mineral deposits, crustal processes, petrology, geochronology, structural geology, hydrogeology and environmental studies). CL studies are fundamental to correctly apply other current analytical methods as Scanning Electron Microprobe (SEM) and Electron Microprobe Analysis (EPMA). CL is particularly important in the study of the distribution of certain trace elements (e.g. rare earth elements) also contributing to the knowledge of mineral genesis. Apatite was one of the first minerals to be studied in CL and one of the most studied. This fact is related with the great willingness of this mineral to emit CL. Apatite is an ubiquitous mineral occurring in different environments and contain abundant rare earths elements, becoming favourable to the study of processes involving the genesis of rocks. CL, SEM and EPMA were applied to different samples of apatite of northwestern Portugal, giving continuity to previous studies. The analyzed samples were related with gold and antimony mineralizations of the Dúrico-Beirão mining district located in northwestern Portugal. Apatites from Cambrian and Lower Ordovician metasediments and from albitized felsic igneous rocks were studied by cathodoluminescence imaging and spectroscopy complemented with EPMA allowing the characterization of geochemical signatures of the different generations of apatite.

Keywords: apatite, cathodoluminescence, gold, metassediments, albitized felsic igneous rocks

INTRODUCTION

Cathodoluminescence (CL) imaging and spectroscopy has proved to be an instrument of great geological utility being especially important in the study of the distribution of certain trace elements in minerals, particularly rare earth minerals, also contributing to the knowledge of its genesis. Apatite, given its high willingness to emit cathodoluminescence, was one of the first minerals to be studied and one of the most studied. Since the mid-seventies several studies on cathodoluminescence were performed in apatites [1] [2] [3] [4] [5] [6] [7].

The main activators elements of CL in apatite are rare earth elements (REE) and Mn^{2+} [5] and the emission intensity of CL is correlated with the concentration of the activator element. Besides being a mineral containing abundant REE, apatite occurs in different

CHARACTERIZATION OF A HIGH QUALITY QUARTZ SAMPLE PROCESSED APPLYING DIFFERENT COMMINUTION TECHNOLOGIES

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ABSTRACT

This paper confirms the advantages of the release impurity-bearing minerals from quartz samples using two different comminution technologies such as the “Selfrag” high voltage fragmentation (HV), compare with conventional milling (CM). For this study, bulk samples of quartz of hydrothermal origin from “Sierro” quartz veins in the province of Salamanca in western Spain were used. Mineralogical and chemical studies using transmitted light microscopy, XRF and XRD were conducted on bulk rock samples, samples fragmented using CM and HV methods, and on various size fractions prepared to attain greater efficiency in ore processing and removal of impurities. Fragmentation using HV "SelFrag" resulted in a high degree of release of impurities, in particular in the coarser size fractions and in rounded mineral particles with abundant cracks perpendicular to the surface of the mineral surface. By comparison, using mechanical grinding, the mineral particles show angular shapes with micro-cracks preferentially oriented subparallel to the mineral surface and the rate of release of secondary minerals is clearly inferior and only better in the finer particle size fractions.

Keywords: purification, fragmentation by high voltage, mechanical grinding, hydrothermal quartz, impurities.

CHEMICAL ACTIVATED GRINDING OF KUTAHYA GEDIZ LIGNITE SIRNAK ASPHALTITE AND SHALE BY ACIDIC COAL MINE WATER

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ABSTRACT

Depending on advanced technological developments in energy production the low quality coals needed the most economical technologies and even in order to make it possible to produce coal-derived products. Compliance with environmental norms of coal grinding or washing of various type of coals, feasible combustion systems and energy production facilities are needed in today's modern technology, also enable the production of liquid and gaseous coal fuels. However, raw materials and chemical nature of them requires a variety of adaptation methods. For this purpose, universities and industry needing to work together to provide the basic information required in pilot scale. This study examined the high sulfur and ash types of Kütahya Gediz lignite, Sirnak asphaltite and coal shale. The representative samples were taken from local areas of the lignite. Fundamentally, the conditions regarding better desulfurization way, easy grinding lignite and washing, high calorific value lignite yield, 24% high Hardgrove Grinding Index were determined at the chemical grinding of high fuel producing yield. For this purpose, chemical ground further washing for Kütayha Gediz lignite, Sirnak asphaltite and coal shale were discussed.

