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Water chemistry analysis of an industrial selective flocculation dispersion hematite ore concentrator plant

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INTERNATIONAL JOURNAL OF MINERAL PROCESSING, Jan, 2012, Vol.102, pp. 99-106

Hematite ore selective flocculation-dispersion process water is a complex system of ions and reagents working together to produce a concentrated iron oxide product. The purpose of this study was to determine the process water concentrations of the important ionic species in a selective flocculation-dispersion hematite ore concentrating plant while process conditions were stable. This information was used to provide a detailed water chemistry analysis and to further understand how water quality affects the process. An analysis of the water chemistry of an operating selective flocculation-dispersion iron ore concentration plant has never before been published. The pH of the process water was the most important factor in the selective flocculation and dispersion process because, according to prior studies, it has a direct relationship with the surface chemistry of the particles (Carlson, 2010). The pH also had a direct relationship with the solubilities of both calcium and magnesium in the process. Water hardness was significantly increased with the addition of calcite/dolomite flux which may cause issues in pelletization and in the reuse water. Soluble iron was removed in the flotation circuit suggesting that it may have been oxidized during flotation or it may have been absorbed by the collector. (C) 2011 Elsevier B.V. All rights reserved. 10.1016/j.minpro.2011.10.002

Characterization of kaolin from the Capim River region - Brazil

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APPLIED CLAY SCIENCE, Jan, 2012, Vol. 55, pp. 164-167

Kaolin has been intensively used as an industrial mineral, mainly in the paper industry, as coating or filler material. In order to achieve the market requirements for this kind of use, there are several beneficiation processes that kaolin should pass, such as grain size classification, chemical bleaching and magnetic separation. In this

work, mineralogical, chemical and physical characterizations were carried out in kaolin samples from the mined ore in Capim 1 deposit being commercially exploited by Para Pigmentos S/A, before and after different steps of the industrial beneficiation processes. X-ray fluorescence and brightness measurement results indicate that all kaolin samples are typified by low iron content and high brightness grade. X-ray diffraction and scanning electron microscopy data exhibit kaolinite as the main mineral phase with minor amounts of quartz. The Hinckley index (>1.06) as determined with XRD shows that all samples exhibit high structural order. From electron spin resonance and Fe-57 Mossbauer spectroscopy data we obtained essential information about the chemical nature of iron impurities. Results reveal that the highest improvement in kaolin properties is obtained when previous magnetic separation is included in the beneficiation. 10.1016/j.clay.2011.11.009

Qualitative analysis of fine coals obtained from triboelectrostatic separation

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JOURNAL OF THE SOUTHERN AFRICAN INSTITUTE OF MINING AND METALLURGY, Jan, 2012, Vol.112(1), pp. 55-62

Coal samples taken from the No. 2 Seam and No. 4 Seam in a South African colliery were tested in a rotary triboelectrostatic separator. The two-stage triboelectrostatic separation results using the -177 mu m size fraction reduced No. 2 Seam coal containing about 30.4 per cent ash to a clean product of 8.9 per cent and 13.1 per cent ash with combustible recoveries of 9.6 per cent and 30.7 per cent respectively. The same separation approach on No.4 seam feed coal, which contained 36 per cent ash, produced a dean coal product with 10.8 per cent ash at a combustible recovery of 6.0 per cent. Petrographic tests show a significant improvement in the vitrinite content and a reduction in visible minerals encountered when using the triboelectrostatic separator, with about 53 per cent vitrinite reporting to the clean fraction for No. 2 Seam compared to the feed content of 21 per cent, and a 54 per cent vitrinite in the clean No. 4 Seam from a feed content of 21 per cent. Significant sulphur reductions were also observed after separation in both coal samples, with a better separation in the second-stage coal products.

Experimental validation of 2D DEM code by digital image analysis in tumbling mills

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MINERALS ENGINEERING, Jan, 2012, Vol.25(1), pp. 20-27

The discrete element method (DEM) is widely used as an optimization tool in the design of tumbling mills. Nevertheless, the experimental validation of DEM codes is an important step to guarantee that the system is well described and that the predictions are close to the real operating conditions. The power draw is the principal parameter used to validate DEM codes, but using this as the only reference

can be inappropriate. The power draw can be fitted by simply changing the model constants until the predicted values are close to the experimental data, when the charge profile looks similar to the real operation and there is no experimental velocity profile with which to compare. This paper presents an experimental validation of a 20 DEM code by digital image analysis of the velocity profiles of the balls, the toe and shoulder angles and the predicted power draw. The experimental values were compared with the simulated data using different charge lifters and charge levels. The DEM simulation clearly shows that the velocity charge changes with a modification of the lifter profile. An accurate map of velocities at each location in the mill was obtained by digital image analysis and compared with DEM calculations. The simulated and experimental values are very close, leading to the conclusion that such DEM predictions represent an accurate description of the process in a tumbling mill.
10.1016/j.mineng.2011.09.018

Simulating the Bond rod mill grindability test

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MINERALS ENGINEERING, Jan, 2012, Vol.26, pp. 99-101

