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The treatment of ultrafine coal, especially by froth flotation*

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SYNOPSIS

This paper summarizes work carried out on the treatment of fine coal, nominally classified as minus 0,5 mm (wedge-wire screen), which is removed from the raw coal prior to the treatment of the plus 0,5 mm sizes. The minus 0,5 mm coal divides, for treatment purposes, into fines, nominally between 500 and 150 μm, and ultrafines, nominally minus 150 μm.

Studies on processes for the treatment of minus 0,5 mm coal are discussed, and the lower size limit beneficiated is indicated for each process. The installation and operational results from a pilot froth-flotation plant treating minus 150 μm coal are described.

SAMEVATTING

Hierdie referaat gee 'n opsomming van werk wat gedoen is in verband met die behandeling van fynsteenkool, nominaal geklassifiseer as minus 0,5 mm (wigdraadsif) wat voor die behandeling van die plus 0,5 mm-groottes uit die ru-steenkool verwyder is. Die steenkool van minus 0,5 mm word vir behandelingsdoeleindes verdeel in fynsteenkool, nominaal tussen 500 en 150 μm, en ultrafynsteenkool, nominaal minus 150 μm.

Studies van prosesse vir die behandeling van minus 0,5 mm-steenkool word bespreek en die onderste perk van die grootte wat veredel is, word vir elke proses aangedui. Die installasie van 'n proefskuimflottasieaanleg wat minus 150 μm-steenkool behandel, en die bedryfsresultate van die aanleg word beskryf.

Introduction

Run-of-mine coal contains varying amounts of fine coal. Where dense-medium processes are employed (which is almost invariably the case in South Africa), fines are wet-screened out of the raw coal ahead of those processes. The size usually selected is passing 0,5 mm on a wedge-wire screen. Thereafter, the minus 0,5 mm coal is classified approximately into plus and minus 150 μm fractions. The minus 150 μm coal is referred to as ultrafines. On the average, about 10 to 12 per cent of the run-of-mine coal is smaller than 0,5 mm (wedge-wire screen), and about 2 to 4 per cent smaller than 150 μm.

The fraction larger than 150 μm is being beneficiated to an increasing extent; the ultrafines are usually discarded to the dump as filter cake, to surface slurry ponds, or to disused workings underground. The work described in this paper shows that at least two-thirds of the discarded ultrafines consist of high-quality exportable coal. Its recovery not only would increase the overall yield, and hence the mine revenue, but would also diminish the environmental impact of mining operations. Moreover, such treatment would lead to better utilization of the country's coal resources.

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Production of Ultrafine Coal

After being removed from the raw coal by wet-screening, the minus 0,5 mm coal is classified in cyclones. The approximate cut-point of the cyclone is generally in the range 100 to 250 μm and, for the work described in this paper, 150 μm was selected as the cut-point.

After classification, the plus 150 μm fraction is discarded, added unwashed to the colliery products, or beneficiated by dense-medium cyclones, spirals, or froth flotation. The ultrafines, together with the bulk of the water, containing about 5 per cent solids by mass in the form of ultrafines, is sent to thickeners. The thickener underflow, at about 35 per cent solids by mass, is sent to slimes ponds or is used as minefill.

In general, the smaller the particles of coal, the more difficult or more expensive it is to separate them from non-coal or stone particles. On the other hand, the smaller the particles, the more liberated is the coal from the stone. This has the effect of both increasing the yield of saleable material, and diminishing the selectivity needed in the separation. The liberation effect has been demonstrated empirically by Horsfall[1,2] (Fig. 1), and has been confirmed by Falcon[3] using mineralogical examination. Franzidis *et al.*[4] and Panopoulos *et al.*[5] have confirmed that, at ultrafine sizes, the liberation may be sufficient for a fairly non-selective process to be effective.

Attempts to exploit this phenomenon within Anglo American Corporation were made in 1977, when samples of the minus 150 μm fraction and the fraction between 175 and 150 μm were tested on the newly developed Leeds cell. The results showed clearly that lower volumes of ash, for equivalent yields, were obtained from the ultrafine coal than from the fine coal; but neither quality was sufficient to justify implementation of the procedure. Despite the current success of the pilot flotation plant at