Keywords: chemical activation, coal grinding, coal breakage, HGI

CLAY MINERALS OF OOLITIC IRON ORES FROM THE BAKCHAR DEPOSIT (WESTERN SIBERIA)

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ABSTRACT

This article is a result of investigation oolitic iron ores from Bakchar deposit by: X-ray crystallography, simultaneous thermal analysis (STA), and a scanning electron microscope (SEM) combined with an energy-dispersive micro analyzer. The Bakchar iron ore deposit is located within the West Siberian iron ore basin, which is a large strip of the Cretaceous-Paleogenic littoral sediments with oolitic iron ores overlapped by a thick series (160-200 m) of the Neogene-Quaternary age [1]. The mineral composition of ores was studied in 1950-70s and described in many papers [2]. In 2005, mineral exploration and evaluation started again in the Bakchar deposit. As a result, large-scale works on defining geological composition of the deposit, and studying material composition of the oolitic iron ores were started. The oolitic iron ores were studied from one ore cut (Eastern part). The mineral composition includes many different minerals: terrigenous (quartz, feldspars, magnetite, ilmenite, zircon, rutile and many other), authigenic and clay (carbonates, glauconite, chlorite, goethite, hydrogoethite, lepidocrocite, phosphates, sulfides, and native silver) [3]. The most interesting minerals for studying genetics are clay minerals. This study was funded by the Russian Ministry of Education and Science, program "State consigning" and has been performed in the “Analytical center of geochemistry of natural systems” at National Research Tomsk State University.

Keywords: oolitic iron ore, glauconite, chlorite, kaolinite, illite

CLOSED-CIRCUIT FLOTATION OF BLACK COAL

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ABSTRACT

The paper deals with an assay of flotation agent Montanol 800 and flotation agent on pyrolytic oil base P550 in the flotation of black coal from the locality of Darkov (Doubrava I reservoir), Czech Republic. Black coal flotation was tested in a closed circuit. At the same time, flotation concentrate frothing quality was observed, as it represents a significant problem during its dewatering in the operation conditions. With regard to the fact that coal preparation plants have a closed service water circuit, the residual concentrations of flotation agents have negative impacts on the flotation concentrate quality.

Keywords: Flotation, Flotation Agents, Black Coal

HIGH GRADIENT MAGNETIC SEPARATION OF CALCINED MAGNESITE

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ABSTRACT

The contribution deals with the dry low-intensity high-gradient magnetic separation of caustic magnesia prepared from raw magnesite coming from the Mútnik deposit (Eastern Slovakia). Namely, the grain size classes of 0–0.5 mm and 0.5–1.0 mm have been upgraded using universal laboratory magnetic separator JONES at the magnetic field induction of 0.1T, 0.2T and 0.3T. Thus, selected samples of magnetic and non-magnetic products were subjected to XRD study.

As to a grain size of 0.5–1.0 mm the magnetic products at the mass yields of 69-79 % containing 84.79–86.56 % MgO, 5.79–5.95 % Fe_2O_3, 3.10–3.60 % SiO_2, 1.94–2.74 % CaO and 0.56–0.57 % Al_2O_3 were won from the feed with 74.53–75.80 % MgO, 5.13–5.41 Fe_2O_3, 6.25–6.74% SiO_2, 6.57–7.35% CaO and 0.94–0.97 Al_2O_3. The recoveries of observed components into magnetic products were as follows: MgO 80.14–89.14 %, Fe_2O_3 77.93–86.85 %, SiO_2 31.76–44.32 %, CaO 18.22–30.47 % and Al_2O_3 40.75–46.80 %.

