Magnetic Separation News, 1984, Vol. 1, pp. 141–142
0731-3632/84/0103-0141 $25.00/0

conference reports

MINTEK 50 - INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN MINERAL SCIENCE AND TECHNOLOGY, JOHANNESBURG, 26th to 30th MARCH, 1984

by

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MINTEK 50, which formed part of the celebrations of the fiftieth anniversary of the Council for Mineral Technology (Mintek), brought together a large number of scientists and engineers from over 20 countries. The excellent organization and the high standard of the presented papers contributed to the success of the Conference.

Four papers on magnetic separation were presented.

E.H. Roux and his co-workers of Foskor (Phalaborwa, South Africa) discussed the application of dry magnetic separation to a phosphate-bearing pyroxenite ore. They had tested various separators (induced-roll, perm-roll, SALA HGMS, and super-conducting open-gradient). They compared the performances of these machines both from the metallurgical and the technical point of view, and reviewed the economics of the process with respect to these separators.

J.A. Good of Cryogenic Consultants Ltd (U.K.) presented a paper describing the design and construction of a large-scale super-conducting open-gradient magnetic separator to be applied to the dry beneficiation of phosphates. This dipole magnet is 3,5m long, 450 mm high, and 85 mm wide. Separation takes place on both sides, each of which has a magnetic zone 3m long by 150 mm high. The capacity of the unit is 60 tons per hour.

J.H.P. Watson of the University of Southampton (U.K.) reported on a novel optical system that is used to evaluate the suitability and profitability of magnetic separation for a given mineral. The technique involves the capture of the particles under study onto a ferromagnetic wire in an external magnetic field. The process is monitored by a video system, and the captured material is then analysed. The efficiency of the process can thus be evaluated easily and quickly.

J. Svoboda of Mintek (South Africa) discussed the use of a magnetic field to induce an agglomeration of fine, feebly magnetic minerals, showing that such particles can be flocculated into the secondary minimum of the interaction energy curve. He compared the process with flocculation into the primary minimum and with chemical flocculation, and outlined the potential of this technique for the magnetic flocculation of industrial minerals.

Digests of these papers and of other papers presented at the Conference are given in the volume of abstracts prepared for MINTEK 50, and the full papers will appear in the Proceedings, which will be published in due course.

Magnetic Separation News, 1984, Vol. 1, pp. 143–147
0731-3632/84/0103-0143 $25.00/0

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International Magnetics Conference, Hamburg, F.R.G., April 10-13 1984

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The 1984 Intermag Conference brought together approximately 30 scientists to the morning and afternoon Magnetic Separation sessions. In all 22 papers were presented and the high quality and wide range of the subject matter contributed to the success of the conference. Eleven papers were presented in the afternoon Magnetic Separation session which is now reported in some detail.

D.R. Kelland of the Francis Bitter National Magnet Laboratory (USA) reported on the selective separation of particles according to their volume, magnetic susceptibility (only) by means of a fluid magnetic susceptibility gradient. The magnetic susceptibility gradient was established in a cell with six inlets and outlets by feeding colloidal dispersions of paramagnetic particles with different volume concentrations. An alternative method was to use the paramagnetic salt $MnCl_2$ in different volume concentrations. A nickel wire mounted on the side of the cell produced a field gradient when a magnetic field was applied perpendicular to its axis. Using this technique, preparations were achieved of micron-sized particles of differing magnetic susceptibility.

D.R. Kelland then presented a second paper; on continuous selective H.G.M.S. A ferromagnetic fibre was mounted on the edge of a cell with three outlets. A field was applied perpendicular to the fibre axis such that paramagnetic particles experienced a repulsive force. A submicron colloid of Fe_3O_4 particles was fed into the cell and the relative concentration of particles was measured at each outlet. The separation process was numerically modelled by the computation of particle trajectories. Consideration was given to the separation of both paramagnetic and diamagnetic particles.

F. Soda of the Hitachi plant Engineering and Construction Co, Ltd., reported on the development of a diffusion-bonded matrix (D.B.M.) The project was initiated in response to the need for a reliable matrix in the filtration of crud from B.W.R. condensate water. It was found that heat treatment of the matrix in vacuo improved the magnetic permeability and saturation magnetization of the D.B.M. as well as providing a rigid and steady matrix which retained its volume elasticity to a greater degree than a standard wool matric. The D.B.M. is now commercially available.