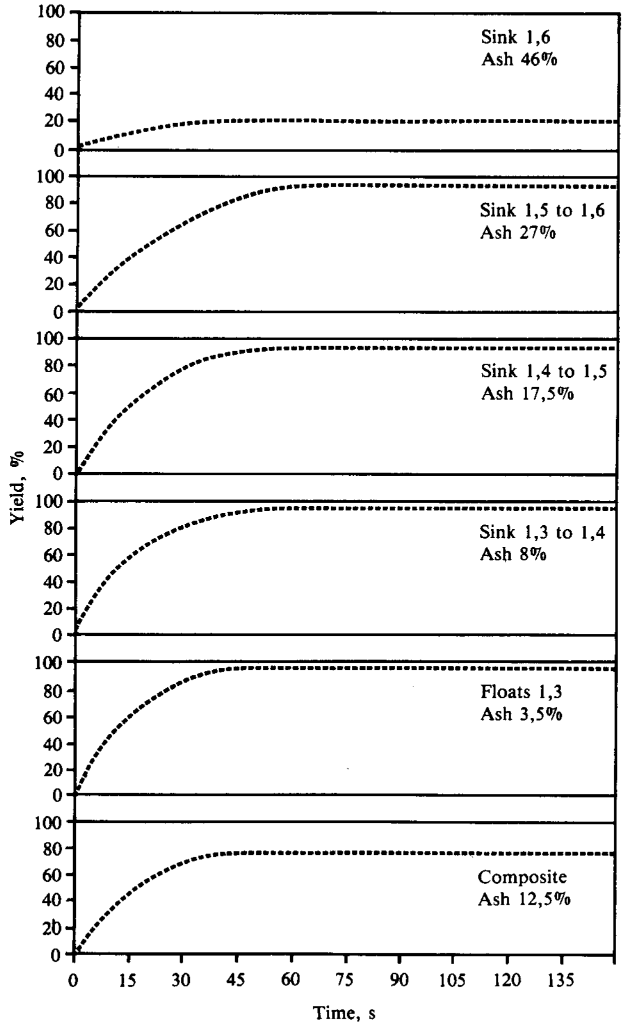

Fig. 1—Liberation of various fractions in froth flotation at the same dosage of reagent[1,2]

Landau, research has been concentrated on the treatment of plus 150 μm coal, the objective being the production of low-ash (7 per cent) coal. Only when a satisfactory treatment process had been identified was attention again devoted to the ultrafines. Several groups of researchers have realized that the beneficiation of ultrafine coal, while having similarities with the beneficiation of fine coal, is an independent field of study. Certain processes can successfully be used for the treatment of fine and ultrafine coal; others are suitable only for fine coal. The extent to which processes are applicable to ultrafines, and the processes specific to the treatment of ultrafine coal are next discussed.

Dense-medium Concentration

Dense-medium beneficiation is of two types: that involving gravity concentration, for example by the use of drums, and that using centrifugal movement as in cyclones.

Gravity processes are seldom used for material smaller than about 10 mm and only unintentionally below about 6 mm since, the smaller the particle, the greater the viscosity resistance relative to the gravitational forces. The application of hydraulic classification with autogenous medium is under investigation at the University of Durban-Westville[6].

Centrifugal washers use centrifugal forces far in excess of the resistance forces. They are efficient for material containing smaller particles, but for many years the lower size limit was accepted as 0,5 mm (wedge-wire screen). Work by Sokaski and Greer[7], Deurbrock[8], and Mengelers and Absil[9] showed that dense-medium cyclones might work on even finer coal. Work at the Anglo American Research Laboratories[10] confirmed this. A 5 t/h pilot plant was built at the Fuel Research Institute (now the National Institute for Coal Research) in Pretoria, which led to the installation of two industrial units. All the published testwork, both on the pilot plant and on industrial scale, indicates that the process is effective only down to about 100 μm. Dense-medium cyclones have been found to provide a highly efficient process for the treatment of coal between 500 and 150 μm. The separation effect of the treatment probably extends to below this size, even down to 75 μm, but separation from magnetite in ultrafine sizes is difficult. However, the process does have a high degree of selectivity and enables low-ash coal to be produced from fines at economic recoveries.

Use of Spirals

Spirals are finding increasing application in the treatment of fine coal. Current work suggests that the lower size at which beneficiation can be carried out is about 100 μm. Hence, ultrafines appear to be largely outside the range of spirals. Similar comments apply to other units such as concentrating tables and jigs, in which the force producing separation according to density is fairly weak and would, for ultrafine sizes, be presumably overcome by resistance forces. It is possible that viscosity modifiers may extend the range of treatment, but work on this aspect is not currently in progress. Spirals are not particularly selective, having an epm of about 0,125; they work best at densities at which there is less than 10 per cent near-density material. Their major application in South Africa is thus in the production of power-station 'smalls' of about 14 to 17 per cent ash content.