The Bond rod mill grindability test is a widely used tool to estimate the response of ores to rod milling. However, the mass of ore required to conduct the test, which can typically vary from about 8 to as much as 20 kg, may represent a challenge when sample availability is critical. The present work proposes an alternative procedure, which is based on the size-mass balance model with a specific account for the acceleration of breakage rates of the coarsest size fraction, a phenomenon that is well documented to occur during rod milling. The model was validated for four materials, showing that it can predict the Bond rod mill work index with deviations below 10%. Requiring only 1.5-3 kg of sample, the procedure is demonstrated to be a viable alternative to the standard test, whenever only a limited amount of sample is available. 10.1016/j.mineng.2011.10.015

The integration of carborundum powder comminution and surface modification in an air jet mill

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MINERALS ENGINEERING, Jan, 2012, Vol.26, pp. 1-4

Surface modification of carborundum (SiC) particles with a modifying agent, with simultaneous ultrafine comminution in an air jet mill, was studied in this work. The production rate of SiC and the viscosity of the SiC-paraffin oil suspension were used to evaluate the performance of comminution and modification. The experimental results indicated that the modifying agent bonded onto the surface of the SiC to form an organic layer in the integrated process of modification and comminution. The types and content of modifying agents and the temperature of the compressed air

have a great effect on the performance of ultrafine modified SiC, and there are some contradictory aspects between modification and comminution in the integrated process. According to the targets of both surface modification and ultrafine comminution, the optimum temperature of compressed air and feed rate of the modifying agent solution was 60 degrees C and 2 ml/min respectively, when the modifying agent A-151 was adopted to obtain the modified ultrafine SiC in one step. 10.1016/j.mineng.2011.08.023

Radionuclide Interaction with Clays in Dilute and Heavily Compacted Systems: A Critical Review

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ENVIRONMENTAL SCIENCE & TECHNOLOGY, Feb, 2012, Vol.46(4), pp. 1981-1994

Given the unique properties of clays (i.e., low permeability and high ion sorption/exchange capacity), clays or clay formations have been proposed either as an engineered material or as a geologic medium for nuclear waste isolation and disposal. A credible evaluation of such disposal systems relies on the ability to predict the behavior of these materials under a wide range of thermal-hydrological-mechanical-chemical (THMc) conditions. Current model couplings between THM and chemical processes are simplistic and limited in scope. This review focuses on the uptake of radionuclides onto clay materials as controlled by mineral composition, structure, and texture (e.g., pore size distribution), and emphasizes the connections between sorption chemistry and mechanical compaction. Variable uptake behavior of an array of elements has been observed on various clays as a function of increasing compaction due to changes in pore size and structure, hydration energy, and overlapping electric double layers. The causes for this variability are divided between "internal" (based on the fundamental structure and composition of the clay minerals) and "external" (caused by a force external to the clay). New techniques need to be developed to exploit known variations in clay mineralogy to separate internal from external effects. 10.1021/es203025q

A comprehensive gold oxide heap leach model: Development and validation

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HYDROMETALLURGY, Feb, 2012, Vol.113, pp. 98-108

A comprehensive mathematical model of the heap leaching of oxide ores with application to gold-silver-copper complexes and its numerical solution strategy is presented. The model is multi-scale, capturing details of the reactions at a particle (mm to cm) level and full transport issues at the scale (m to km) of the full heap. The challenges of model parameterisation and validation are covered, as is the application of the model in the analysis of dynamically expanding full scale three dimensional heaps. Provided that the model can be adequately parameterised, results clearly demonstrate its capability to predict the full scale behaviour of

complex oxide heaps and to form the basis as an engineering management information tool for process planning and control. (C) 2011 Elsevier B.V. All rights reserved. 10.1016/j.hydromet.2011.12.003

Advances in selective flocculation processes for the beneficiation of kaolin

Pruett, RJ
MINERALS & METALLURGICAL PROCESSING, Feb, 2012, Vol.29(1), pp. 27-35

Selective flocculation enables the production of high-brightness kaolin products from kaolin ore once considered too poor in quality for beneficiation into paper-coating pigments. Anatase, Ti(1-X)FeXO2, with X = 0 to 0.05, is a common iron-bearing impurity in sedimentary kaolin that can he unresponsive to kaolin beneficiation processes, such as magnetic separation, due to its extremely fine particle size (<0.3 mu m), or chemical bleaching, because of its chemical stability. Described here are selective flocculation technologies that separate anatase by flocculating anatase or flocculating kaolinite from dispersed slurries. Applying the advances in the chemical and mechanical dispersion of ultrafine particles and the selective aggregation of kaolinite or anatase particles have resulted in the selective flocculation processes practiced today that have increased process recoveries from those technologies practiced beginning in the 1960s.

