

Physical Separation '11

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Thursday 23rd June

08.00 Registration desk opens

09.00 **Opening Remarks**

J. Wills (MEI, UK)

09.10 *Technical Session 1*

Chairmen: B.I. Pålsson (Luleå University of Technology, Sweden) and S.B. Kuang (University of New South Wales, Australia)

09.10 **Microwave separation of multiphase materials: application to concrete recycling**

N. Lippiatt and F. Bourgeois (University of Toulouse, France)

Microwave heating stands as a strong candidate for separating multiphase materials like mineral ores and concrete. In addition to being energy efficient, its modus operandi is selective in nature. Indeed, it takes advantage of the differences in thermal, dielectric and mechanical properties of each of the components to create stress gradients that can lead to damage (reduction in strength) and fracture.

This experimental work focuses on selective embrittlement of concrete by microwaves. Concrete particles 5 to 10 mm in diameter are treated using a single-cavity microwave (2.45 GHz, 1.2 kW) test apparatus, and the microwave-induced reduction in concrete strength is measured using a fast Hopkinson bar. A noticeable reduction in fracture energy is observed as a function of microwave input energy (exposure time), and initial analysis of fragments produced through Hopkinson bar tests reveals a degree of selective liberation.

09.30 **Investigation of effect of microwave energy on electrostatic separation of colemanite and ulexite**

M.F. Eskibalçı and S.G. Ozkan (Istanbul University, Turkey)

The colemanite and ulexite samples used in the experiments were supplied by the Eti Mines Inc.'s Bigadic Boron Mines. Firstly the mineral surfaces were washed by water for removal of clay minerals and dried. Then the minerals were crushed and classified according to particle size range of -1+0.5mm. Material characterization tests including complete chemical, mineralogical and moisture analyses were conducted to reveal the effects of microwave energy on mineral surfaces. A kitchen type microwave oven with 2450 MHz frequency was used for surface modifications before electrostatic separation. The samples were exposed to microwave energy of 360W for 30 minutes.

An electrostatic separator of max 22 kV electrostatic tension was used to determine to changes of electrostatic features of colemanite and ulexite minerals before and after exposure of microwave energy. Before microwave experiments, conductivity of the colemanite and ulexite minerals were investigated under room temperature (22°C) and under conventional heating at 65-70°C.

While colemanite has electrically insulating property under normal conditions, this property was not necessarily changed after heating. However, the clear differences between conventional and microwave heat applications were not determined. While ulexite conductive under normal conditions, this trend was changed because of heat application and increasing the electrostatic tension. Then ulexite gained insulation property.

09.50 **Damage of basalt induced by microwave irradiation**
P. Hartlieb, M. Leindl and F. Kuchar (University of Leoben, Austria)

In this work microwave irradiation on samples of basaltic rock is investigated by laboratory experiments and compared with results from numerical models. Due to the temperature gradient in the samples, induced by the microwave irradiation, a significant damage and further the formation of cracks occur. This effect depends strongly on the geometry of the sample as well as on the energy input of the microwave. It is shown how cracks develop within cylindrically shaped samples and how this process is influenced by their width to height ratio. The laboratory observations are supported by numerical simulations. A thermomechanical model is analysed by the finite element method. With the help of this numerical model an explanation of the occurring damage is given.

10.10 **Triboelectric separator for beneficiation of fine minerals**
J.D. Bittner and S.A. Gasiorowski (Separation Technologies, USA)

Separation Technologies, LLC (ST) has developed a dry processing system based on triboelectric charging and electrostatic separation for mineral processing. Since 1995, ST has utilized this technology to produce over 8 million tons of low carbon content coal fly ash for use as a cement substitute in the production of concrete. Fly ash with carbon levels up to 30% have been used to produce a concrete grade ash with a controlled carbon level of $2 \pm 0.5\%$, a high value material for the construction industry. Eighteen ST carbon separators are in place with over 100 machine-years of operation at locations in the US and Europe. ST's success in the fly ash industry has enabled further development of the technology, including improvements in operation, maintenance and production rates. The technology has been successfully applied to the beneficiation of a variety of minerals including calcium carbonates, talc, and potash.