Subsequently, at the separation of 0–0.5 mm class the magnetic products at the mass yields of 85.39–89.64 % with 81.29–83.23 % MgO, 5.09–5.24 % Fe_2O_3, 4.10–4.39 % SiO_2, 2.57–2.92 % CaO, and 0.83–0.93 % Al_2O_3 were prepared from the feed with 77.17–79.09 % MgO, 4.90–5.07 % Fe_2O_3, 5.35–5.84 % SiO_2, 4.42–4.76 % CaO and 1.03–1.06 % Al_2O_3. The recoveries into magnetic product attained the following values: MgO 91.32–93.66 %, Fe_2O_3 89.52–92.61 %, SiO_2 59.93–73.56 %, CaO 46.15–58.79 % and Al_2O_3 67.09–80.59 %.

The results of XRD study can be summarized as follows. Periclase as a dominant mineral accompanied by talc, magnesioferrite and magnesiowüstite was identified in magnetic product. On the other hand talc and periclase as dominant minerals accompanied by sericite and quartz were determined in non-magnetic product. An occurrence of chlorite and magnesite in this product is questionable.

Keywords: calcined magnesite, HGMS, XRD

INFLUENCE OF GEOMETRIC SHAPE ON THE MECHANICAL PROPERTIES OF COMPONENTS FROM INFRASTRUCTURE

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ABSTRACT

Nowadays, an alternative to reuse is waste disposal which tends to increase to an unacceptable level in relation to the need of preserving the ecological balance. In that way in the construction field have developed technologies that use long "waste" particles (slag, fly ash, etc) environmentally inert, as substitutes for traditional materials. Using waste from foundries, in making road infrastructure can be a necessity of ecological but also economic opportunity for lowland locations that are in areas without significant deposits of rocks. In this paper we consider the two aspects - ecological and economic, the solution founded for the processing of waste being based on conventional crushing and sorting processes. The crushing process of this kind of particles can be obtained through several methods. Indifferent of the used method for the crushing process, you need to act on the material so that in some of these places appear tensions exceed their breaking limit. Crushing method is chosen depending on the physical and mechanical properties of the material, its initial size, degree of crushing etc. Thus, in this paper we follow the choice of an optimal technological flow for obtaining polyhedral shape on different grain fractions.

Keywords: waste, slag, infrastructure, crushing and sorting processes, polyhedral shape

INVESTIGATION OF THE OIL AGGLOMERATION OF ESKICELTEK LIGNITES IN TURKEY

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ABSTRACT

Oil agglomeration is one of the effective separation techniques that can be performed for the beneficiation of the fine particles in mineral processing. The oil agglomeration behavior of Eskiceltek, Amasya lignites was investigated in the present work. Raw lignite sample having an upper calorific value of 3046.8 kcal/kg has 51.03% of ash content. The experimental conditions were conducted as taking kerosene concentration, pH and agglomeration time into consideration. After realizing the oil agglomeration experiments, lignite sample was enriched with the ash content of 29.4% and 78% of combustible recovery.

Keywords: Oil agglomeration, kerosene, lignite, ash

MATHEMATICAL MODELLING OF BLAST FURNACE OPERATION AT CENTRE ENET, VŠB – TECHNICAL UNIVERSITY OF OSTRAVA

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ABSTRACT

The paper deals with mathematical models developed at Centre ENET, VŠB – Technical University of Ostrava. It is aimed at a model simulating blast furnace operation. The model has three parts. The first one calculates kinetic constants of iron raw materials reduction in blast furnace aggregate. The second used it for a simulation of iron oxides reduction. In the third part, the model simulates production process within the blast furnace feedstock contains of two-component burden. In the paper, the model is presented – its objective, main calculations and conditions of simulation.