Optimization of multistage circuits for gravity concentration of heavy mineral sands

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MINERALS & METALLURGICAL PROCESSING, Feb, 2012, Vol. 29(1), pp. 1-5

Gravity separators such as spirals are commonly used in multistage cleaning and scavenging circuits to improve the quality and recovery of concentrates produced in the industrial minerals industry Unfortunately, field surveys suggest that many industrial operations are poorly configured in terms of equipment layout. This shortcoming can often be attributed to a failure by engineers to make use of fundamental process engineering tools for circuit design. One of the most important of these is linear circuit analysis. This powerful tool makes it possible to mathematically compare the relative efficiency of circuit configurations in advance of experimental testing. This article provides a basic review of the linear circuit analysis concept and discusses some of the key insights it provides for the layout of multistage circuits. An industrial case study is provided to show the tremendous impact that this process engineering tool can have on the design of multistage spiral circuits in a heavy mineral wet plant.

Properties of decanter centrifuges in the mining industry

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MINERALS & METALLURGICAL PROCESSING, Feb, 2012, Vol.29(1), pp. 6-12

Since the 1940s, decanter centrifuges have become more important for increasingly

complex solid-liquid or solid-liquid-liquid separation processes. Sometimes processed industrial or metalliferous minerals are abrasive or are treated with corrosive chemical agents. Traditional mining applications include the processing of coal, gravel and other products, where low-speed decanters, as well as screen bowl decanters and filters, dominate. These have been increasingly replaced by high-speed decanters during the last decade. Decanter centrifuges also started to play a key role in applications such as drilling muds, processing carbonates and separating SX crud in copper platinum ore concentrations of nickel and gold. Communication between machine producers and mineral processing engineers is vital for the right choice of materials and the design of the right decanter centrifuge for the individual process.

Mineral liberation by high voltage pulses and conventional comminution with same specific energy levels

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MINERALS ENGINEERING, Feb, 2012, Vol.27, pp. 28-36

Comparative comminution between high voltage pulses and conventional grinding, at the same specific energy levels, shows that the electrical comminution generates a coarser product with significantly less fines than the mechanical breakage. However, minerals of interest in the electrical comminution product are better liberated than in the conventional comminution with an over 95% statistical significance. There is a potential to use less energy in the electrical comminution to generate the similar degree of mineral liberation as in the mechanical comminution. Distribution of the liberated minerals demonstrates that, in the electrical comminution product, a large percentage of the liberated minerals appear in size fractions coarser than 53 gm; while in the mechanical comminution product, the liberated minerals are accumulated in fine and very fine size fractions. Therefore there may be potential benefits in recovering the coarse liberated minerals in the electrical comminution product, prior to further grinding.
10.1016/j.mineng.2011.12.005

Effects of simultaneous ultrasonic treatment on flotation of hard coal slimes

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FUEL, Mar, 2012, Vol. 93(1), pp. 576-580

In this study, effects of simultaneous ultrasonic treatment on flotation of original and aged hard coal slimes were investigated with aiming to recover more combustible and good quality products. Conventional and ultrasonically assisted flotation tests of original and aged coal slimes were performed by using Montanol-531, a special coal flotation reagent, at variable dosages. The results of the batch flotation tests revealed that simultaneous ultrasonic treatment increased combustible recovery

and lowered ash values of concentrates compared to the conventional flotation conditions despite using similar reagent dosages. These results were also verified by testing some physico-chemical properties of the samples, i.e. temperature, pH, oxidation-reduction potential, and zeta potential. Finally, it is concluded that a thorough surface cleaning by cavitation due to power ultrasound might improve the flotation recovery compared with the conventional flotation conditions, even though very slight changes were also observed in some physico-chemical properties of the treated samples.
10.1016/j.fuel.2011.10.032

A practical and rigorous approach for the integration of sustainability principles into the decision-making processes at minerals processing operations

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MINERALS ENGINEERING, Mar, 2012, Vol. 29, pp. 65-71

In the mining industry, high-level commitments to adopt sustainability have been made at the corporate levels of mining companies, but there continue to be problems when attempts are made to adopt these high-level sustainability aspirations and translate them into appropriate targets and methods at the more-specific operational level. The integration of sustainability principles into day-to-day mineral processing operational decision-making processes has unique challenges that are not addressed adequately by current tools and methodologies. A proposed methodology to achieve integration of sustainability at the operational level will direct the systematic and rigorous identification and qualification of sustainability issues and opportunities in an operation. The methodology, starting from a sustainability point-of-view rather than an operational one, guides the identification of process issues ("problems") and opportunities by examining the operation, unit-by-unit, similar to a HAZOP process. Each issue or opportunity is qualified according to its measurability, scopes of impact and consequences so that it may be understood fully and the correct engineering problems are formed. The methodology has been tested with two case studies at minerals processing operations. At one site, the methodology identified a dust issue which had considerable business risks (loss of valuable product) compared to conventional engineering analysis processes. The other site also benefited from using the methodology as an opportunity to improve the milling circuit between the semi-autogenous grinding (SAG) mill and flotation circuit was identified. The opportunity not only showed a potential to improve the operational efficiency of the units concerned, but also potential improvements in water and energy (both direct and embodied) efficiency. It was important to utilise the holistic approach of the methodology in the identification of opportunities at this site; the goals of the operation showed a strong coupling between water and energy issues which would be difficult to overcome using the operation's current organisational model which

deals with such issues separately of each other. (C) 2011 Elsevier Ltd. All rights reserved. 10.1016/j.mineng.2011.10.017