10.30 Coffee

11.10 **Preconcentration applied to a low grade iron ore deposit**
S.A.A. França et al (Ferrous, Brazil)

Ferrous is a young iron ore company, formed in 2007, with several low grade projects. Its business is to create value after low grade iron ore resources, by certifying resources, developing viable process / engineering and demonstrating economic viability. Ferrous wants to make ore out of what is waste to other companies. This is an environment friendly trend, demanding a higher degree of technology than current status. Ferrous first operation (Viga) is to start due mid 2014. Among other projects, one contains an unusual characteristic: strong presence of amphiboles and very low grade (below 20%). It was a major challenge to develop a process that could provide competitive operation cost and investment. After the conclusion that direct routes would not be economical, preconcentration tests proved that this is the most probable way to make viable this project. The paper will present preconcentration test results and its impact on project economics.

11.30 **Sensor-based sorting - experience and opportunities at CommodasUltrasort**
J.-M. Bergmann (CommodasUltrasort GmbH, Germany)

The paper will cover different aspects of sensor based sorting of minerals and ores by optical inspection and other, more sophisticated inspection technologies, such as X-Ray transmission (XRT), Near Infrared (NIR), Electromagnetic (EM) or Radiometric (RM).

Starting with the fundamentals of each technology it will highlight the latest developments, continuing with a detailed look on selected applications including examples of existing plants and the achieved qualities. Materials covered will be Calcium Carbonates (optical), Talc (NIR), Nickel-ore (EM) and Coal (XRT).

Finally the paper will give a short view on the economic side of these technologies to provide a global idea of the operation expenditures per ton.

11.50 **Theory and operational experience of X-Ray-Transmission sorting in the minerals industry**

C. Kleine, M. Robben and H. Wotruba (RWTH Aachen University, Germany)

The challenge at present and in the future is the economization of the most important resources energy and water. This is applied particularly in fields of mineral processing and it shows the potential and motivation for the use of an efficient dry separation device which is suitable for both waste dump retreatment as well as run-of-mine ore sorting. XRT sorting is a dry separation process with little infrastructure requirements and relatively low operating costs.

Compared DMS to XRT-sorting, DMS discriminates between the average specific densities of the whole particle, while XRT-sorting sees a planar projection of the particle's atomic density (depending on their mass attenuation coefficient).

This report summarizes the results obtained on full production scale pilot plants for destoning of run-of-mine coal and for pre-concentrating a narrow-vein sulphide type gold ore. Last but not least lab scale results of sorting flint out of limestone are given.

12.10 **Rethinking electro-magnets for separation technologies: a materials, manufacturing and financial study**

T. Greyvenstein (Magnetech, South Africa)

Magnetic separators are used widely in the mining industry. With the increase in environmental awareness and the need to cut costs in a post-recession world, manufacturers of electromagnetic separators have started to move away from copper as a winding material. Aluminium has been increasingly used in place of copper in many areas, as it is about one third of the price. (*Aluminium \$2633/ton versus Copper \$9165/ton*)

This study comprises two materials in terms of their physical properties, manufacturing methods, environmental considerations, financial implications and coil suitability for a number of mining applications, in an attempt to identify the better suited coil material and manufacturing method for a variety of standard industry separator applications.

This study will enable the reader to comprehensively understand the advantages and disadvantages of the various materials and manufacturing processes for practical use. In understanding which coil suits which application, the reader can safeguard against potential pitfalls that could otherwise be avoided.

