Colloquium and General Meeting

A General Meeting and Colloquium was held on 'New Advances in Non-ferrous Pyrometallurgy' in Kelvin House, Johannesburg, on Wednesday, 17th March, 1976. The President, Dr R. E. Robinson, opened the proceedings at 10h00, by welcoming the authors and delegates, who numbered approximately one hundred and twenty.

Membership

The President announced that the undernoted candidates, whose names had been published in accordance with Bye-Law 5.2.5, had been elected to membership in the following grades:

Fellow A. Ball, D. G. Osborne.

Member C. G. Jonker, D. H. P. Jackson, D. B. du Preez, S. P. Pienaar, A. N. Jones, D. G. Dalton, A. J. Richardson, A. F. Lambert.

Graduate D. M. Jones, C. T. Burgess, G. I. Cunningham.

Student C. Viviers, G. Beldon, J. J. Coetzee.

Transfer to Fellow A. D. Ochse, G. R. Parker, G. J. Keogh.

Transfer to Member G. A. Dingley, J. D. Minnaar, M. B. Algeo, C. C. Cloete.

Transfer to Associate H. J. O. P. Smith.

He welcomed the newly elected members to the Institute and congratulated those who had transferred to a higher grade.

Colloquium Papers

The following papers were presented, under the chairmanship of Mr P. J. Slabbert (Anglo American Corporation of South Africa Ltd) and Dr T. B. Beeton (Iscor).

(1) Smelter ancillary operations and sulphuric acid manufacture at Impala Platinum Ltd, by R. P. Plasket and D. A. Ireland.
(2) Oxygen enrichment of the converter air at Rustenburg Platinum Mines, by J. E. Forbes.
(3) Power requirements for smelting a copper–nickel sulphide concentrate in a 7,5 MVA electric smelting furnace, by H. E. Bartlett and P. Markham.
(4) Control systems for submerged arc smelting furnaces, by J. Kemp.
(5) Tin smelting at Iscor, Vanderbylpark, by H. A. Uys.
(6) Treatment of zinc silicates by the Waelz process, by J. E. Clay and G. P. Schoonraad.

The interesting feature of the first paper was the description of the new spray dryer, the first of its type in this country, for the treatment of thickener underflow that has a moisture content of 35 to 40 per cent. This pulp is atomized by being fed through peripheral nozzles in a high-speed rotating wheel. The hot gases from coal-fired furnaces at a temperature of 750 °C are admitted to the drying chamber through a duct with a louvred cone distributor mounted directly below the atomizer wheel. The moisture-laden gases leaving the dryer at 120 °C carry away about 30 per cent of the total solids feed, which is recovered in an electrostatic precipitator. Many safety and interlocking devices are provided to ensure that the temperatures of the 2 mm-thick walls of the dryer, which are made of 304 stainless-steel plate, never reach temperatures in the region of 700 °C.

In the second paper, Mr Forbes gave an account of the results obtained with oxygen enrichment of up to 6 per cent by volume of the blowing air used in the converters at Rustenburg. The main reasons for the adoption of oxygen enrichment were to enable a high proportion of 'cold dope' to be treated and to yield converter gases with an enriched sulphur dioxide content. Continuous use of 6 per cent oxygen enrichment permitted the treatment of a mixture of 1:1 cold dope to matte with an increased converter capacity of 15 per cent. An average ratio of 4 tonnes of cold dope to 1 tonne of oxygen was achieved.

In discussing paper (3), which had been presented in 1975 to the Institute of Mining and Metallurgy in London, Dr Bartlett showed how the power requirements for the smelting of copper–nickel concentrates could be calculated from basic thermodynamic data by use of a linear equation developed by the authors. With the composition of the concentrate at Western Platinum, it was shown that the addition of lime could be reduced, giving a lower power consumption per tonne of dry concentrate, despite the fact that a higher slag temperature was required for tapping.

In paper (4), Mr Kemp briefly described a control system developed by several companies under the control and guidance of Barnes–Birlec. This is a solid-state regulator depending upon arc impedance, which is claimed to have very simple possibilities for quick repair and replacement of defective parts.

Mr Uys gave an account of some of the important operating and control factors in the smelting of high-grade tin concentrates in a 350 kVA submerged-arc furnace. The production is about 1000 tonnes of tin per year.

Mr Schoonraad, who presented the last paper, gave a brief description of the operation of the Waelz process at Grootfontein, dealing particularly with the problem of ring formation. He showed that ring formation could be minimized by the use of a high proportion (45 per cent) of reductant in the feed and the maintenance of a $(CaO+MgO):SiO_2$ ratio of about unity.

Colloquium Discussion

Mr J. C. Mostert (J.C.I.), Mr V. C. Ward (Techmet), and Dr A. A. Hejja (University of Witwatersrand) were the main contributors to the discussions of the first three papers.