Use of Hydrocyclones

Hydrocyclones, which use water instead of a dense medium, have been found to be unselective, and they cannot treat material of fine size unless it has exceptionally easy cleaning characteristics. Their efficiency of separation is also restricted by particle size; the present lower limit for such cleaning as they achieve is about 100 μm.

Selective Flocculation

Selective flocculation has been studied to a limited extent. The problem with South African coals is their lack of distinguishing characteristics: the difference in surface characteristics between a particle of, say, 25 per cent ash and one of 30 per cent ash is negligible, so that distinguishing between the two is almost certainly beyond the scope of selective flocculation. However, the application of selective flocculation to ultrafine particles is worth an in-depth investigation in view of their better liberation.

Oil Agglomeration

Oil agglomeration has been investigated extensively. The process consists in the addition of a reagent, usually an oil, to the pulp, which is then agitated. The oil coats the coal but not the stone, and the oil-coated particles of coal coalesce to form caviar-like balls of surprising mechanical strength that can be screened from the pulp. The product drains well on a dewatering screen.

Laboratory studies have been carried out by workers from (among others) the Anglo American Corporation and from the University at Potchefstroom. The former organization operated a small pilot plant at Kleinkopje Colliery. The process can give high yields of low-ash coal, the process of agglomerate formation probably restricting the degree of entrainment of non-coal particles. However, the process is costly in terms of oil consumption and, more significantly, is variable in performance.

Recent work at Potchefstroom[11] has shown the process to be highly sensitive to oxidation. In one series of tests, a change in the percentage of the COOH groups in coal from 0,8 to 1,8 per cent reduced the degree of agglomeration from 87 per cent to zero. These COOH changes resulted from heating of the coal in air for various periods at various temperatures. Other workers in oil agglomeration, especially in the Northern Hemisphere, have indicated that the process is reasonably tolerant to coal changes. However, this may be valid only for their high-vitrinite coals.

Froth Flotation

Froth flotation is widely used overseas for the treatment of fine coal. It is used in South Africa in Natal and the Transvaal, but not extensively. Generally speaking, spirals are now being used for the treatment of coal with particle sizes that were formerly the exclusive domain of froth flotation. Although this is a pronounced tendency in South Africa, as pointed out above, the use of spirals for the treatment of coal in size ranges usually handled by flotation is spreading in the Northern Hemisphere.

The essential problem with flotation is its lack of selectivity. Some work has been done on the selectivity or otherwise of coal flotation. Fines (between 500 and 150 μm) from Vryheid Coronation Colliery were separated by float-and-sink analysis into a series of density fractions. The individual fractions were then used in flotation tests under identical conditions of reagents, concentrations, etc. The results[12] are shown in Fig. 2. The curves show that the flotation results were practically independent of the ratio of coal to mineral matter, i.e. that froth flotation is not selective. This is confirmed by Fig. 3, which indicates the sharpness of separation[12].

No investigation was carried out into the possible influence of the liquids used in density separation on the froth-flotation properties; nor were various flotation reagents studied. It is understood[13] that similar work, on Transvaal coals, is at present in progress at the University of Cape Town. Petrographic differences were not investigated.

By contrast, density-based processes are likely to be far more selective. With fines from Witbank No. 2 seam as a data source, the following values are obtained for the plotting of particle density against particle ash content:

Relative density	1,30	1,37	1,42	1,47	1,55	1,65
Ash content	6,6	8,6	22,8	15,5	20,4	34,1 .

Hence, a change in particle ash content of 2 per cent results in a density change of 0,07 (i.e. a change in ash content from 6,6 to 8,6 per cent changes the density from 1,30 to 1,37) at low densities. This corresponds to a change in density point of 0,03 for 1 per cent ash. At higher densities, the value drops to a density point of about 0,02 for 1 per cent ash. A simple density separator such as a spiral can be controlled to a density of about 0,1, so that particles differing by about 5 per cent in ash