Characteristics of fly ash from the dry flue gas desulfurization system for iron ore sintering plants

Sheng, Guanghong; Huang, Peng; Mou, Yaqin; et al.
ENVIRONMENTAL TECHNOLOGY Vol. 33(7), 2012, pp. 837-844
DOI: 10.1080/09593330.2011.599428

The characteristics of fly ash from the flue gas desulfurization (FGD) system are important for its reuse and are mainly depend on the desulfurization process. The physical and chemical properties of DSF ash, which refers to fly ash from the dry FGD system for the iron ore sintering process, were investigated. Its mineralogical contents were determined by X-ray diffraction and thermogravimetry analysis, and its micro-morphology was studied by scanning electric micrograph analysis. The results show that DSF ash has a higher CaO and SO3 content, and the main sulfur form is sulfite, with only a part of it oxidized to sulfate. The major minerals present in DSF ash are hannebachite, anhydrite, calcite and portlandite; a minor constituent is calcium chloride. The particles of DSF ash are irregular, fragmentary and small, and hannebachite grows on their surfaces. Particle size is affected by the FGD process, and the ash size from the maximized emission reduction of the sintering-FGD process is lower than that from the circulating fluidized bed-FGD process. The particle size distribution of DSF ash follows the Rosin-Rammler-Bennet equation.

Mitigating acid rock drainage risks while recovering low-sulfur coal from ultrafine colliery wastes using froth flotation

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MINERALS ENGINEERING, Mar, 2012, Vol. 29, pp. 13-21

Ultrafine coal wastes contain sulfide minerals, particularly pyrite, which oxidize and give rise to acid rock drainage (ARD) resulting in extensive and prolonged contamination of local ground and surface waters. Currently, mining operations emphasise an end-of-pipe approach to ARD management using costly chemical or biological treatment techniques, which do not address the long term problem of achieving sustainable closure solutions within the resource lifetime. Eliminating ARD potential before waste disposal would have a major beneficial impact on water quality and facilitate long term closure solutions. Recovering a saleable coal product would be an added economic incentive. This paper presents the results of an investigation to establish the feasibility of a two-stage flotation process to produce: (i) a low-volume sulfide-rich concentrate, (ii) a high-volume benign (low sulfur) tailings. and (iii) a coal concentrate. Laboratory-scale batch flotation experiments were carried out using an oily collector to float coal from samples of coal ultrafines and a xanthate collector to recover acid-generating sulfides. The results of acid

generating potential tests (both static and biokinetic) indicate that a low-sulfur tailings with low ARD potential may be produced, together with a coal ultrafine concentrate stream with a low ash content. (C) 2012 Elsevier Ltd. All rights reserved. 10.1016/j.mineng.2012.02.001

Technical and commercial progress in the adoption of geopolymer cement

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MINERALS ENGINEERING, Mar, 2012, Vol. 29, pp. 89-104

If formulated optimally, geopolymer cement made from fly ash, metallurgical slags and natural pozzolans could reduce by 80% the CO2 emissions associated with the manufacturing of cement. However, almost all standards and design codes governing the use of cementitious binders and concrete in construction are based on the use of Portland cement. The 100+ year track record of in-service application of Portland cement is inherently assumed to validate the protocols used for accelerated durability testing. Moreover, the entire supply chain associated with cementitious materials is based on the production of Portland cement. The geopolymerisation of aluminosilicates constitutes a radical change in construction materials chemistry and synthesis pathways compared with the calcium silicate hydrate chemistry which underpins Portland cement. Consequently, there are regulatory, supply chain, product confidence and technical barriers which must be overcome before geopolymer cement could be widely adopted. High profile demonstration projects in Australia have highlighted the complex regulatory, asset management, liability and industry stakeholder engagement process required to commercialise geopolymer cement. While the scale-up from the laboratory to the real-world is technically challenging, the core challenge is the scale-up of industry participation and acceptance of geopolymer cement. Demand pull by a carbon conscious market continues to be the key driver for the short term adoption of geopolymer cement. In the absence of an in-service track record comparable in scale and longevity to Portland cement, research is essential to validate durability testing methodology and improve geopolymer cement technology. Colloid and interface science, gel chemistry, phase formation, reaction kinetics, transport phenomena, comminution, particle packing and rheology, which are familiar concepts to minerals engineers, are also key building blocks in the development of geopolymer knowledge. Analysis of the nanostructure of geopolymer gels has enabled the tailored selection of geopolymer precursors and the design of alkali activator composition, aiding in establishing the relationship between geopolymer gel microstructure and durability. (C) 2011 Elsevier Ltd. All rights reserved. 10.1016/j.mineng.2011.09.009

Effect of Washing High-Ash Indian Noncoking Coals on Combustion

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INTERNATIONAL JOURNAL OF COAL PREPARATION AND UTILIZATION, 2012, Vol. 32(2), pp. 69-79