Keywords: iron-making, blast furnace, model, coke consumption

METHODS OF PHYSICAL TREATMENT OF THE SEWAGE SLUDGE SAMPLE CONTAINING PAHs FOCUSED ON THE ORIGINAL MICROBIAL CONSORTIA REMOVAL

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ABSTRACT

For determination of the biodegradation efficiency of PAHs contained in sewage sludge using a selected bacterial strain, the microbiological purity arrangement is essential step in procedure of input sample treatment.

Initial microflora poses undesirable effects for this type of research. Therefore, samples submitted for selective degradation using single selected strain is necessary to pre-treat.

The use of physical methods appears to be an appropriate way of laboratory treatment with regard to the costs and time demands.

The aim of the research was to compare the different methods of the initial microorganisms reduction with respect to the amount of original PAH content and the amount of PAH content after the physical treatment of the sample using selected method.

In the presented study, the methods are compared with regard to the effectiveness of treatment, time demands and the undesirable reduction of PAHs. Methods of ionizing radiation, tyndallization, steam sterilization and deep freezing were tested in the experiment.

The results prove the influence of thermal methods on the amount of PAHs among investigated sludge samples after different types of treatment.

Keywords: sludge, pre-treatment, physical methods, PAH

MINERALIZATION OF THE GNEISS BODIES IN ORASTIE MOUNTAINS (ROMANIA)

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ABSTRACT

In the north part of Orăştie Mountains (Southern Carpathians), a series of four microcline-bearing gneiss bodies were identified high levels of radioactivity, that are associated mineralizations of rare metals, located in one of the above mentioned gneiss bodies. The host body has a tabular aspect, conformable with the surrounding forrnations. The mineralization with rare metals consists of salts of Zr, Nb, Th, U, Rb, Sn, Ba and REE (Y, Ce, La). Several rare metals and REE minerals were identified: zircon, monazite, xenotime, orthite, lessingite, torneboehmite, pyrochlore, fergusonite, thorite, cassiterite etc. Distribution maps of these elements, at deposit level, point out an uneven distribution and a tendency of concentrating in nests located at the intersection of local faults. The is assumed to be pneumatholitic, with supercritical fluids of potassic nature, circulating along a crustal regional fault located in the north part of Orăştie Mountains.

Keywords: gneiss bodies, mineralizations, rare metals, distribution of elements, origin of mineralization.\

MODIFIED CLAY AS SOIL AMENDMENT FOR REMEDIATION: STUDIES OF LEACHING AND SORPTION KINETICS

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ABSTRACT

Soil contamination with metals and metalloids is serious environmental problem nowadays, caused mainly by intensive anthropogenic activities such as industry, traffic or mining. Soil remediation regarding metals and metalloids in polluted sites includes methodologies based on chemical precipitation, ion exchange, carbon adsorption, membrane filtration, adsorption and co-precipitation. Soil amendments that affect metal immobilization can be used for remediation of soil. Use of clay, natural (raw) or modified, as a soil amendment is one of the most perspective soil remediation methodologies due to the efficiency and cost effectiveness.

Clay consists of crystalline-hydrated aluminosilicates and it has high exchange capacity that is important property for the process of binding of metals and metalloids. Efficiency of clay as an immobilization agent for metal binding was tested by sorption and batch leaching tests. Sorption capacity for raw and modified clay samples was experimentally tested under various pH and temperature conditions. Samples of modified clay as a sorbent were tested for sorption of Pb as monocontaminant and at complex contamination of metals. Clay modification was done by using Ca and Na salts, HNO_3 (protonated forms), Fe-oxyhydroxide, hydroxyapatite. Higher sorption capacity was observed for clay modified with hydroxyapatite and Ca salts. Sorption capacity increased with a rise of temperature at the optimum pH 5.0-5.5. Immobilization of metals with cheap soil amendments such as clay *in situ* is effective method for reduction of environmental hazards with low and medium target concentrations of metals or metalloids at relatively stable environmental conditions. Increased efficiency of a soil amendment can be reached by using clay modified with hydroxyapatite.