12.30 **Feasibility study on physical beneficiation of low-grade PGM flotation tailings by mechanical spirals and enhanced gravity separation**

H. Kasaini and J. Siame (Tshwane University, South Africa)

A study to recover and upgrade platinum group metals (PGMs) from low grade UG2 flotation tailings was performed by using a combination of mechanical spirals and a pilot-scale continuous Knelson Concentrator (KC-CVD) unit. The major deposits for PGM minerals in South Africa have been well described in literature as UG2 and Melensky reefs.

UG2 flotation tailings have a high content of chromium ($\text{Cr}_2\text{O}_3/\text{CrO}$) and pentlandite ($(\text{Ni}, \text{Fe})_9\text{S}_8$) which are hosted within the matrix of aluminium silicate and quartz minerals. Owing to the large differences in specific gravities between the host minerals and PGM sulphides, gravity separation was selected for the pilot-scale studies. Firstly, the UG2 solids were subjected to mechanical spiral separation and then the tailings arising from the spiral were reprocessed by a continuous KC-CVD unit ($1.69 \text{ m}^3/\text{hr}$).

In this study, the UG2 flotation tailings were reclaimed from the waste pond at Northam Platinum Ltd. in South Africa. The particle size distribution for 65% of total solids varied between - 45 μm and 106 μm . Nevertheless, 30 % of total solids were very fine (< 45 μm). In terms of metal distribution, 43 % of total PGMs in the feed solids reported to the fine fraction. The head grade of total PGMs was about 0.75 ppm while chromium and iron oxide minerals were relatively higher at 30% and 12%, respectively.

Pilot-scale test results showed that a combination of mechanical spirals and knelson concentrator unit could be used successfully to recover and upgrade PGM flotation tailings as described in this paper. A patent (pct) providing comprehensive optimum conditions for reprocessing low grade PGM tailings by combining physical beneficiation and high pressure acid leaching was filed.

12.50 Lunch

14.00 *Technical Session 2*

Chairman: S.G. Ozkan (Istanbul University, Turkey)

14.00 **Gravity separation of a UG-2 ore secondary sample for the reduction of chromite minerals**

L. Maharaj, B.K. Loveday and J. Pocock (University of KwaZulu-Natal, South Africa)

The PGE reserves in South Africa are located in the UG-2 chromitite layer of the Bushveld Igneous Complex. The chromium oxide (Cr_2O_3) content in UG-2 concentrates is typically 3%, which results in severe operational problems in the downstream smelting process. Gravity separation of the chromite and silicate particles prior to secondary grinding was investigated in various forms with a spiral concentrator. Laboratory cleaner spiral tests were conducted on a secondary mill feed sample to determine whether a chromite-rich stream could be removed and discarded from the process prior to secondary milling. Analysis of the chromite-rich stream showed that it could not be discarded, as a large proportion of the PGE minerals in the feed to secondary milling (~16%) would be discarded with about 55% of the chromite minerals. Pilot plant cleaner spiral test work confirmed the trends observed in the initial laboratory spiral tests.

The incorporation of gravity separation in the circuit made it possible to optimise separate grinding of the heavy and light fractions, to reduce the amount of fine chromite entrained in rougher flotation of platinum minerals. The ground fractions were re-combined and laboratory batch flotation tests were used to assess the effects of separate grinding. The optimum result was a reduction in the Cr_2O_3 content of the flotation concentrate of about 30 per cent and a marginal increase in platinum recovery, (using the same overall grinding energy).

14.20 **Experimental study on the influence of critical process variables on the performance of a pilot scale decanter centrifuge**

T. Kinnarinen, M.Louhi-Kultanen, A. Häkkinen (Lappeenranta University of Technology, Finland) and E. Meshcheryakov (Saint Petersburg State Technological University, Russia)

Decanter centrifuges are used widely in the chemical and process industries for dewatering of solid-liquid suspensions. The most important applications of these kinds of centrifuges are found in wastewater sludge treatment and in pigment production. Primary separation mechanism in decanter centrifuges is similar to that in simple settling tanks but the main difference is that the application of high centrifugal forces in centrifuges increases the settling velocity of the solids and compacts the solid bed formed on the walls of the centrifuge bowl.