Indian thermal coals are usually high-moisture, high-ash, and high-volatile subbituminous type coal and are difficult to wash. Beneficiation of high-ash thermal coals of India has become the prerequisite for improving the overall economics and efficiency of power generation. The article highlights the studies carried out on the cleaning potentialities of thermal coal samples collected from three major coalfields through washability investigations followed by the identification of the level of cleaning by linking with the burning behavior. Conventional float-sink testing was used to determine the washability characteristics, and based on the washability data, clean coal was generated at three different ash levels. Combustion studies of the raw and clean coal have been conducted in a Drop Tube Furnace basically to observe the change in the burning behavior with the level of cleaning. From the combustion behavior of the washed fraction, it was found that, for two coal samples, Burnout Efficiency (BE) has improved compared to that of the raw coal, while for another sample, a reverse trend was observed. The studies concluded that it is better to fix the level of washing a particular coal based on combustion properties of the clean coal rather than taking an arbitrary value.
10.1080/19392699.2011.640296

Effects of Particle Size, Shape, and Density on the Performance of an Air Fluidized Bed in Dry Coal Beneficiation

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INTERNATIONAL JOURNAL OF COAL PREPARATION AND UTILIZATION, 2012, Vol. 32(2), pp. 80-94

We consider here the implementation of dry coal beneficiation using air fluidized bed technology. Although the applications of the fluidized bed dry coal separator have been done successfully on an industrial scale in the past, the process has been characterized by relatively poor Ep values. In this study, a 40 x 40 x 60 cm dry batch air fluidized bed coal separator with a relatively uniform and stable average magnetite-silica bed density of 1.64 was used for the detailed separations test using particles of the different densities, shapes, and sizes ranging from +9.5-53 mm. The separation tests were conducted at relatively low throughput and average Ep values as low as 0.05 were recorded for the separation of +37-53 mm and +22-31.5 mm particles. On the other hand, the separation of the +16-22 mm and +9.5-16 mm particles was characterized by relatively high average Ep values of 0.07 and 0.11, respectively. The continuous shift of the cut density for the +9.5-16 mm made it difficult to efficiently separate the particles. Particle shape is a difficult parameter to control, but the observed separation trends for the +16-22 mm particles of different shapes indicate that it has a significant effect on the separation performance of the dry air fluidized bed just like other parameters such as particle size and density.
10.1080/19392699.2011.640297

Establishment and Evaluation of a United Dry Coal Beneficiation System

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INTERNATIONAL JOURNAL OF COAL PREPARATION AND UTILIZATION, 2012, Vol. 32(2), pp. 95-102

A united dry coal beneficiation system combining the FGX separator with the air-dense medium fluidized bed separator was firstly established basing on careful considerations for the recent situation of dry coal preparation at home and abroad. The main equipment and the process flow of the United System are described in detail. The separation performance of the United System was accessed by separating run-of-mine coal from an open-pit mine in the Wuhai Region. The results showed that the E-p value of the roughing stage and the cleaning stage of the United System were 0.13 g/cm(3) and 0.055 g/cm(3), respectively. Finally, the United System reduced the ash content of the feed coal by 24.87% and increased the calorific value by 10.32 MJ/kg. This result evidenced that the United System had excellent separation ability. 10.1080/19392699.2011.640299

Application of a Central Composite Design with Response Surface Methodology in Beneficiation Studies of Coal Fines Using an Oleo-Flotation Process

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This article presents beneficiation studies of coal fines using Oleo flotation process. Central Composite Design (CCD) integrated with Response Surface Methodology (RSM) was applied to develop a process model from an input-output data set of an Oleo flotation process. The effects of the operating parameter values, that is, diesel oil dosage, wash oil dosage, and rotation per minute, were studied for determination of the optimum operating conditions to optimize the yield percent of the Oleo flotation process at a desired ash percent. Significant reduction in ash percent was possible using an Oleo flotation process. Analysis of variance (ANOVA) was also used to test yield and ash percent models for their acceptability for prediction of the output variables from the developed models. 10.1080/19392699.2012.695414

Scavenging of High-Value Product from High-Ash Medium Coking Coal: A Compulsion for Less Endowed Regions

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INTERNATIONAL JOURNAL OF COAL PREPARATION AND UTILIZATION, 2012, Vol. 32(5), pp. 238-251

Beneficiation of a high-ash (35%) medium coking coal to obtain a low-ash (12%) clean coal product is investigated. Characterization studies indicated that this coal can be processed after reducing the size to 1.18 mm in order to achieve reasonable yield of the clean coal at such a low target-ash level. The desired ash reduction is possible only after treating different size fractions of the -1.18 mm crushed coal separately. A gravity-based processing scheme comprising of a spiral-floatex circuit along with multigravity separator for the -1.18+0.5 mm fraction is developed to generate clean coal at 12% ash with 10.3% overall yield. Mechanical cell flotation circuit for the -0.5+0.15 mm size fraction resulted in additional 5.2% yield at 12% target ash level for the clean coal. A flotation circuit for the ultrafine fraction (-0.15 mm) is also developed using Jameson cell flotation that added further 4.4% yield in the overall mass recovery of the combustibles at the desired ash level. Thus, a total of 20% yield of the clean coal with 12% ash is achieved by treating various size classes separately. Application of the clean coal is recommended for metallurgical purpose. Out of the remaining 80% material, 35% is recovered at a 27% ash level that is recommended for use in sponge iron sector. The balance 45% with an ash level of 50% is marked for use in fluidized bed combustion for power generation. A complex flowsheet such as the one described in the present article is likely to be the future requirement for processing high-ash medium coking coals to a high-value low-ash product to enhance its utilization potential for metallurgical purpose.
10.1080/19392699.2012.695756