G. Rupp of the Siemens A.G., Research Laboratories F.R.G., discussed the removal of crud from the secondary loop of a P.W.R. Three different H.G.M.S. filters were tested, all of which gave removal efficiencies of greater than 95%. In this application, the pressure drop across the filter with filter loading is a crucial parameter. It was found that an extended filter bound by a low then high field solenoid produced the best results and had advantages over a mechanical filter of equivalent size.

M.R. Parker of the University of Salford (U.K.) presented a paper by S.S. Liberman (Commision Nacional de Energia Atomica, Argentina) and D.R. Kelland on the H.G.M.S. of submicron magnetite and hematite particles. The test colloids were characterised by a narrow well-defined size range and were monodisperse. The recovery was found to be proportional to the ratio of the magnetic-to-fluid velocities V_m/V_o as predicted by a theoretical model of Watson despite the experimental value of the ratio of V_m/V_o being lower than the minimum allowed value of the Watson model.

Y. Kenmoku of the N.E.C. Corporation (Japan) reported on the development and installation of a commercial H.G.M.S. system used for the recovery of and recycling of glass grinding sludge. The sludge contained glass powder, abrasives and iron wear particles. A reduction of 85% in the total iron content of the sludge allowed the sludge to be recycled. The commercial system has a maximum throughput of 500 t h^{-1} of C.R.T. grinding slurry. Removals of 88% of the iron content in the resulting solids with a throughput of 10 cms^{-1} in a 0.25 T field are achieved. This allows 8 to 15 tons of sludge per day to be recycled as raw material for glass production.

D. Rassi of the University of Southampton (U.K.) presented a paper on the concentration of uranium ores by H.G.M.S. In what was a preliminary study, the authors set themselves the task of doubling the concentration of uranium and associated elements while retaining 80% of elements. A superconducting system capable of producing fields of up to 8 T was used. Both dry and wet tests were undertaken

and targets set by the authors were achieved using wet H.G.M.S. Encouraging results were also obtained for dry separation for relatively large particle sizes.

J. Kopp, University of the Witswatersrand, reported on the development of a permanent magnetic disk separator. Simple theory showed that the separation angle is a function of magnetic, centrifugal and gravitational accelerations. The drum separator developed was used for the magnetic separation of kimberlite at a fixed rate of 2 t h^{-1}. Dr Kopp indicated that size classification of the kimberlite was very important for the successful operation of the machine.

G. Stange of the Fachhochschule Kiel (F.R.G.) presented a theoretical paper on the numerical optimization of an extraction permanent magnet in the form of a flat table. The magnet takes the form of a comb-like periodical magnetic structure with parallel straight poles of alternating polarity. Ideally, such a system requires a homogenous force distribution over one period. A computer program was developed which allowed the field to be calculated at all points outside the magnet and the optimization of the magnet with respect to minimum excitation for maximum force and to optimum geometry for homogenous force distribution. During questions from the floor Dr Strange discussed an application of the flat table magnet in the recovery of polutant oil from water surfaces. Here, 0.5 mm iron ball-bearings are sprayed in front of a ship and a table magnet lowered to just below the water surface. Ball-bearings and oil are retained on the magnet surface.

M. Adbelsalam (Applied Superconducting Center, University of Wisconsin) reported on a helical flow magnetic ore separator. Slurry flows helically in a cylindrical annulus around a current-carrying conductor which takes the form of a ring of approximately 70 cm diameter. The conductor provides a centripetal force to deflect particles inwards towards the conductor, non-magnetic particles are deflected outwards by the rotational centrifugal force. Separation occurs at the end of the channel by means of a divider. The separator was tested using a homogenous mix of magnetite and epoxy ground to size. Experimental values of recovery and grade were shown to agree well with a theoretical analytical description of deflection in turbulent fluids.

The final paper of the afternoon session was presented by G. Gillet Institute National Polytechnique de Nancy, France. He discussed the design and use of a superconducting solenoid-type magnetic separator. The system developed was extensively automated, had an integrated liquefaction unit, entirely closed helium circuit, was self contained for 400 h and produced a field of 7 T. The system was tested for the concentration of different raw materials and proved more efficient than conventional devices in the concentration or iron ore and in the purification of sand for glass manufacture.