In this study, the influence of some critical process parameters on the operation of a pilot-scale decanter centrifuge was investigated. The suspension used in the experiments was prepared by adding a mixture of kaolin clay and titanium dioxide to water at various solid concentrations. In addition to the solid concentration of the feed, also the feed rate of the suspension and the speed difference between the bowl and the conveyer screw were chosen as variables. Experiments were carried out according to a factorial test design and the responses that were monitored were the production capacity of the decanter, the solid contents of the concentrated and the diluted fractions as well as the time that was required for stabilization of the test unit. The results obtained clearly showed that the studied variables have a significant influence on the performance of the dewatering process. It also became obvious that random variations in the feed conditions may cause remarkable and long-lasting impacts on the operation of the centrifuge.

14.40 **Numerical study of gas-liquid-solid flow in classifying cyclones**

S.B. Kuang, K.W. Chu, A.B. Yu (University of New South Wales, Australia) and A. Vince (Elsa Consulting Group Pty Ltd, Australia)

This paper presents a numerical study of gas-liquid-solid flow in classifying cyclones (CC) with different overflow outlet configurations. In the numerical model, the turbulent flow of gas and liquid is modelled using the Reynolds stress model, the interface between the liquid and air core and the particle flow are both modelled using the mixture multiphase model. The flow features are examined in terms of flow field, pressure drop, split ratio reported to the underflow, solid volume fraction, and separation efficiency. The proposed model is first validated by the good agreement between the measured and predicted results, and then used to study the effects of overflow outlet configurations (e.g. bend and straight open outlets, and cap outlet). The results show that the performances of the CC units with straight and bend open outlets for classifying different sized particles are similar, and are better than that of the CC unit with cap outlet. Then, the effect of solid feed concentration in the CC unit with straight outlet is studied. It is shown that an increase in the solid concentration in the feed leads to an increase in the separation size.

15.00 **Hydrocyclone classification in the μm -range**

E. Endres, J. Dueck and Th. Neesse (German Friedrich-Alexander-Universität Erlangen-Nuremberg, Germany)

For products of nanotechnology classification in the micron- and submicron range are of growing interest. Usually hydrocyclones don't reach these low cut sizes. The paper presents a special batch classification with a 20 mm hydrocyclone for classification in the μm - range. The hydrocyclone is equipped with a special underflow box which stores the coarse particles. The overflow is recirculated to the feed box. A set of experiments was done using this batch hydrocyclone technology. Quartz $< 10\mu\text{m}$ was used as a feed for the hydrocyclone, which operated in closed circuit for 120 min. The results show that the separation in the first 60 minutes preferably concentrates on the size range of $>1\ \mu\text{m}$, and later the particles in the submicron range are increasingly discharged in the underflow.

A model for the classification in a batch hydrocyclone with closed circuit and underflow box has been developed.

15.20 **Understanding the effect of solids concentration on hydrocyclone performance**

A. Davailles, E. Climent and F. Bourgeois (Université de Toulouse, France)

Operating at high solids concentration is an important route for intensification of mineral processing operations. Intensifying proven unit operations requires an understanding of their physical workings and limitations that extends beyond the massive body of empirical knowledge established over many decades. With solid-liquid separators like the hydrocyclone, computational fluid mechanics has long been recognised as the key to process intensification. The present paper is concerned with understanding and improving operation of hydrocyclones at high solids concentrations, which ranks high amongst pressing issues with industrial plants.

A local CFD model, whose physics has been validated elsewhere against dilute conditions data, is herewith applied to analysis of high solids concentration experimental results obtained with a 100-mm diameter hydrocyclone. Analysis of model predictions gives new insights into how particle separation inside a hydrocyclone is modified at high feed solids concentration.