Keywords: modified clay, soil amendments, soil remediation, sorption kinetics

PRODUCTION OF MANGANESE ALLOYS FROM LOW-GRADE ORES: A MODERN APPROACH

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ABSTRACT

The article discusses development of complex hydrometallurgical technologies of processing lean manganese raw materials (low-grade complex phosphorite ores of both carbonate and oxide types, ferrous slags, offshore ferromanganese nodules) and fabricating high-purity commercial manganese products (oxides, ferroalloys, manganese, foundry alloys).

Keywords: manganese alloys, hydrometallurgy, pyrometallurgy, low-grade ores, environmental performance.

PROJECTING OF THE AUTOCLAVE-DISTILLATE UNIT AND ITS TESTING ON EXTRACTION OF OSMIUM OUT OF INDUSTRIAL INTERMEDIATE PRODUCTS OF COPPER PRODUCTION WITH USAGE OF POTASSIUM CHROMATE AND POTASSIUM CHLORATE

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ABSTRACT

Researches on elaboration of the technology of osmium extraction from lead cake, a pressure leaching product of lead dusts of copper production, allowed to define technological conditions of the dissolution processes of cake by sulfuric acid with oxidants - potassium chromate (K_2CrO_4) and potassium chlorate ($KClO_3$) and distillation out of osmium from the resulting solution. Pressure leaching processes of lead cake and distillation out of osmium from solution were carried out in hermetic autoclave-distillation unit, which prevented the loss of osmium and harmful toxicity effect of osmium tetroxide on the environment. In this case, the condensation of osmium was implemented beyond that unit in an alkaline solution.

Keywords: Lead cake, pressure leaching, osmium tetroxide, distillation, alkaline distillate

RELIABILITY OF THE COMPONENT UNITS OF EXCESSIVE WEAR OF COAL PREPARATION EQUIPMENT

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ABSTRACT

Energy coal exploited in the mining basin of the Jiu Valley is prepared and concentrated in Coroești plant, the subject of technological stages: classification, selection, breakage, jigging concentration draining. Technological equipment in existing plant consists of: vibrating screens, crushers, jig washer and vibrating centrifugal machines; the vibrating screens made classification, desliming and draining of coal. The paper presents the results of the working behavior of vibrating screens type SCC III 2.6x5.25 for a period of 29 months. Based on data obtained regarding operating times between failures and times consumed with repair work, it could be an analysis of reliability for some subassemblies which presented significant wear, for example: splits, couplings, springs, troughs, beams, steel flats, etc. Were calculated time intervals to determine the relative and cumulative frequency as well as mean time between failures, failures rate and reliability variation depending on the time of operation based on distribution exponential and Weibull. The distribution law adopted (exponential or Weibull) was validated under test Kolmogorov, for each subassemblies analyzed. Determine the reliability of using distribution exponential and Weibull for subassemblies vibrating screens type SCC III 2.6x5.25 has great theoretical importance but mostly practical creating a data base of reliability parameters useful in practice to establish the required spare parts, preventive maintenance planning including maintenance organization based on reliability.

Keywords: vibrating screens, coal, reliability, subassemblies, failures

STUDY OF SCAFFOLD FORMATION MECHANISM IN BLAST FURNACE STACK

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ABSTRACT

The scaffold is a build-up on blast furnace refractory (BF) lining, which is generated in temperature zones from 800 to 1100°C without presence of liquid phase. Such zones are middle and upper part of blast furnace stack. The scaffolds consist of dust portions of particular charge components (coke dust, pellet and sinter fine particles) and have increased content of Na, K, Zn, Pb that support generation of scaffolds. The generation of scaffolds is an undesired phenomenon, which negatively impacts stability of blast furnace operation. The release of scaffold and its following shift towards BF hearth may result, depending on its size, in serious violation of BF thermal balance or even in tuyers' damage in case of direct contact with a scaffold. Moreover, the occurrence of scaffolds reduces furnace's working volume. Several scaffolds were analyzed from perspective of factors supporting their generation and the factors having impact upon the release of scaffolds from furnace refractory lining.

