SPOTLIGHT

on the direct-reduction plant at Vanderbijlpark

by T.B. BEETON*

In view of the limited reserves of good-quality coking coals in South Africa, Iscor has been involved in direct reduction since the middle sixties. Since the early seventies, its interest in direct reduction was stimulated further by a swing towards continuous casting, which, in turn, contributed to a shortage of the scrap supply for electric-arc-furnace (EAF) steelmaking. This shortage of scrap was the main reason for the decision to install a direct-reduction plant at Vanderbijlpark.

As a result of the progress made in coal-based rotary-kiln technology, Iscor decided in favour of a Stelco Lurgi/Republic National (SL/RN) plant. An order was placed with Lurgi S.A. in November 1981 for a plant with a capacity of 720 kt per annum of directly reduced iron (plus 1 mm, 93 per cent metallization, 0,01 per cent sulphur). The four-kiln direct-reduction plant is the largest of its kind in the world, and incorporates all the latest technological advances in computer-controlled processes, being the first of its type to recover waste-gas energy.

Operation of the Plant

The raw materials are charged in a predetermined qualitative ratio at a constant rate into the kilns, which rotate continuously. After the charge has been dried and preheated to the reduction temperature, the iron oxides of the ore are reduced by means of carbon, carbon monoxide, and hydrogen. An uninterrupted supply of these is ensured by the conversion of the coal used as a reductant.

The temperatures required by the process are provided and controlled by pre-determined rates of combustion air, which is injected through shell blowers arranged along the kiln length.

At temperatures ranging from 800 to 1000°C, the ore is reduced in the solid state to from sponge iron. After being discharged form the rotary kiln, the sponge iron, together with the remaining char, is cooled indirectly to ambient temperature in a cooler arranged downstream. These materials are thus conditioned for subsequent handling and re-oxidation is avoided.

The sponge iron is separated from the non-magnetic kiln-discharge material by screening and magnetic separation.

The total retention time is 8 to 10 hours to produce sponge iron with a metallization degree of 93 per cent.

A valuable byproduct of the process is steam. The gas released from the kilns is cooled and converted into steam by means of waste-heat boilers, and the steam is used in the Works as process steam. The four kilns produce about

A view of the four-kiln direct-reduction plant at Iscor's Vanderbijlpark Works

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150 t of steam an hour.

The plant has the most modern and effective equipment for dust control, including electrostatic precipitators, and minimal pollution is ensured.

The sponge iron is used in the electric-arc furnaces at a ratio of 67 per cent scrap to 33 per cent sponge iron.

Coal-based Mini-steelworks

The first kiln was commissioned in July 1984, and the plant was opened officially in April 1985. Steelmakers throughout the world have shown keen interest in this coal-based process. At a recent international conference on Stelco Lurgi/Republic National technology, which was held at Vanderbijlpark, the plant was shown to be the forerunner of a new generation of entirely coal-based integrated mini-steelworks that will have kiln plants and will generate sufficient gas and electricity to operate associated electric furnaces and rolling mills. This can be achieved by the modification of the heat-recovery system to incorporate the injection of additional coal.

Rock engineering

The First International Conference—Rock Engineering and Excavation in an Urban Environment—organized by The Institution of Mining and Metallurgy and the Hong Kong Section of the Institution, in association with the Hong Kong Institution of Engineers, will be held in Hong Kong from 23rd to 28th February, 1986.

Registration on 23rd February, 1986, will be followed by four days of technical sessions, the final day of the conference being devoted to local field visits and demonstrations. In conjunction with the conference, there will be an exhibition of products, equipment, services, etc., by manufacturers, specialist contractors, and consultants.

The Organizing Committee has invited a number of international experts to submit papers for presentation at the technical sessions, but abstracts of additional papers will be welcomed for consideration. Abstracts (200 to 300 words, in English—the official language of the Conference) of intended presentations should be submitted to

The Conference Office
Rock Engineering and Excavation in an Urban Environment
The Institution of Mining and Metallurgy
44 Portland Place
London W1N 4BR
England.

Selected authors will be required to submit the completed manuscripts of their texts by 1st October, 1985, to enable the preprinted volume of papers that are to be presented for discussion at the technical sessions—*Rock engineering and excavation in an urban environment*—to be distributed to registrants in February 1986. Contributions to the technical programme are invited, *inter alia,* on the following topics, with particular emphasis on case histories:

Open excavation—design of rock slopes for highways; lateral rock stresses and design of deep basements; control of rockfalls on large natural slopes; design of quarrying activities to provide usable space for building; reinforcement of existing rock slopes; investigation and mapping for excavation of urban rock slopes; and presplitting and specialist excavation techniques.

Underground excavation—prediction and observation of displacements around rock excavations; instrumentation of rock excavations; groundwater flow in jointed rock; geophysical methods of subsurface investigation; blasting vibrations from and their effect on underground excavations; and rock tunnelling techniques in difficult areas.

