Summaries

FOSZCZ DARIUSZ, GAWENDA TOMASZ

Analysis of Efficiency of Grinding in Ball and Rod Mills Dependably on Contents of Fine Particles in Feed • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

The paper presents the analysis of efficiency of the work of ball and rod mills dependably on granulation of the feed, particularly on fine particles contents. The analysis was conducted on the basis of the laboratory and industrial results realized as the part of research works for O/ZWR KGHM PM SA. The efficiency of grinding process was evaluated by the factor describing increase of certain chosen particle size fractions in mill yield. The issue of determining fine particle fractions before operations of comminution is crucial from the point of view of economics of conducting processing process. The liberation of fine particle fractions, so-called "ready" for further operations not requiring comminution on certain level influences on comminution costs and expected capacity of comminuting devices. It is very important to determine the efficiency of comminuting operations dependably on fine particles contents for correct determination of comminution system scheme. It allows determination of expected efficiency of classification process and optimization of investments costs connected with purchase of devices of certain capacity as well operative ones connected with energy consumed by designed technological system.

Keywords: *comminution, ball mills, rod mills, fine particles, energy consumption*

KISIELOWSKA EWA, WOJTASIK RAFAŁ, KASIŃSKA-PILUT EWELINA, HOŁDA ANNA

The Bioleaching of Silver from the "Żelazny Most" Disposal After-Flotation Wastes in Lubin with Application of Microfungi from Genus Aspergillus Niger • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

The aim of the research presented in an analysis of ways of utilizing microfloral autochthonous organism from the after-flotation waste of the Gilow stockpile in order to bioleach silver. A research of the bioleaching process of the after-flotation waste was conducted using microfungi of the Aspergillus niger species, which dominate in the autochthonous environment. The metabolism of these fungi, connected with the production of large amounts of organic acids, allowed to conceptualize their usage in the biohydrometalurgy silver processes. After isolating in a pure culture and multiplying the microfungal biomass Aspergillus niger, the experiment began. Weighed samples of the waste were covered with a selective medium and then inoculated with the microfungal biomass, playing the role of the bioleaching agent. After thirty days of incubation, the end product was chemically analyzed, showing effects of the conducted bioleaching process (12–41.5%).

Keywords: *bioleaching, silver, microfungi, Aspergillus niger, after-flotation waste*

KOLACZ JACEK

Advanced Sorting Technologies and Its Potential in Mineral Processing • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

A new optical sorting system based on a complex image analysis and high definition imaging has been developed by Comex. The image analysis is based on high definition image analysis, X-ray attenuation and advanced filtration tools. Different mineral properties are used to identify the processed material. The system is further combined with

a high speed rejection mechanism based on FPGA technology and operating in real time conditions. This provides a minimal error when removing waste particles from the sorted material.

Keywords: *optical separation, electronic separation, optical sorting*

KOWOL DANIEL, ŁAGÓDKA MICHAŁ

Impact of Quantitative And Qualitative Differentiation of Feed on Effectiveness of Jig Beneficiation Process · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

Effectiveness of operation of pulsatory jigs depends on their design solutions and adjustment of operational parameters to the characteristics of beneficiated material and production quality requirements. Proper preparation (blending, feeding) of the material for beneficiation is a very important issue. Results of laboratory tests aiming at determination of impact of quantitative-and-qualitative differentiation of feed on effectiveness of its separation in a pulsatory jig are presented in the paper. The tests showed that irregular feeding of material along entire operational trough to a pulsatory jig causes a significant reduction of beneficiation effectiveness. It was found that quantitative irregularity of feeding has bigger impact on a beneficiation result.

Keywords: *pulsatory jig, separation process, grained material, mineral processing, beneficiation*

KRAWCZYKOWSKA ALDONA, MARCINIAK-KOWALSKA JOLANTA

Problems of Water Content in Lignites — Methods of Its Reduction · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

The article is an overview of coal drying methods used in the world. Lignite is the most abundant and economically viable source of energy. One of the drawbacks for utilizing the lignite is high moisture content on mining, which varies from 30% to as high as 70%. Before any industrial use, lignite must be dried. It is important to reduce water content to enhance the heating value and reduce transportation costs while enhancing combustion efficiency, safety, and reduction of emissions on combustion. To allow lignite to be processed into gaseous and liquid products as well as high-grade solid fuels, its moisture content must be reduced to 10 to 20% — depending on the production goal.