Mr Mostert drew some interesting comparisons between practice at the Waterwal and Union Smelters of R.P.M. and at Western Plats. He emphasized the possible disadvantages of reducing the lime addition to slags, pointing out that this could result in a slag with a higher FeO content, which is usually associated with higher losses of PGM and nickel. He also stated that, after six years' operation, the magnesite refractories in one of R.P.M.'s furnaces showed no sign of erosion, and on this count alone R.P.M.

would not lightly reduce the lime addition. He stated that R.P.M. were investigating the use of spray dryers because the Büttner tray dryers installed were prone to mechanical failure and did not produce a material particularly well suited to pelletization. Although R.P.M. is commissioning a sulphuric acid plant for the treatment of the converter gases, fluctuations in the sulphur dioxide content have forced the company to decide to install a sulphur burner that will give a continuous sulphur dioxide content of about 7,5 per cent.

Mr Ward's contribution, which was not presented at the meeting, discussed the formation of accretions in the furnace at Western Plats, pointing out that these could contain over 17 per cent Cr_2O_3 and defied all known forms of remedial treatment such as cast iron, lump pyrites, air-lancing, etc. He maintained that, while some chromic oxide was derived from the Merensky Reef concentrate, the bulk must be contributed by the chrome/mag refractory used in most converters. The essential difference between the fuel-fired reverberatory furnace and the electric furnace is that the chromite accretions float on the shallow slag bath in the reverberatories and can be removed; the procedure is not feasible in electric furnaces with the very deep slag bath. Mr Ward illustrated some of the problems encountered in Western Plats due to the formation of large accretions, pointing out that one persistent accretion that had formed a bar across the hearth had made it impossible to tap matte to a depth lower than 25 to 29 inches. This resulted in unnecessary superheating of the matte, the temperature of which had risen by 100°C. Another accretion at the slag end of the furnace had extended the slag tap-hole into the zone adjacent to the electrodes, where there is incomplete separation of slag and matte. Metal losses in the slag had substantially increased as a result, the nickel rising from 0,07 to 0,13 per cent and the copper from 0,04 to 0,08 per cent.

Dr Hejja, while confirming the general findings of Dr Bartlett about lime additions, pointed out that these additions seriously decreased the resistivity of the slag. He felt that the resistivity of the slag may have been an important factor in the lower power consumptions experienced with the low-lime slag. Dr Hejja discussed some of the factors governing the design of electric-arc furnaces, pointing out that certain electrical and symmetry factors must be taken into consideration.

In discussing the paper on tin smelting, Mr E. C. Stoltz gave some interesting details of Gold Fields' proposed new smelter, which had been designed to treat lower-grade concentrates of only 30 to 50 per cent tin and up to 25 per cent iron oxide and 18 per cent silica. He pointed out that this smelting operation would require two additional stages: first, a preliminary roast in three steps— reducing, oxidizing, and chloridizing; and second, a thermal stage consisting of liquation and centrifuging of the crude tin directly after tapping.

Mr C. J. van Niekerk, Works Superintendent of Zincor, discussed the difficulties encountered in the electrolytic production of zinc as a result of the high MgO and the fluorine in the Waelz oxide. He pointed out that the presence of the MgO meant that both additional sulphuric acid and lime were used in the leaching circuit. He stated that Zincor spent about R400 per tonne of magnesium in the Waelz oxide for the purchase of sulphuric acid and lime. Two circuits had to be operated at Zincor: one low in fluorine and the other at a higher fluorine level. He suggested treatment of the Waelz oxide in a densifying kiln, which could be used to drive off the fluorine and facilitate the separation of zinc and lead.

Professor Howat showed a diagram for the reduction equilibria of zinc and iron oxides. The thermodynamic data indicated that, with $CO:CO_2$ ratios of 1,4:2,0 in the kiln gases, the minimum temperature for the reduction of zinc oxide was between 1050 and 1100°C. At those temperatures and with those gas compositions, iron oxides could be reduced to metal. An increase in the temperatures of operation in an attempt to speed up the reactions would probably result in severe ring formation. There therefore appeared to be a relatively narrow range between the temperatures at which the zinc oxides could be reduced and the temperatures at which ring formation could present serious problems.

Tinplate Conference

The Tin Research Institute is organizing the 1st International Tinplate Conference, which is to be held in London from 5th to 8th October, 1976.

Some thirty-eight papers will be presented at this Conference in seven sessions, which will cover the following topics: tinplate production, can making, can performance, lacquering, instrumentation and quality control, laboratory techniques, metals reclamation, and marketing.

The international aspect of the Conference is reflected by the participation of speakers from about a dozen countries throughout the world, and among the many organizations represented by speakers are British Steel Corporation, United States Steel Corporation, Nippon Steel Corporation, Carnaud Basse—Indre, American Iron and Steel Institute, Australian Iron and Steel Pty Ltd, Rasselstein AG, Metal Box Ltd, Metal Box South Africa Ltd, Sollac, Italsider, Europemballage, International Tin Council, and the Tin Research Institute.

Further information can be obtained from Dr R. R. Dean, Conference Secretary, Tin Research Institute, Fraser Road, Perivale, Greenford, Middlesex UB6 7AQ, England.