Beneficiation of Coarse Coal Ore in an Air-Fluidized Bed Dry Dense-Medium Separator

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INTERNATIONAL JOURNAL OF COAL PREPARATION AND UTILIZATION, 2012, Vol. 32(6), pp. 276-289

The beneficiation of different size fractions (+5, -31mm) of coal using an air-fluidized bed dry dense-medium separator with silica/zircon sands as the fluidizing-bed medium has been studied. Particle size and bed height were found to strongly influence the efficiency of separation with the dry dense-medium separator. An increase in bubble size associated with increase in bed height to 15 cm results in density variations within the bed that increase the probable error for deeper fluidized beds for the smaller particles up to 0.19 from 0.06 for the shallower 10 cm bed. Good agreement was found between the theoretical yield and ash content obtained from washability curves (produced from conventional float/sink tests) and the actual yield from the dry fluid bed separation for the bulk coal sample. A comparison with industrial coal-washing unit operations indicates that dry dense-medium separations are a strong candidate as an energy-and resource-efficient alternative process. 10.1080/19392699.2012.716801

Optimization of Some Parameters in a Modified Water-Only Cyclone for Metallurgical Coal Production from High-Ash Fine Coking Coals

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INTERNATIONAL JOURNAL OF COAL PREPARATION AND UTILIZATION, 2012, Vol. 32(6), pp. 290-297

Coking coal with generally 11% or lower ash content is termed as metallurgical coal and is used in the steel industry after the coking process. In Turkey, generally spirals and flotation machines are used for the production of metallurgical coal from high-ash fine coals. According to plant data, these devices are capable of producing clean coal with an ash content of 7%-15% from raw coal with 40%-60% ash content. This study aimed to produce metallurgical coal from high-ash coal using a modified water-only cyclone as this method is simple and easy to control. Firstly, the conventional water-only cyclone was modified, then some important operating parameters such as cyclone inclination, inlet pressure, and solids concentration were optimized. Following the optimization procedure, it was found that clean coal of metallurgical quality with 11% or lower ash content can be produced using a modified water-only cyclone. 10.1080/19392699.2012.717564

Interaction of sodium ions with feldspar surfaces and its effect on the selective separation of Na- and K-feldspars

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Mineral Processing and Extractive Metallurgy Review, 2012, Vol. 33(4), pp. 233-245

K-feldspar and Na-feldspar exhibit similar mineralogical, chemical and surface properties. Froth flotation is known to be the only technique to enable their separation. Our earlier studies revealed a good selectivity in the presence of K+ and to a larger extent with Na+ ions. In this context, in order to further identify the role of Na+ ions in the selective separation of these minerals, ion selective electrodes were employed to determine the released Na and K ions released from albite and microcline into the solution and those adsorbed ions onto the mineral surfaces. Adsorption isotherms in feldspars/inorganic systems were constructed and the regions representing ion exchange and ion adsorption isotherms delineated. The mechanism of selective separation was elaborated on the basis of micro-flotation, solubility, adsorption and zeta potential measurements.
10.1080/08827508.2011.562952

Optimizing rougher flotation parameters of the esfordi phosphate ore

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The performance of rougher flotation of the Esfordi phosphate ore was studied by a series of batch flotation tests. A central composite experimental design was employed to evaluate the effects of six main parameters on the recovery of phosphate and iron into the concentrate. A response surface model was fitted to results for the recovery of P2O5, which showed that the linear effects of conditioning time and co-collector, and the quadratic effects of conditioning time and solid concentration, were statistically significant. The significant parameters for the recovery of iron were the linear effects of pH, solid concentration, collector and conditioning time, the interaction effect of solid concentration and depressant, and the quadratic effect of pH. Using Design Expert software, it was shown that within the range of parameters investigated, a P2O5 recovery of 90.4% with a Fe recovery of 6.6%, could be obtained. The optimized values of the parameters were verified on feed samples and compared with the actual regime in the process plant.
10.1080/08827508.2011.584092