Keywords: blast furnace, build-up, scaffold, microstructure

TECHNOLOGICAL ASPECTS OF THE UTILIZATION OF KARELIAN ARTIFICIAL MICACEOUS PEGMATITE DUMPS

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ABSTRACT

The industrial utilization of Karelia's technogenic deposits, such as mine dumps where the pegmatite veins of some deposits have been mined since the early 20th century, was studied. Sheet muscovite-mica was extracted from pegmatite. The use of environmentally safe processing technologies and an integrated approach to the extraction of all minerals are of great importance nowadays. Mine survey has shown that the veins of the pegmatite deposits in the Chupa-Louhi District, Karelia, are of different types responsible for the geochemical characteristics and quantitative ratios of minerals. This would have a negative effect when enriching by conventional methods using a common scheme.

Nowadays, the most acceptable method for the utilization of technogenic dumps is a bulk technology for the mining and enrichment of rocks with the selective extraction of the major minerals of quartz, microcline, plagioclase, muscovite and other associated minerals.

The development of sensor separation technologies, a unique, rational and profitable alternative to conventional dressing processes, has provided the opportunity to improve ore dressing processes and subsequent enrichment

The dump utilization technology, which is now in progress, is expected to lead to low expenses and the high productivity of crushing and sizing operations and to offer general-purpose enrichment schemes for the complete extraction of minerals of different particle-size composition within one dump using the flow method. The economic efficiency of the utilization of artificial dumps can be considerably increased by making the extraction of major mineral concentrates (quartz, feldspars and muscovite) more complete.

Keywords: artificial deposits, pegmatite, enrichment, extraction

AN APPLICATION OF MICROWAVE HEATING IN TREATMENT OF SELECTED MINERALS

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ABSTRACT

The heating of minerals and ores in the microwave field depends on the dielectric properties and their ability to absorb the microwave energy. The temperature of samples was measured with a contactless infrared thermometer Raytek RAYMX4PG during microwave heating. The results of microwave heating of minerals during 1 and 5 minutes at power 900 W and the frequency 2.45 GHz are described. The sufficient penetration depth of microwaves to the material is needed at the heating of different types of materials in the microwave field. On the basic of the heating rate, irradiated minerals were divided into weakly heated minerals such as quartz, barite and well heated minerals, such as pyrite, chalcopyrite, magnetite, galenite and siderite. The temperature distribution in the sample of siderite and magnesite during microwave heating was described by COMSOL Multiphysic programme, on the basis of knowledge of their dielectric and physical characteristics, as well as the frequency and the intensity of the electric field. The submitted work described the influence of microwave energy on the intensification of the comminution processes. In consequence of microwave heating the stress and thermal dilatation at the interface of mineral grains arises. It increases the failure and following processes of irradiated specimens comminution. The rate of failure has been investigated on the basis of measurement of the elastic wave velocity by the impulse-dynamic method. The high degree of failure was observed after 2 minutes of microwave irradiation of siderite sample and after 5 minutes at magnesite sample at the power 900 W. The unpretreated and microwave pretreated samples of magnesite were crushed using the vibratory jaw crusher VČM-3. Consequently, the particle size distribution curves for crushed products were constructed. Finally, the relative work indexes according to the Berry and Bruce method were calculated and compared. After microwave heating of magnesite sample at the power 2500 W it was confirmed 18% decreasing of work index and 38% decreasing at the microwave power 5000 W.