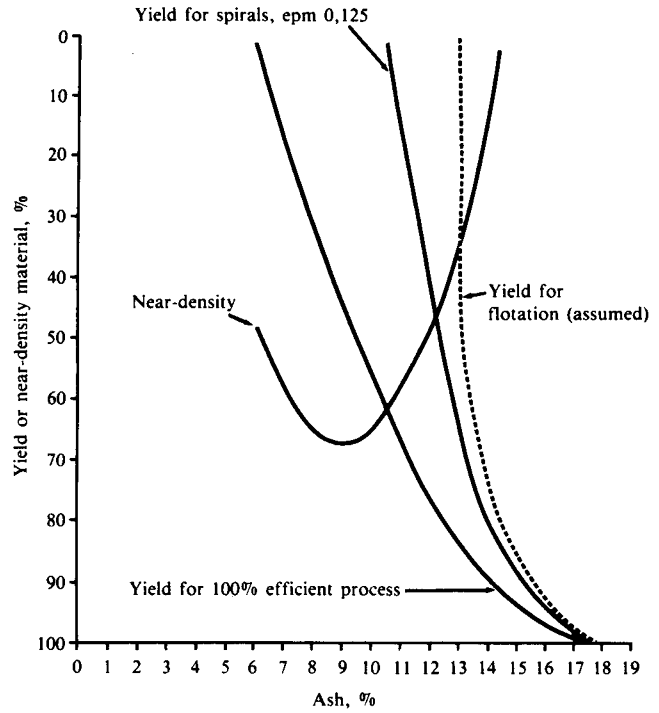

Fig. 2—Flotation results under identical conditions of reagents, concentrations, etc.

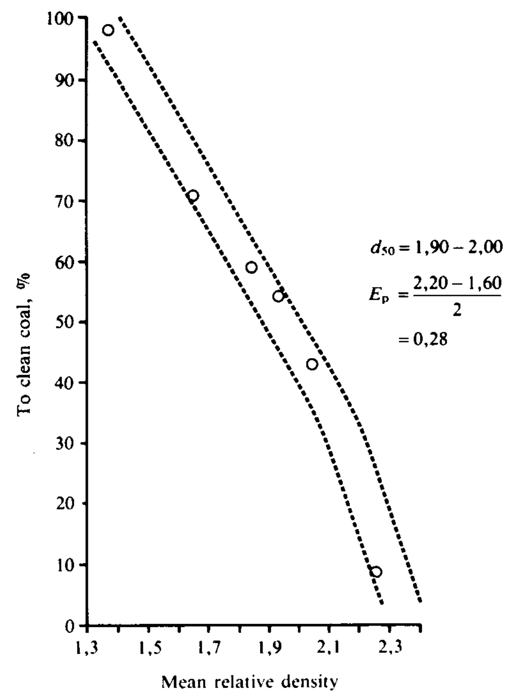

Fig. 3—Partition factors in laboratory froth flotation at the University of Natal[12]

can be accepted or rejected into the product. A dense-medium process can be controlled to 0,01, so that particles differing in ash by only 0,5 per cent can be accepted or rejected. Hence, a density-based process can be highly selective.

This contrasts with froth flotation, where, as Fig. 1 suggests, discrimination between particles of 17 and 27 per cent would be difficult. If particle density is indicative of the relative proportions of organic and inorganic components in an individual particle, it should also be indicative of the degree of aerophilicity of a particle. Hence, near-density material can be equated with material that the flotation process finds difficult to accept or reject accurately as float products. Hence, if much near-density material is present, the superior selectivity of gravity processes should result in a better yield than from flotation. This advantage should diminish as the amount of near-gravity material becomes less and the importance of selectivity declines. This is illustrated in Fig. 2, which shows the relationship between ash, percentage near-density material, and cumulative yield for fines from Witbank No. 2 seam[14]. The yields for a gravity process using spirals at an epm of 0,125 are compared with the theoretical yield (i.e. an epm of zero) and near-density material. The author[14] conjectures that froth flotation would give the curve shown as the dotted line. Some preliminary results from the University of Cape Town (Fig. 4) confirm this. Another feature of importance in froth flotation is entrainment. At conventional pulp concentrations (say 12 to 15 per cent solids), non-coal particles, which are not attached to the bubbles, are likely to be caught up in the upward moving mass of froth. Repeated retreatment of the froth may be necessary to reduce such entrained particles to an acceptable level.