Keywords: *lignite, moisture content, drying processes*

KRAWCZYKOWSKI DAMIAN, KRAWCZYKOWSKA ALDONA

Influence of Particle Shape on Balancing the Classification Products Given by Hydrocyclones on the Basis of the Results of Laser Particle Size Analysis · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

The paper concerns the problem of balancing of hydraulic classification products of fine-grained materials on the basis of particle fractions contents in products determined by laser diffraction method. The investigations contained the experiment of classification of fine-grained materials differing the shape of grains in hydrocyclones, analysis of particle size distribution of classification products by laser method, determination of the method adequacy and calculations balancing the yields of classification products and their comparison with yields determined in experimental way.

Keywords: *laser granulometric analyzes, balance of classification products, shape of grains*

MARCINISZYN TOMASZ, SIERADZKI ADAM

Selected Properties of Amphibolites and Migmatites from the G.A.M. Kluczowa Mine · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

In this paper we present the results of thermal conductivity, thermal expansion and water absorption measurements of the migmatite and amphibolites rocks. The studies are intended to classify migmatites and amphibolites in terms of their practical application. The results revealed that investigated materials can be used as a construction material with good thermal and visual properties.

Keywords: *migmatite, amphibolite, thermal conductivity*

MITURA ANDRZEJ

Research over the Influence of Energetic Mixture Compounds on Combustion Heat • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

The paper presents the initial investigation of possible energetic applications of chosen wastes from groups: 06, 13, 05 and 01. The change of combustion heat value was evaluated in produced energetic mixtures together with the change of their individual components. Furthermore, the application of regressive method was proposed in purpose of calculating combustion heat value and then the comparison of empirically determined and theoretically calculated heat values was performed.

Keywords: *wastes, combustion heat, coal slime, combustion*

MODRZEWSKI REMIGIUSZ, WODZIŃSKI PIOTR

Motion Simulation of Industrial Screen Meshes • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

This paper is an account of a method of motion simulation of vibrating screen meshes developed and tested at the Department of Process Equipment at the Technical University of Łódź. It is obvious that a type of screen vibration and its parameters such as throwing index have a crucial influence on the efficacy of separating granular mixtures. The possibility of simulating this motion before construction of a machine helps to save both the time and money, and it is also a significant contribution to further kinematic tests because it gives the chance of verifying the proper functioning of electronic meter circuits.

Keywords: *screening, screen, mesh, vibration*

NAD ALONA, BROŻEK MARIAN, NAZIEMIEC ZDZISŁAW

The Tensile Strength Properties of Lithological Variety of Polish Copper Ores • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

The paper presents the results of investigations of crushing by compression of single particles. The investigations were performed on three lithological variety of Polish copper ores: carbonate, sandstone and shale. The tensile strength of particles was determined by uniaxial compression. The tensile strength of mineral particles is characterized by a large scatter results. This scatter is caused by the influence of random factors such as load conditions, the particle position, a particle shape and the internal structure of a particle. Due to this, the strength of a set of mineral particles is characterized by a certain distribution. The strength distribution is approximated by Weibull's distribution and the distribution parameters are independent from the particle size. The paper presents the dependence of average tensile strength of such minerals as dolomite, slate and sandstone particles on size particles

Keywords: *tensile strength, dolomite, slate, sandstone, Weibull's distribution function, compression*

PAN XIAOWEI

Development of Stockpile Soft Sensor • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

With the advancement and the wide usage of measurement instruments associated with stockpiles, a soft sensor can be developed to monitor the level of a stockpile. Furthermore, the stockpile soft sensor can be used to provide the mixing behaviour of different ores discharged out of the stockpile. With the assistance of DEM modeling and simulation, the mixing behaviour of different materials in a stockpile can be estimated. The information on the mixing behaviour includes when and how the mixing takes place in a stockpile, and more important, when the mixed materials with a certain blending portion is discharged out of the stockpile. The stockpile soft sensor can help estimate accurate residential time for different group of ores charged to a stockpile. The soft sensor makes it possible to monitor the behavior of different ore types in and out of a stockpile in real time. The ore type information includes ore grade, density, hardness, strength, etc. The stockpile soft sensor forms part of an ore tracking system, which utilises the real time information available in both SCADA and database of a mineral processing plant or a mine. Using the ore geological data and the tonnage of ore being treated, the ore tracking system calculates and

provides ore type information to all process units at a mine. The stockpile soft sensor, developed originally for a diamond mine, can be used for stockpiles of other mineral operations, including iron ore, coal, copper, chromite ore, manganese ore and cement plants, etc.