Keywords: heating, microwave, minerals, relative work index

THE EFFECT OF SAW-DUST ADDITION FROM PINE AND OAK WOOD ON IRON-ORE SINTERING PERFORMANCE

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ABSTRACT

An investigation was carried out into the use of saw-dust from pine wood (SDPW) and oak wood (SDOW) as a supplementary fuels in the iron ore sintering process. The saw-dusts used in this study was added as a replacement for a coke breeze. Total heat output of all tested raw mixtures was calculated as 3,8 wt. % coke breeze. The coke substitution and energy requirement provided by saw-dusts was in the range of 8 - 20 %. Experimental tests were made by using a laboratory sinter pot with charge capacity of around 70 – 90 kg per run. The main objective of the work reported here was to determine the effects of substituting coke with SDPW and SDOW in the iron ore sintering process with respect to combustion efficiency and sinter quality. The substitution of coke by saw-dust fuels more than 20 % resulted in an increase in the sintering time because of the permeability was decreased. Consequently it may lead to achieve low temperature profile of bed. Explain in more detail and interpretation of results is described in the paper.

Keywords: saw-dust, biomass, sintering process, pine wood, oak wood

THE POSSIBILITY OF USING OF BIOMASS IN THE AGGLOMERATION PROCESS

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ABSTRACT

In this paper, commercially available biomass materials suited to sinter making have been identified as an alternative source of fuel to coke breeze. A study was carried out into the use of wood charcoal, sawdust, pine and oak as a supplementary fuel in the iron-ore sintering process. The application of renewable reducing agents in the iron-ore sintering process depends on their chemical and physical properties.
In this reason were analysed the possibility of using of biomass in the agglomeration process in terms of its chemical and physical properties and its confrontation with the properties of the currently used coke breeze.
Biomass was characterized according to its chemical composition and chemical composition of ash. The obtained data were confronted with data for coke breeze, and from the results, conclusions were made about the possible use of selected types of biomass as an alternative fuel in the process of iron ore agglomerate production. The results of analysis of selected biomass types suggest that the orientation on their use in agglomeration process is a correct direction.

Keywords: fuel, biomass, sintering process, coke breeze, chemical properties, physical properties

THERMODYNAMIC STUDY OF UTILIZATION OF SAWDUST FROM OAK-WOOD IN THE IRON-ORE SINTERING PROCESS

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ABSTRACT

The aim of this study was to evaluate, from thermodynamic point of view, the possibilities of sawdust from oak-wood utilization in iron-ore sintering process. Sawdust from oak-wood with standard coke breeze were studied as sintering fuels. Materials used in this study were subjected to chemical and physical analyses typically used for coal and coke characterisation. Sawdust from oak-wood has lower content of fixed carbon and higher volatile matter content. Sawdust from oak-wood has relatively low calorific values (16,90 MJ/kg) compared with coke breeze (28,16 MJ/kg). It can be observed from the chemical analyses that sawdust from oak-wood has lower sulphur level and much lower ash content, in comparison with the coke breeze. In order to visualize feasibility of individual reactions depending on temperature, Gibbs equilibrium diagrams were calculated by thermodynamic modelling program HSC Chemistry 5.11. From analysis of fuels burning reactions follows, that the highest temperatures in the sintering bed (experimental about 1150 – 1360^{o}C) are achieved with the coke breeze. Combustion of higher amount of volatile matter in sawdust from oak-wood leading to the lower maximum temperatures in the sintering bed (experimental about 780 – 1180^{o}C). It was found that less of this energy would be available in sinter making due to the evaporation of some of the volatile matter ahead of the flame front. Overall the results suggest that it is realistic to substitute maximum 8-10% of coke breeze with sawdust from from oak-wood in the iron ore sintering process.