15.40 **Dynamic features of hydrocyclone flow of relevance to separation**

R. Wakelin (Northern Research Institute Narvik, Norway)

Hydrocyclones are widely used in mineral processing, but their simple construction and operation belies a complex fluid flow dynamic. Design procedures have been developed empirically, with respect to the geometry, flow range and solids loading. Performance deviations are observed, but not completely described by existing theory. It is considered to be related to the phenomenon of the natural length of the vortex, beyond which the vortex undergoes various forms of 'vortex breakdown'.

The ability of computational fluid dynamics to describe the complex turbulent motion in the hydrocyclone has increased in recent years, to the extent that the occurrence of the vortex breakdown

can be demonstrated. This introduces the possibility for more advanced optimisation of the hydrocyclone design and operation. In addition additional insights into the nature of the phenomenon have been provided by particle tracking velocity measurements, wall pressure measurements and flow visualisation.

This article aims to highlight the relevance of the vortex breakdown phenomenon to hydrocyclone separation efficiency, in order to motivate greater attention to the feature in modelling, design and operational studies. It appears that greater attention to vortex breakdown has been paid in the case of gas cyclones than with hydrocyclones and the general applicability will be examined. Results will be presented from previously unpublished work.

16.00 Coffee

17.00 Optional Guided Coast Path Walk, ending with a beer at the Chain Locker Pub, Old Falmouth

Friday 24th June

09.00 **Cornwall the birthplace of modern mining- introduction to the Camborne-Redruth tour**
B.A. Wills (MEI, UK)
(Accompanying partners welcome)

09.40 *Technical Session 3*
Chairmen: F. Bourgeois (University of Toulouse, France) and C. Bazin (Laval University, Canada)

09.40 **Investigation of washing process for bauxite beneficiation**
I. Ahmad, E.-U. Hartge, J. Werther, S. Heinrich (Hamburg University of Technology, Germany) and R. Wischniewski (Hydro Aluminium AS, Norway)

The clay impurity associated with the bauxite ore causes problems in the Bayer process which produces aluminum hydroxide. Therefore clay should be removed as far as possible by a beneficiation process before sending the ore to the Bayer process. In the current investigation washing as one step of beneficiation has been studied in the laboratory. The washing process is a physical process which causes deagglomeration of the bauxite and removes the clay from its surface. Three techniques were used i.e. ultrasonic washing, drum washing and water jet washing. Various operating parameters were investigated. It is concluded on the basis of experimental results that the retention time of bauxite inside the water with slight movement of the pulp is the major source of clay removal from the bauxite surfaces. The other operating parameters for example water jet pressure, water jet spray height and rotation speed of the drum do not play a significant role for the bauxite washing.

10.00 **Empirical study of a gravitational air classifier**
R. Johansson and M. Evertsson (Chalmers University of Technology, Sweden)

An empirical study of a gravitational air classifier used in a Swedish quarry has been performed. The classifier is working in two steps and is used to classify a VSI-crushed 0-2 mm fraction into three different products for use in the concrete and asphalt industry. The study has been performed using Design of Experiments (DOE) and the influences of three different variable control parameters have been investigated. The influence of the parameters on cut size, mass flow of the different products and air flow into the machine has been obtained. The results show that different parameters and control strategies shall be applied depending on the quality requirements and capacity needs set on the final products.

10.20 **Fine screening with electrically heated screen decks**
B.I. Pålsson (Luleå University of Technology, Sweden) and J. Bucht (LKAB, Sweden)

The purpose was to test some specific applications with electrically heated screen decks, and to prepare a standard test procedure for evaluating probabilistic screens. One application was the production of magnetite -1 mm from sinter fines, where very strong consolidation effects were discovered and had to

be taken into consideration. Specifically, consolidated sinter fines with moisture content more than 1 % gave high losses.