Keywords: *stockpile level, stockpile soft sensor, stockpile modelling, process measurement*

PAN XIAOWEI

Optimization of Mineral Processing Plant Through Rom Ore Size · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

The ore beneficiation at a mine could be described as complex and expensive, involving many balancing processes where material flow rates, size, density and other factors must all be in balance, if any degree of plant optimization is to be achieved. To determine the optimum setup for maximizing throughput at the final step in the beneficiation process, such as the dense media separation units, a mine optimizer is developed using constraint-based global optimization. The Mine Optimizer uses plant unit availability, capacity in tons per hour (t/h), change in material size (between crushers) and other constraints. The result is that improving cheaper upstream processes, such as blasting, can significantly increase the throughput of expensive downstream processes, like crushing, through improved fragmentation of the ROM ore. For instance, if the ROM ore is not in the required range, the plant production is unbalanced and consequently the mine could loss production by 10–20%, even 50% in the worst case. On one hand, a finer ROM ore may result in lower utilisation of both crushing and coarse separation by 50%. Meanwhile other process units are running at 100% capacity, such as slimes and tailing dumping. In addition, a finer ROM ore may destroy the mineral value as well, such as in the cases of mining coal, iron ore, and diamond ore, where a higher price is for the products of larger size.

Keywords: *process optimization, mine production, production simulation, mineral processing*

PAN XIAOWEI

Smart ore Tracking System Using Soft Sensor Technology · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

The relationship between ore mineralogy and downstream processing is well known in the mining industry. In fact, the very definition of a mineral deposit as an ore body depends on its susceptibility to processing in an economical manner. With an ore tracking system, the information about each ore block, gained during exploration and mining, could be used as input data to the mineral processing operation. This would allow the real-time optimization and control of the ore processing. A smart ore tracking system can be developed by using soft sensor technique. The ore tracking system utilizes the real time information available in both SCADA and database of a mine. Using the ore geological data and the tonnage of ore being treated, the ore tracking system calculates and provides ore type information such as ore mixing percentage, ore grade and ore hardness and density. The ore type information provided by the ore tracking system can be made available at all process units at a mine, including primary crusher, primary stock pile, primary scrubbers, secondary scrubbers, secondary crushers, re-crusher stock pile, dense media separation stock piles, dense media separation feeders, and the feed to next processing plant. The smart ore tracking system, developed originally for a diamond mine, can be used for other mines, such as iron ore, coal, chromite ore, manganese ore, etc.

Keywords: *ore tracking, ore type soft sensor, ore type monitoring, process modeling, process measurement, soft sensor*

POĆWIARDOWSKI WOJCIECH, WODZIŃSKI PIOTR, KANIEWSKA JOANNA

Investigation of the Rolling Screen · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

This paper concerns rolling screens. These machines are made up from circular sieve panels which, arranged one above the other, form the machine's riddle. Sieves in rolling screens perform a precessional movement of a "drunken barrel". It is a complex, spatial movement and therefore these machines are specifically designed for screening fine

and fine-grained materials. The authors of this paper deal with screens driven by two symmetrical, synchronised rotating motovibrators. This drive is relatively simple and allows to achieve good process properties of the screening machine. Studies of this screen are conducted with the use of limestone aggregates. The aim of the paper is presenting the constructional study of rolling screens as well as results of process studies of these machines.