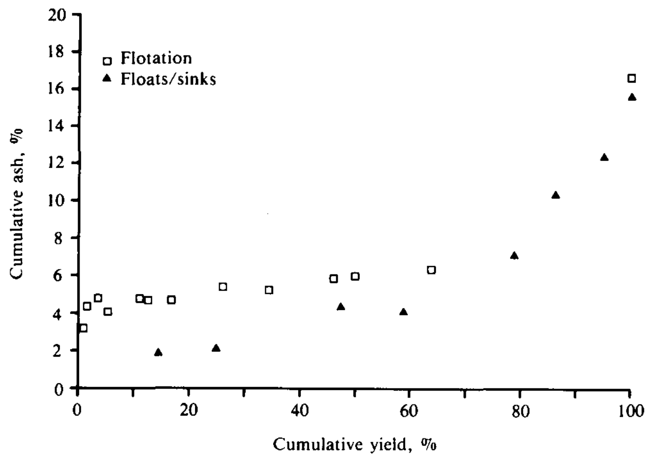

Fig. 4—Results obtained at the University of Cape Town on Landau coal

It should be noted that the solids in coal processing have a much lower density, say 1,6, than the solids in other mineral-processing industries, say 2,7. Thus for coal, 5 and 35 per cent solids by mass correspond to 3 and 25 per cent solids by volume. The equivalents for other minerals at a density of, say, 2,7 solids are 1 and 17 per cent solids by volume. Thus, the coal occupies a much larger volume of pulp than that occupied by the solids in the other mineral-processing industries. This means that, as far as coal is concerned, the solids occupy a greater percentage of the volume than in other mineral-flotation processes, leading to a greater tendency for entrainment to occur. Testwork at the University of Cape Town revealed that the use of pulps containing low concentrations of coal materially reduced entrainment, even to the point where single-stage flotation could give a froth concentrate of high quality. Such a conclusion obviously has an effect upon the capital investment in froth flotation. Work within the Anglo American Corporation, based on the University's results, has shown that low concentrations of solids (about 5 per cent) give high yields of products containing less than 10 per cent ash. At this stage, pilot-plant work (described below) has confirmed the desirability of dilute feeds. Conventionally, froth flotation is carried out on suspensions containing 12 to 15 per cent solids.

Testwork

All the effects outlined above suggest that the froth flotation of ultrafine coal may be more successful than the flotation of fine coal. Testwork within the past year has confirmed this.

Laboratory Testwork

The Universities of the Witwatersrand and of Cape Town, as well as the Anglo American Corporation, have investigated the froth flotation of ultrafine coal. These tests were conducted mainly on coal from No. 2 seam at Witbank, with a few studies on coal from seams Nos. 1 and 4 of the same coalfield.

At the University of the Witwatersrand, Panopoulos *et al.*[5] investigated the flotation of the No. 2 seam: they stress that floatability depends upon the particle-size distribution and quality within each size fraction. The petrographic parameters of each size fraction are also important. Panopoulos and his co-workers[5] found, as have other researchers[15], that the reproducibility of flotation tests is poor in the laboratory. Multistage addition of reagents increased the recoveries, and ultrafine coal was beneficiated by flotation. A continuous pilot plant of 1 l/min was operated successfully.

Franzidis and Schroeder-Buys[4] of the University of Cape Town worked on coal from Nos. 1 and 2 seams at Kleinkopje Colliery, and found that pulps of ultrafines containing 5 to 10 per cent solids by mass gave a 60 per cent yield of coal (about 12 per cent ash content) when paraffin and methyl isobutyl carbinol (MIBC) were used as reagents.

The earliest work of Anglo American Corporation on the flotation of fine and ultrafine coal[16] was carried out at the University of Leeds under the direction of C.C. Dell. The studies, on Landau coal, showed that the ultrafines were, as then predicted, more amenable to flotation than were the fines but, as the required quality of product was not achieved, the work was abandoned. The latest work, using the parameters established at the University of Cape Town, has been on ultrafines from No. 4 seam at Kriel. The work demonstrated that these ultrafines could yield about 70 per cent of PSS-grade coal (about 17 per cent ash). Investigations of ultrafines from No. 4 seam at Goedehoop are in progress.

The foregoing studies allowed the following conclu-

TABLE I
SUMMARY OF FLOTATION RUNS ON THE PILOT PLANT AT LANDAU
Conditions: Collector 90:10 paraffin: MIBC single-stage addition