Zinc recovery from lead-zinc-copper complex ores by using column flotation

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Pb-Zn-Cu complex ore from Balikesir-Ivrindi district have been concentrated by GESOM A. S, using a selective mechanical flotation technique. Ore feeds containing 3.23% Pb, 0.52% Cu, and 2.71% Zn were concentrated by six stages of cleaning and four stages of scavenging. The final zinc concentrate which contains 2.13% Pb, 1.14% Cu, and 52.77% Zn were produced with 61.38% Zn recovery. In this study, the effects of air rate, bubble diameter, gas holdup, and superficial air rate on the column flotation performance were investigated. In order to obtain best results, operation parameters were optimized. Besides, the number of cleaning and scavenging stages of zinc circuit was reduced by using column flotation instead of mechanical flotation. Hence, higher grade zinc concentrates with higher recovery were obtained. Using three stages of cleaning and three stages of scavenging, the zinc concentrate having 58.81% Zn was produced with a recovery of 74.21% indicating an improvement in final zinc concentrate. This achievement of column flotation method was recommended as an alternative method for the zinc circuit to the plant mentioned above, since it will reduce the operating costs.
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Present Situation on Beneficiation of Lead-Zinc Oxide Ore

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With the exhausting of lead zinc sulphide ores, the recovery of lead-zinc oxide ores becomes more and more significant. Extensive work has been carried out at home and abroad on the treatment of lead and zinc oxide ores in reagent scheme, flotation flowsheets, and joint process. Sliming is one of the main reasons why the lead-zinc oxides are difficult to recover. Eliminating the influence of slime and strengthening the study of joint process are the main development trends in future work.
10.4028/www.scientific.net/AMR.524-527.1017

Study on the Distribution Regularity of Accompanying Harmful Elements in the Scheelite in the Mineral Processing System

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The paper discusses the distribution regularity of the accompanying harmful elements in skarn-type scheelite and mineral processing system of The Jinping Mountain Mining Co., LTD. The first class pollutants accompanying in the crude ore of skarn-type scheelite are arsenic and lead. In the beneficiation process, there are about 0.049%, 0.016%, 0.030% and 3.27% of lead's quantity respectively distributed into tungsten concentrate, copper concentrate, molybdenum concentrate and sulfur concentrate. Meanwhile, there are respectively 0.09%, 2.11%, 0.68 % and 11.85% of arsenic's quantity distributed. The enrichment degree of harmful elements in sulfur concentrate is so noteworthy that it results in the contamination hidden troubles in subsequent processing. After beneficiation, the elements of arsenic, lead and zinc in crude ore are highly concentrated in the tailings. These harmful elements such as lead, arsenic and zinc and so on enriched in tailings could exist as undissolved state in the neutral aqueous solution. Therefore, we would regard such tailings as the first class of general industrial solid waste for the time being before making a sufficient study. 10.4028/www.scientific.net/AMR.524-527.910

The Development of Preconcentration Technology in Low-grade Magnetite's Beneficiation

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Exhaustion of high-grade magnetite resources and large demand for iron ore in the rapidly developing steel industry promotes the mining enterprises to exploit low-

grade magnetite. Low-grade magnetite with a low content of valuable minerals is hard to be separated with the conventional separation process flow because of its high beneficiation costs. By preconcentration technology, enriching valuable minerals and discarding large amounts of gangue as soon as possible before grinding, low beneficiation costs can be achieved in low-grade magnetite's beneficiation. After continuous researches and production practices and the development of relevant efficient crushing and separating equipments, preconcentration technology has made great progress: from crushing-dry magnetic separation technology to grinding-wet magnetic separation technology, then to ultrafine crushing-wet magnetic separation technology. Now preconcentration has become an indispensable stage in low-grade magnetite's beneficiation.
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Analysis of selected methods of beneficiating coal slurries deposited in impoundments

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The paper presents research results of the possibility to beneficiate coal slurries deposited in 21 impoundments located in the region of Silesia, Poland. Coal slurries of particle size diameter below 1 (0.5) mm were subjected to beneficiation tests with the use of the following methods: centrifugal separator, hydrocyclone, Reichert spiral separator and flotation. Applied methods showed significant differences in obtained results. The most effective method was flotation where yield was on average 64% with concentrate of high calorific value. In case of centrifugal separator and Reichert type spiral average yield was 22% and 25%, respectively. In case of hydrocyclone classifier-separator, a high yield of low quality concentrate was obtained. The study revealed that such impoundments have a high energetic potential which can be effectively used by applying a proper beneficiation technology. 10.5277/ppmp120221

Beneficiation of low-grade feldspar ore using cyclojet flotation cell, conventional cell and magnetic separator

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In order to increase the quality of feldspar ore and to obtain sellable feldspar concentrate, it is necessary to remove coloring impurities such as iron and titanium contained in it. For the removal of coloring minerals from feldspar ore the most widely used method is reverse flotation method. Reverse flotation process is generally carried out in conventional mechanical cells. In this study, it was aimed to enrich low-grade feldspar by using cyclojet flotation cell which was developed as an alternative to conventional cell. Then, experiments were performed by using

conventional cell and wet magnetic separator and the results were compared with the flotation results obtained by using cyclojet cell. In experimental studies, 200 micrometer grain sized feldspar (albite) ore obtained from Mugla province at the west side of Turkey was used. It was detected that the sample was containing 0.100% Fe2O3 and 0.360% TiO2 as coloring minerals. Cyclojet cell, conventional cell and magnetic separator reduced the Fe2O3 content down to 0.010%, but TiO2 content was different in the concentrates obtained by different devices. There was almost no reduction in TiO2 content by magnetic separation method. Cyclojet cell reduced TiO2 content down to 0.030% and mechanical cell reduced TiO2 content down to 0.020%. The weights of the concentrate were detected as the highest (92.70%) in magnetic separator and as the lowest (75.40%) in cyclojet cell. Therefore, it is possible to say that cyclojet cell can compete with mechanical cell and removal of TiO2 in cyclojet cell is much better than the removal of TiO2 in magnetic separator. Generally, in the flotation process performed by using a reagent of Aero801 and Acro825 mixture in natural pH medium, both Fe2O3 and TiO2 can be removed at a rate of up to 90%, but magnetic separator can only remove Fe2O3 mineral.
10.5277/ppmp120205