Keywords: *screening, screening efficiency, rolling screens*

POMYKAŁA RADOSŁAW, STEMPKOWSKA AGATA, ŁYKO PAULINA

Rheological Properties of Slime Waste from Hard Coal Processing · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

Slime waste arises in water-sludge circuit as a suspension of fine-grained coal waste with solids content of from 200 to 450 g/dm^3. It is secreted in hydrocyclones and Dorr thickeners. Depending on the feed and the treatment process, slime waste may be even more than 30% of the total waste generated. The article presents the results of measurements of the rheological properties of suspensions of solid waste and water, using three different viscometers, based on different measurement systems. Research results are presented in the form of flow curves and viscosity curves, and adjusted them to the three most common rheological models. Identify the key factors influencing the measurement results. Solid content is in suspension of solid waste is the most important of them. It determines not only the shear stress values for a specific shear rate, but also the behavior and properties of such liquids. The best fit of flow curves corresponds to different rheological models also depending on this factor.

Keywords: *slime waste, suspension, coal processing, rheology, yield point*

RÓŻANOWSKI BARTOSZ, MICHAŁOWSKI MACIEJ,
TORA BARBARA, CABLIK VLADIMIR, CERNOTOVA LENKA

Effectiveness of the Use of Willow Tree (Salix Viminalis) for Wastewater Treatment · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

The aim of this study was to determine the applicability of willows to sewage sludge utilisation. Fast growing willow subspecies of Salix viminalis was planted on sewage settlement tank in mechanical and biological sewage treatment in Zakliczyn near Tarnów. The physicochemical properties of samples of sludge were determined. It was shown that willows planted on sewage sludge accumulate substantial amounts of nitrogen, phosphorus and heavy metals from their environment and therefore decrease the content of these elements in the sludge. The results indicate that willows Salix viminalis, particularly its fast-growing subspecies, are effective in sewage sludge utilisation.

Keywords: *waste water treatment, neutralisation, growth, plants*

TUMIDAJSKI TADEUSZ, NIEDOBA TOMASZ, SARAMAK DANIEL

Introduction to Mathematical Statistics of Grained Materials · AGH Journal of Mining and Geoengineering · vol. 36, No. 4, 2012

Mineral processing called also minerallurgy concerns mainly separation of grained materials so, generally speaking sets of individual particles. The main subject of interest of minerallurgy is the application of particles sets segregated because of certain feature or group of features. The statistical description of grained materials and separation processes connected with them may be called as mathematical statistics of grained materials or minerallurgostatistics. The paper presents group of problems connected with adequate determination of basic definitions of such understood statistics like general population, methods of probability determination, definition of distribution curves, description of separation processes with application of mass balance law. Furthermore, the purposes of cycle of publications signaled by the paper which will precise language of statistics of grained materials, definitions and theorems. All of these works lead to unification of the language of description and its modernization.

Keywords: *statistics of grained materials, general population, beneficiation curve, sampling*

UMUCU YAKUP, DENİZ VEDAT

A Study Simulation and Modeling on the Performance of the Heavy Media Cyclone in Coal Beneficiation • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

In this study, time-dependent performance of heavy-medium cyclone were determined with sink-float testing of clean coal and schist samples taken from cyclone feeding at Buruyar coal company located at Manisa-Soma Region. Later, samples taken from coal mines located at Denizli-Çivril region were firstly classified, and then subjected to float-sink test for washability assessment. Finally, hourly changes in the amount of clean coal and schist recovered from processing of Denizli-Çivril coals with heavy media cyclone were determined using classic simulation and modeling methods depending on performance values of heavy-medium cyclone. Results obtained from both methods were compared.

Keywords: *coal, washability, modeling*

UMUCU YAKUP, DENIZ VEDAT, BOZKURT VOLKAN

The Evaluation of Grinding Process Using Modsim© • AGH Journal of Mining and Geoengineering • vol. 36, No. 4, 2012

There are programs for the computer design of mineral processing circuits, and that these programs contain computer simulation models for ball mill design. Simulation techniques are popular because they allow complex problems to be tackled without the expenditure of large resources. MODSIM© is a simulator that will calculate the detailed mass balance for any ore dressing plant. MODSIM© can simulate integrated flow sheets that include grinding. In this studies S_i and $B_{i,j}$ (selection and breakage distribution functions) equations were determined from the size distributions at different grinding times and with model parameters (S_i, a_t, α, γ, β and ϕ_J) for different powder filling ratios. Experimentally determined data were statistically compared with data obtained from MODSIM© simulator program using model parameters.

Keywords: *kinetic model, MODSIM©, grinding, modeling, simulation*