Test no.	Feed flow l/h	Solids %	Ash, % Feed	Combined floats	Cell 1	Cell 2	Cell 3	Tailings	t (s)	Yield %
2	2571	6,4	17,8	8,35	7,45	7,75	12,6	41,6	107	71,1
3	2118	7,8	16,7	9,25	9,7	8,7	11,1	53,7	150	83,1
4	3000	15,5	16,2	9,4	8,85	9,75	10,55	19,9	84	34,7
5	1125	4,05	15,8	7,8	–	–	–	61,6	252	85,7
6	972	5,7	15,2	9,15	8,9	10,4	11,45	59,5	480	88,1
8	2000	4,3	18,0	7,9	6,6	7,75	8,1	42,15	132	74,2
9	2571	3,8	16,2	9,5	–	–	–	39,8	102	77,9
10	2769	4,7	17,0	8,85	7,8	7,5	9,75	54,4	108	82,2
11	2000	8,79	15,8	8,2	8,1	7,6	8,3	25,2	144	55,2
12	2400	4,6	17,0	8,2	8,15	9,4	8,6	61,6	120	83,6
13	2400	4,6	18,4	8,8	8,6	10,15	9,85	52,95	132	79,4
14	2400	4,6	17,7	9,15	8,35	8,95	10,25	66,85	126	85,2
15	4000	5,44	17,4	8,95	8,9	8,75	8,7	21,7	84	33,7
16	1800	5,06	21,7	9,15	8,65	8,45	9,0	51,4	144	70,4
17	1800	5,06	17,1	8,1	8,1	8,2	9,0	51,2	144	79,1
18	2000	4,7	16,7	8,55	8,2	8,6	9,7	52,3	132	81,3
19	1636	5,4	16,4	8,6	8,1	8,7	9,6	55,3	150	83,3
20	1636	5,4	17,1	8,7	8,3	9,1	9,8	57,2	150	82,6
21	2000	5,3	16,9	8,9	8,2	8,8	9,4	32,3	126	65,8
22	1636	4,6	16,4	8,4	7,9	8,3	8,7	29,4	144	61,9
23	1894	5,1	16,7	9,2	8,8	9,1	10,3	21,2	126	37,5
24	2000	4,5	21,2	9,4	8,65	9,15	9,45	57,9	120	75,8
Mean, x				8,75						71,44
Standard deviation, o				0,51						16,81
Coefficient of variation, o/x				0,06						0,24

sions to be reached.

(1) Floatability depends upon the size distribution and the quality distribution within each size fraction.
(2) The petrographic parameters of each size fraction are important.
(3) The reproducibility of laboratory tests is poor.
(4) The multistage addition of reagents increases yields.
(5) Low pulp densities lead to better selectivity.

The overall conclusion was that, under the right conditions, ultrafine coal can be successfully treated by froth flotation.

Pilot-plant Testwork

Accordingly, a continuous pilot plant was installed at Landau Colliery, and a Uhde microbubble flotation pilot plant at Kleinkopje. The initial objective of the pilot-plant testwork at Landau was twofold: to show whether a high-quality steam coal can be produced by froth flotation and to establish the operational parameters for such an operation. The pilot plant started operating in July 1985 and, virtually from that time, it has been giving a froth product of about 10 per cent ash or less. The units, three cells of 20-litre capacity each, were borrowed from the National Institute for Coal Research. The feed is taken from the slimes classifying cyclones, and passes to a small thickener, with the addition of reagent via a Clarkson feeder. The froth and tailing, after being sampled, are remixed and added to the slimes circuit.

TABLE II
EFFECT OF COLLECTOR ADDITION ON YIELD
LANDAU PILOT PLANT
Conditions: Collector 90:10 paraffin: MIBC single-stage addition

Test no.	Solids, %	Collector addition ml/t (dry basis)	Yield, %
2	6,4	1 458	71,1
3	7,8	1 816	83,1
4	15,5	2 614	34,7
5	4,05	NA	85,7
6	5,7	21 660	88,08
8	4,3	2 093	74,2
9	3,8	2 436	77,9
10	4,7	1 884	82,2
11	8,79	1 024	55,2
12	4,6	2 174	83,61
13	4,6	3 260	79,37
14	4,6	4 658	85,18
15	5,44	1 103	33,7
16	5,06	4 000	70,4
17	5,06	4 000	79,12
18	4,7	2 553	81,3
19	5,4	2 727	83,3
20	5,4	2 727	82,6
21	5,3	1 689	65,8
22	4,6	2 400	61,9
23	5,1	1 863	37,5
24	4,5	4 222	75,8