Effective processing of low-grade iron ore through gravity and magnetic separation techniques

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This study investigates the effectiveness of gravity and magnetic concentration techniques for the beneficiation of a Sudanese iron ore, the newly discovered Wadi Haifa iron ore deposit. It is a low-grade type of ore with high silica content, more than 45% SiO2, and an average iron content of about 35% Fe. Based on the fact that there are appreciable differences in specific gravity and magnetic susceptibility between the desired iron minerals and the gangue minerals, it was suggested that gravity separation and/or magnetic separation may be useful to concentrate this type of ore. These two techniques were adopted for the beneficiation of the Wadi Haifa low-grade iron ore. As a result of the fine dissemination of the iron minerals and the most abundant gangue mineral, quartz, the optimum degree of grinding is around 150 micrometers. The rougher tests of both the gravity separation and magnetic separation produced concentrates of about 44% Fe. Each of these two concentrates was cleaned in a second stage of processing using high intensity magnetic separator. Final iron concentrates, assaying about 64% Fe at a recovery of about 70%, were achieved. 10.5277/ppmp120220

Clean Chromite Production from Fine Chromite Tailings by Combination of Multi Gravity Separator and Hydrocyclone

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Chromite is an important mineral used in the metallurgy, chemistry, and refractory industries. For this reason, beneficiation of chromite tailings is very important. In this study, the possibility of beneficiation of chromite tailings in the Uckopru/Fethiye-Turkey region by Hydrocyclone and Multi Gravity Separator (MGS) combination was investigated. The two signification operational parameters of hydrocyclone, which were diameter of apex and diameter of vortex, and the three signification operational parameters of MGS, which were drum speed, tilt angle, and wash water, were varied and the results were evaluated with the Central Composite Rotatable Design. The results of beneficiation studies showed that commercial concentrate containing 48.18% Cr2O3 was obtainable with a 69.79% rate of recovery.
10.1080/01496395.2012.663445

Fluidization Characteristics of a Fine Magnetite Powder Fluidized Bed for Density-Based Dry Separation of Coal

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Gas-solid fluidized bed separation technique is very beneficial for saving water resources and for the clean utilization of coal resource. The hydrodynamics of 0.15-0.06 mm fine Geldart B magnetite powder were experimentally and numerically studied to decrease the lower size limit. The results show that the static bed height should be controlled near 300 mm (e. g., 300-350 mm). The bubble size, amount, and frequency of the fine particle bed are smaller than those of the bed containing 0.3-0.15 mm large Geldart B particles, thus leading to a higher bed activity. The pressure drop and density of the fine particle bed are uniform and stable, which indicates a good fluidization quality. Furthermore, simulated results are consistent with experimental data, which indicates the correctness and effectiveness of the simulations. The superficial gas velocity should be adjusted to not more than 1.8U(mf) for the fine particle bed. Additionally, wide size range magnetite powder, which contains 94.23 wt% < 0.3 mm particles with a 0.3-0.06 mm particles content of 91.38 wt%, was used in an industrial scale modularized demonstration system for 50-6 mm coal density separation. The ash content of feed coal was reduced from 55.35% to 14.67% with a probable error, E, value of 0.06 g/cm(3).
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SELECTIVE ABSTRACTS

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Dey, Shobhana (2012) *Enhancement in hydrophobicity of low rank coal by surfactants - A critical overview.* Fuel Processing Technology, 94 (1). pp. 151-158.

The flotation of fine (- 0.5 mm) low rank or oxidized coal is difficult to achieve with the common coal flotation collectors like kerosene, fuel oil or diesel oil (oily collector). The presence of small amounts of oxygen is enough to cause oxidation. The oxidation of coals starts with the physical adsorption of oxygen on the surface to form an oxycomplex followed by chemical adsorption of oxygen to form polar phenolic-OH, carbonyls, phenols and peroxide type oxygenated moieties by the rupture of cyclic rings. The addition of promoter, surfactant or oxygenated functional groups to the collector molecule markedly enhances the flotation of lower rank and oxidized coals due to the hydrogen bonding with the polar part of the coal surface and the reagent. The performance of these reagents is compared with that of oily collectors, namely kerosene, dodecane, nonylbenzene and polar part of the surfactant having an oxygen atom. The mode of addition of non-ionic surfactant with oily collector also has a major role in the flotation response. The addition of non-ionic surfactant after the oily collector has shown a positive effect on yield and grade.