The best way to evaluate the screening results is to plot the proportion of finished product, and the loss of the correct fraction as a function of feed rate and moisture content. These being quantity results, they need to be supplemented with quality parameters, and the best seem to be the weight percentage of too coarse and too fine particles in the finished product. There appears to be some threshold level for the heating effect, but to what extent this is related to the screen deck type, the heat capacity and density of the material, or the particle size, is still unclear.

10.40 Coffee

11.20 **PC-based mathematical model for understanding and control of dense medium cyclones**

J. Chen, K.W. Chu, R. Zou, A.B. Yu (University of New South Wales, Australia) and A. Vince (Elsa Consulting Group Pty Ltd, Australia)

Dense medium cyclone (DMC) is a high-tonnage device that is widely used to upgrade run-of-mine coal in coal industry. Its complicated multiphase flow structure is difficult to investigate experimentally. In recent years, Computational Fluid Dynamics (CFD) and in particular, its combination with Discrete Element Method (DEM) have been shown to be effective to overcome this difficulty. However, such a mathematical model, particularly the CFD-DEM one, is very time-consuming and not suitable for engineering application. In this paper, a PC-based mathematical model is formulated to predict the performance of DMCs under various conditions, based on the CFD and CFD-DEM simulated data. It will first discuss how such a model can be developed, with its validity examined against the collected plant data. Then, the effects of some key variables related to materials properties, DMC geometry and operational conditions are examined. It is shown that the proposed model can indeed offer a convenient way to quantify the effects of different variables and help the optimum design and control of DMC under different conditions.

11.40 **CFD-DEM study of the multiphase flow in a dense medium cyclone: the effect of vortex finder pressure**

K.W. Chu, B. Wang, A.B. Yu (University of New South Wales, Australia) and A. Vince (Elsa Consulting Group Pty Ltd, Australia)

Dense medium cyclone (DMC) is widely used to upgrade run-of-mine coal in the coal industry. In practice, different designs of the outlet geometry of the vortex finder have been used to achieve different purposes. In this work, the underlying mechanism is investigated by numerically studying the effect of the vortex finder pressure boundary condition using a combined approach of Computational Fluid Dynamics (CFD) and Discrete Element Method (DEM). It is shown that a small change of the vortex finder pressure can cause significant variations of both the medium and particle flows. An important finding is that the upward flow velocity of the air phase in the air-core decreases significantly with the increase of the vortex finder pressure, which causes many low density coal product misplaced to reject. This work suggests that the pressure at the outlet of the vortex finder is an important factor for DMC performance.

12.00 **Analysis and modelling of the operation of a hydraulic classifier for iron ore concentrate**

C. Bazin (Laval University, Canada) and G.M. Payenzo (Arcelor Mittal Mines, Canada)

Arcelor Mittal Mines Canada operates hydraulic classifiers to remove silica from an iron oxide concentrate produced by spiral concentrators at its mine site in Northern Quebec Canada. The hydraulic classifiers are operated to reduce the silica content of the spiral concentrate from 4.5% to less than 1.2% SiO₂. Several sampling campaigns were conducted during the normal operation of the classifier to produce data for the analysis and initial development of a model for the hydraulic classifier. Results show that iron oxide minerals are concentrated in the +0.2 mm size fraction, while silica is mainly concentrated in the -0.2 mm size fraction. This distribution is favourable to the removal of silica by the hydraulic classifier and its knowledge is strategic for modelling of the process. The data from the sampling campaigns was also used to estimate the partition curves of the minerals in the hydraulic classifier. The partition curve shows that the selectivity of the hydraulic classifier for the separation of silica and iron oxide minerals is maximal for particle sizes below 0.1 mm. The information concerning the partition curve of the minerals in the classifier and the size

distribution of the minerals in the feed to the classifier is used to build a preliminary simulator of the equipment. The simulator can be used for the diagnosis of inadequate classifier operation and as a basis for the development of a phenomenological model of the unit.