NA = Not available

TABLE III
ANALYSIS OF AIR-DRY MATERIALS, LANDAU PILOT PLANT

Size µm	Yield		Ash		Coefficient of variation		Sulphur	
	Fraction	Cumulative	Fraction	Cumulative	Fraction	Cumulative	Fraction	Cumulative
Feed								
- 1000 + 500	–	–	–	–	–	–	–	–
- 500 + 250	2,9	2,9	5,1	5,1	31,74	31,74	0,68	0,68
- 250 + 125	18,1	21,0	7,6	7,3	30,49	30,66	0,58	0,59
- 125 + 63	14,2	35,2	10,6	8,6	29,22	30,08	0,56	0,58
- 63 + 45	8,6	43,8	13,8	9,6	27,89	29,65	0,78	0,62
- 45	56,2	100	21,2	16,1	24,38	26,69	1,75	0,92
Product								
- 1000 + 500	–	–	–	–	–	–	–	–
- 500 + 250	5,9	5,9	6,3	6,3	31,13	31,13	0,54	0,54
- 250 + 125	23,8	29,7	7,7	7,4	30,65	30,75	0,55	0,55
- 125 + 63	16,9	46,6	9,2	8,1	29,70	30,37	0,60	0,57
- 63 + 45	7,6	54,2	10,5	8,4	29,40	30,23	0,67	0,58
- 45	45,8	100	10,1	9,2	29,48	29,89	0,82	0,69
Tailings								
- 1000 + 500	12,2	12,2	11,8	11,8	29,18	29,18	0,80	0,80
- 500 + 250	7,0	19,2	16,3	13,4	27,29	28,50	0,92	0,84
- 250 + 125	7,0	26,2	19,8	15,1	25,35	27,70	1,63	1,05
- 125 + 63	9,0	35,2	27,4	18,3	21,76	26,10	2,35	1,39
- 63 + 45	4,5	39,7	32,5	19,9	19,32	25,40	2,48	1,51
- 45	60,3	100	52,9	39,8	11,93	17,30	2,31	1,99

The operational parameters investigated in order to meet the secondary objective were as follows:

(a) type and addition rate of reagents,
(b) solids content of the feed, and
(c) flotation period.

The reagent chosen for the initial testwork was a 90-to-10 mixture of paraffin and MIBC, which can be considered to be 'standard'.

Table I gives a set of results obtained over about one month. It is interesting to note that, although the yields varied, there was much less variation in the quality of the product. Hence, a 'fail safe' situation appeared to be developing. If, for any reason, the flotation characteristics of the coal changed, the effect would be a deterioration in the yield, rather than in the quality of the product.

Thus, the addition rates (Table II) were varied over a wide range of values so that their effects on the quality and recovery of the product could be observed. It was concluded that an addition rate of approximately 2000 ml per ton of dry feed achieved optimum recovery conditions. Lower addition rates affected the recovery adversely but had no significant effect on the quality of the product. Excess addition rates seemed to have very little effect on either the recovery or the quality.

The solids content of the feed was set at 5 per cent by mass for most of the test runs, this being the concentration at which the feed would normally arise in most operations. Higher solids contents were found to have a negative effect on the recovery, although the quality of the product was not greatly affected.

Flotation time, estimated by the assumption of plug-flow conditions through the cells, was found to be between 120 and 180 seconds. From the results achieved at those times, some interesting observations can be made.

The bulk of the upgrading effect (Table III) is in the size fractions smaller than 125 µm, especially below 45 µm. This would seem to confirm the opinion that ultrafines are more amenable to froth flotation than fines.

The upgrading effect on the minus 45 µm fraction was clearly evident on all the parameters tested, i.e. ash content, calorific value, and sulphur content. It is interesting to note that the sulphur content was reduced to a level at which the flotation product would be acceptable as steam coal.

Conclusion

The testwork done to date seems to indicate that the production of a high-quality steam coal from the froth flotation of ultrafines is viable. Further testwork on the pilot cells will be aimed at methods to improve the results obtained so far. The stage addition of reagents and alternative types of reagents are among the subjects envisaged for the additional testwork.

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Atlas Copco Awards

The winners of the 1986 Delfos & Atlas Copco Travel Grant for mining engineers were announced by Mr George Nisbet at a function held in Johannesburg on 30th July, 1986. They are Mr J. Steenkamp, Production Manager, Prieska Copper Mine (Pty) Ltd; Mr P. Kinver, Assistant Manager, Black Mountain Mineral Development Company (Pty) Ltd; and Mr C. Pretorius, Pit Superintendent, Iscor Sishen Iron Ore Mine.

The grants are awarded annually to top young mining engineers, and are administered by The South African Institute of Mining and Metallurgy. The winners receive an all-expenses-paid trip abroad for about one month, during which mines, projects of technical interest, and various mining and educational institutions are visited. This year, for the first time, three instead of two winners were selected.