Keywords: biomass, sawdust from oak-wood, iron-ore sintering process, thermodynamic analysis, Gibbs equilibrium diagrams

TYPOMORPHIC CHARACTERISTICS AND ENRICHMENT POTENTIAL OF KARELIAN SHUNGITES

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ABSTRACT

Shungite is a mixed type of carbon-cherty rocks because it consists of amorphous carbon which displays a distinctive structure: shungite matter, quartz, mica and metal oxide impurities. There are no analogues to shungite rocks in the world, for shungites are only known from Karelia, Russia.

The study of shungite rocks from the Tolvuja structure has shown that sodium-series shungite rocks (Lebeshchina deposit) differ considerably from potassium-series shungite rocks (Zazhogino and Maksovo deposits). Potassium-series shungite rocks are composed dominantly of fine-crystalline aggregate of sericite-biotite-quartz composition with finely dispersed shungite matter. The rocks are massive. Three morphotypes of quartz, measuring over 20 μm, have been identified. Micas are 0.1-0.5 μm and pyrite up to 1μm in size. The ash portion contains 0.04-0.08% Na_2O and 1.31-2.35% K_2O. At the Maksovo deposit, shungite rocks are brecciated and have a shungite-cherty matrix. They are similar in chemical composition and structure to Zazhogino shungites. Their ash portion contains 0.1-0.38% Na_2O and 1.28-2.47% K_2O.

The sodium-series shungite rock body at the Lebeshchina target is heterogeneous in composition. There are transitional varieties between carbon-rich sodium-series rocks and shungite-albite rocks that contain 13-19.5%. Their alkali concentration varies substantially: 3.08-8.33% Na_2O, 0.1-4.07% K_2O.

Variable rock composition within a variety, confirmed by long-term studies, is an essential index in industrial production. Electrical conductivity is one of the properties responsible for shungite application.

Electrical conductivity-based methods are most efficient mechanical methods for enrichment of compositionally variable rocks from the practical point of view. The study of high electrical conductivity shungite production from rocks differing in carbon content and the mineralogical composition of the matrix has shown that their separation into fractions, differing in electrical conductivity (up to 200 Cm/m), by the induction radioresonance method using lumps of shungite is promising. The natural electrical conductivity of Zazhogino shungite rocks is 43 Cm/m and that of Maksovo shungite rocks is 35.6 Cm/m.

The separation efficiency of all shungite rocks has been found to depend on H_2O concentration and density.

Keywords: shungite, chemical composition, enrichment, electrical conductivity, application

UTILISATION OF COAL MINING WASTE

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ABSTRACT

The paper deals with an application of refuse from black coal mining as land reclamation materials in the Czech Republic. The north-east part of the Czech Republic is the most significant deposit of black coal. Black coal has been mined there for over 200 years. This deposit is found in the southern part of the Upper-Silesian Basin, greater fraction of which lies in Poland (over 75 % of its area). The paper describes the management of fine-grained wastes deposited in settling ponds for further industrial processing, such as energy recovery, beneficiation of the raw materials by re-flotation, utilisation of the raw material in the production of bricks and cement clinker. Fine-grained flotation tailings may also be used as a filling material in the remediation of settling ponds.

Keywords: coal mining waste, fine refuse, coal preparation, pelletization of waste

UTILIZATION OF LIQUID PRODUCTS FROM PYROLYSIS OF WASTE MATERIALS IN COAL FLOTATION

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ABSTRACT

The paper deals with an examination of potential new flotation agents in black coal flotation (Lazy) originating from the preparation plant of Paskov Mine and their comparison with an industrial applied collector Montanol 551, which is used in the coal preparation plants in the Czech Republic. The potential new flotation agents were formed via pyrolysis of rubber (G1) and of biomass (Z). The following flotation parameters were measured during the flotation process, such as collector dosage, pulp concentration, and agitation time. Through mixing these new flotation agents with industrial applied collector Montanol 551 and their application in black coal flotation, it is possible to decrease the ash content in the flotation concentrate below 10%.

Keywords: Flotation, Flotation Agents, Black Coal