SPOTLIGHT

on Gold Fields National Engineering Awards

For the Gold Fields Foundation National Engineering Awards, each university affiliated to the South African Federation of University Engineering Students (S.A.F.U.E.S.) selected a candidate who, in their opinion, presented the most outstanding design project in their final year during 1984. On 24th April, 1985, the first prize of R3000, a second prize of R1000, and five prizes of R200 each were handed to the successful candidates at a reception held at Gold Fields' new Head Office Building after the presentations of their theses at Kelvin House. The winner and runner-up were as follows:

R3000 Gold Fields National Engineering Award

Ian Goss-Ross (University of Pretoria). Subject: Laser target designation by means of quadrant detection.

R1000 Gold Fields National Engineering Award

Michael Paul Zacharias (University of Natal). Subject: Bitumen rubber as a stress-absorbing membrane interlayer in asphalt overlays.

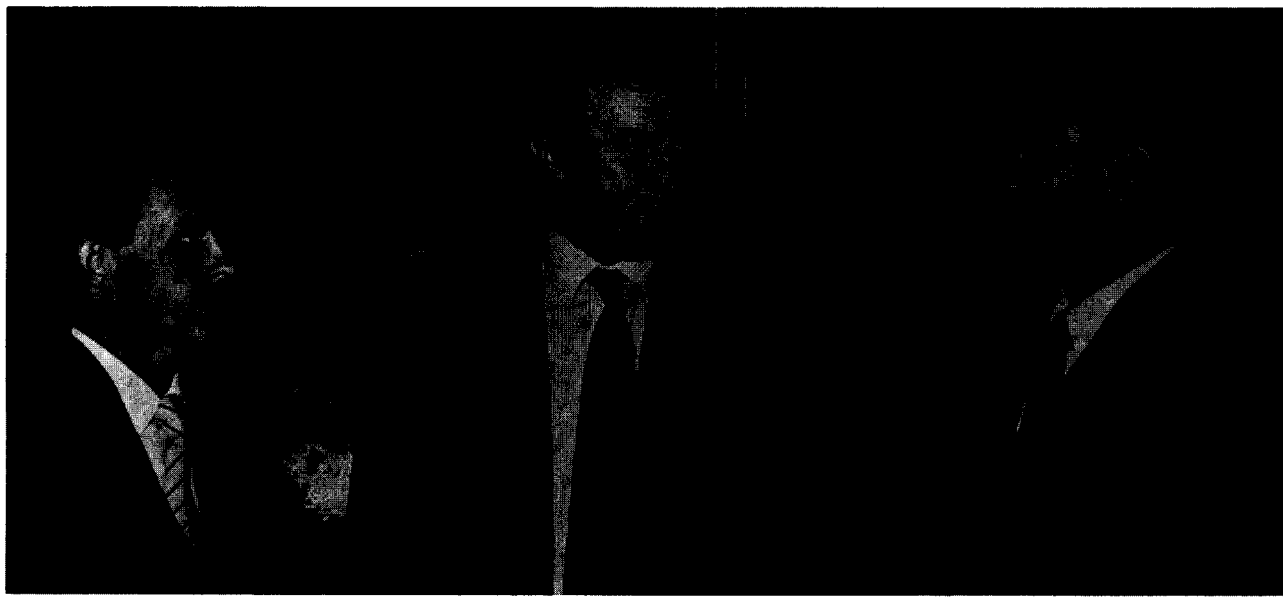
Robin A. Plumbridge, Chairman and Chief Executive, Gold Fields of South Africa Limited, delivered a short address to the gathering before handing the prizes to the recipients.

He pointed out that, in the area of social responsibility, education was the Gold Fields Group's primary commitment. South Africa faced challenges as never before, and challenges brought opportunities—opportunities to become involved in and committed to an enhanced quality of life for every citizen. The critical shortage of skills in South Africa had become a common cause and, rather than continue to talk about it, industry was now actively seeking remedies.

Gold Fields, for its part, dedicated itself to educating and training not only its own employees but, where practical, also the community at large through its Foundation's activities. By doing this, it helped to create a more-productive labour force, which benefited not only the communities of origin but also the industry in general.

Gold Fields had channelled vast amounts of money into facilities for better technical education in those areas from which it drew its labour. However, the Group also recognised needs within the sphere of academic education and made significant grants to universities and technikons in Southern Africa. Many a building project such as libraries, residences, and resource centres carried the company's name at institutions of learning across the country. Gold Fields was very proud of the educational projects with which they had identified themselves over the years, but were also aware of the need for grass-roots contact and the motivation of the individual not only to achieve a skill but also to transcend into excellence.

Mining was a dynamic industry that demanded only the best of its people, and everybody realized the importance of recognizing excellence. To create an incentive to act as a catalyst for greater achievement was the object of The Gold Fields National Engineering Awards.



Messrs Ian Goss-Ross (left) and Mike Zacharias in conversation with Mr Robin Plumbridge at the function following the presentations.