12.20 Particle dynamics and stability study in air dense medium fluidized bed separator

A.K. Sahu, A. Tripathy and S.K. Biswal (Institute of Minerals and Materials Technology, India)

Air dense medium fluidized bed separation (ADMFBS) is one of the dry beneficiation techniques which is used for beneficiation of coal. Fine magnetite particles are used as medium to make pseudo-fluid by fluidization method. The effectiveness of ADMFBS depends on stability of the particulate fluidized bed. In the present work, an attempt has been made to study the stability characteristics of different cross-sectional shapes i.e. circular, square and rectangular of fluidized bed having same cross-sectional area. Different indicators like fluidization index, particulate expansion function, pressure drop of bed and distributor minimum fluidization and bubbling velocities were used to characterize the stability of fluidized bed. The effect of different operating and design parameters on the homogeneity and stability of the fluidized bed was studied. It was observed that cross sectional shape of the fluidized bed column has a significant effect on the stability of the bed. It was found that rectangular cross-sectional shape provides better stability properties compared to square or circular shape.

12.40 Closing Remarks

A.J. Wills (MEI, UK)

12.50 Lunch

14.10 Visit to the historical Camborne-Redruth tin and copper mining district

POSTERS

Consideration on purification of bentonite and loading citric acid for mango preservation

Liu Kun, Li Xiang-wei, Wang Xue-ling and Xiang Shan-ping (Guangxi University, China)

Raw calcium bentonite coming from Ningming in Guangxi province of China was treated by hydraulic settling. The bentonite content was increased from 60.5% to 96.6% (wt %) in purified material when slurry density to be 5%. The purified bentonite as a basic fresh material, citric acid was loaded into it. Using the material was mixed by water to be a suspending matter, then coating on mango's face. The mango was covered by a membrane. The mango preservation was investigated at room temperature. Weight loss rate, decay index, respiration rate, total acid content, total sugar content was measured, respectively. The experimental results show whether purified bentonite or bentonite loading citric acid all have fresh-keeping function. Furthermore there was no obvious respiration peak during preservation. In addition, there were better results including weight loss and decay index of mango, and higher total sugar and total acid after using bentonite loading citric acid.

Viga iron ore project filtration technology selection

R.S. Behring et al (Ferrous, Brazil)

Ferrous will produce 25 MTPY iron ore concentrate at Viga mine, at Congonhas, Minas Gerais, Brazil, in the Iron Quadrangle. The concentrate will be pumped through a 400 km pipeling to Ferrous` private port at Presidente Kennedy, Espirito Santo, Brazil. Audited mine resources are approximately 1.5 billion metric tons, at 36% Fe average grade. The ore contains a high level of goethite (iron hydroxide), around 28% among iron ore minerals. Due to pipeline pumping reology, product shall be finer than 70% < 325# and pH adjusted to 11.2 with slacked lime. Due to peculiar mineralogy and reology, bench and pilot tests were performed in order to determine suitable filtration technology to be used at port site. In this paper, we present lab and pilot test results and the final selection, which is innovative when compared to standard Brazilian iron ore filtration installations.

Numerical simulation of the particle flow and sieving behaviour on the sieve bend/low head screen combination

K.J. Dong and A.B. Yu (University of New South Wales, Australia)

This paper presents a numerical study of the particle flow and sieving behaviour on the sieve bend/low head screen combination used in coal preparations. The particle flow is simulated by discrete element method (DEM) while the water flow on the sieve bend is modelled by computational fluid dynamics (CFD). The effects of operational conditions are investigated by a series of controlled numerical experiments. The particle flow on the screen is analysed by velocity field, particle-wall interactions and residence time, while the sieving behaviour is analysed by partition curve and percentage passing distribution along the screen. For sieve bend, large amount of water with slow velocity is preferable to break cohesion between particles and control particle velocities, which improves the percentage passing and decreases screen wearing. For low head screen, increasing incline angle and the amplitude along the horizontal direction can increase the productivity while maintaining the percentage passing.