The United States of America and Canada will be the destination for the 1986 winners. The itinerary was especially drawn up to incorporate the world-renowned Las Vegas Mining Show, which will no doubt be one of the highlights of the American programme.

The Grant is open to all mining engineers with a minimum of three and a maximum of ten years' experience within the industry, and applications for the 1987 Grant will open in October 1986.

For further information, please contact

Melanie Davis
Delfos & Atlas Copco (Pty) Ltd
P.O. Box 504
Benoni, 1500

Telephone: 54-4411.

From left: Mr J. Steenkamp, Mr M. Pellegrino (Managing Director, Delfos & Atlas Copco), Mr P. Kinver, Mr G. Nisbet (who presented the awards on behalf of the SAIMM), and Mr C. Pretorius

Alumina and bauxite

Special sessions on alumina and bauxite are to be held during the 116th AIME Annual Meeting in Denver, U.S.A., from 22nd to 26th February, 1987.

The suggested broad topics are as follows:

- New Developments
- Fundamental Understanding
- Cost Reductions
- Swing Capacity—Adjustment to or Management of
- Symposium on Energy
- Environmental Needs and Developments
- Instrumentation, Control, and Analytical Detection
- Obsolescence.

Enquiries should be addressed to

Mr J. Finley Bush
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Alcoa Center, Pa 15069
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Telephone: 412-337-2905.

South African Institute of Supervisors

The South African Institute of Supervisors (SAIS) is an incorporated association not for gain. It is non-racial and draws its membership from all sectors of the economy.

The supervisor is management's interface with labour

The supervisor's job is a challenging one. A special combination of knowledge, skill, and attitude is required: managerial, technical, personnel, and human relations.

Supervisors are first line managers whose major function is working with and through non-management employees to meet the objectives of the organization and the needs of the employees. They are better placed than any other manager to know and understand what is happening in their departments. Supervisors can observe and control employee performance, recognize potential problems, and take corrective action. Their role has become more complex with the development of the union movement in South Africa. While the crucial role of supervisory jobs is commonly recognized, the supervisor's status does not correspond fully to the vital function that he or she fulfils.

They have to be developed, supported by management, and have sufficient self-esteem to carry out their duties effectively.

The ratio between supervisory and workforce is poor

In South Africa, the ratio of supervisor to workmen averages 1:42. This compares most unfavourably with highly productive countries like Japan, the U.S.A., and West Germany. It is undeniable that the local ratio has a direct bearing on poor productivity.

In a climate of shrinking markets, tighter profit margins, and increasing raw-material and labour costs, coupled with this very thin line of management, it is urgent that the supervisor should be developed to his full capabilities. The Institute recognizes that more supervisors need to be better trained and that more need to be identified and developed.

What the Institute does

- The SAIS acts as a catalyst, encouraging employers to help employees upgrade their academic skills through the Continuing Education programme.
- It conducts Certificate (Cert SAIS) and Diploma (Dip SAIS) courses for supervisors and supervisor-designates. A system of continuous assessment is used instead of formal examinations.
- It issues Certificates of Competence after assessing supervisors.
- It provides short-term training courses on specific subjects on a public or in-company basis.
- It conducts workshops and seminars for both management and supervisors.
- It conducts research on such subjects as 'The Profile of the South African Supervisor' and 'An Analytical Framework for Maximizing Supervisor Effectiveness'.

To help the supervisor recognize that he is not alone and has the support of fellow members, the SAIS provides social interaction through regular functions. It also publishes a regular newsletter and maintains contact with other institutes and with education, training, and employee organizations in South Africa and abroad.

It has the following categories of membership:

Group affiliate
Full member (MSAIS)
Associate member (ASAIS)
Affiliate member
Student member.

SAIS Office-bearers

President: Dr Dennis Etheredge, OBE, Director of Companies.

Vice Presidents: W.H.P. Cordell, Ex Executive Director of the Institute of Management and Supervisors; J. Doods, recently retired Managing Director, Allied Building Society; and Dr C.G. Ferreira, Director, Mercabank.

Directors: R.J.S. Spencer (Chairman), Training and Development Consultant, AAC; A. Grimble, General Manager, SEIFSA Education and Training Board; J. Seutloadi, Manager, Training, Murray & Roberts; P. Khumalo, Senior Lecturer, Centre for Developing Business, University of the Witwatersrand; F.A. King, Group Training Manager, Grindrods; M.G. Taylor, Executive Director, Director and Secretary, Outward Bound of Southern Africa.

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