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Commercialization of the ConRoast process

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Mintek's ConRoast process was developed to address a number of the shortcomings of the traditional matte smelting process for the production of platinum group metals. It controls sulphur emissions by removing sulphur from concentrates prior to smelting. It easily accommodates high levels of chromite by ensuring that the chromium is dissolved in the slag. The concentrates undergo reduction in the furnace and the PGMs are collected in an iron-rich alloy that has a similar liquidus ('melting') temperature to that of the slag.

Independence Platinum Limited (IPt) was formed to undertake the commercial development and exploitation of Mintek's ConRoast technology, with the strategic objective of providing independent smelting and refining facilities with lower capital and operating costs for the treatment and processing of platinum concentrates, including those with high chrome and/or nickel and/or low platinum group metal values, for the development of platinum projects by emerging PGM producers in South Africa.

Independence Platinum was acquired by Braemore Resources plc in December 2006 and renamed Braemore Platinum (BPt). The company was listed on the JSE in July 2008. Braemore Platinum will be developed as an independent, vertically-integrated platinum company using its independent smelting and base metals refining facilities as a strategic platform to promote the development and mining of platinum projects for emerging platinum mining companies in South Africa through technical co-operation, strategic alliances, joint ventures, off-take, toll-refining, and marketing agreements.

Introduction

Growth in world demand for platinum is forecast to almost double over the next 10 years. That growth is expected to be driven by the consumption of platinum in automotive catalysts and other industrial uses. The prices of platinum group metals are likely to remain high during that period.

Southern Africa produces more than three-quarters of the world's platinum supply and has the reserves to continue to supply most, if not all, of the growth in world demand. Major platinum producers and junior resource companies plan to fill the supply shortfall and have targeted mineral resource projects in Southern Africa. Those projects are in various stages of development, but most emerging platinum mining companies are intending to produce flotation concentrates for toll treatment or sale under off-take agreements.

The platinum mines of South Africa have traditionally exploited the Merensky Reef of the Bushveld Complex for platinum production[1]. However, the mining of this reef is reaching depths that require significant vertical shaft systems and costly refrigeration for access to the orebodies at deeper levels. In the past decade, all of the platinum producers have begun to mine the UG2 reef because of its cheaper mining costs. UG2 ore is composed primarily of chromitite and therefore has a higher chrome content, sometimes with lower platinum group metal contents. The emerging mining companies have gained access primarily to UG2 reefs. Consequently, platinum mining is becoming more UG2-based and the resulting concentrates contain high levels of chromite, unless blended with Merensky or Platreef concentrates. UG2 or high chrome containing concentrates are difficult to smelt in the current six-in-line submerged arc furnaces and this leads to increased capital and operating costs for those smelting operations.

Many of the new project developments planned by junior resource companies are based on the mining of the UG2 reef. The proportion of platinum concentrates produced from UG2 ore is expected to increase to around 70% of all concentrates by 2015, depending on the speed with which some Platreef projects are developed. Concentrates from UG2 contain typically about 2% Cr_2O_3, but can sometimes be a lot higher.

The present smelting and base metals refining capacities in South Africa have a number of limitations and have not seen the use of a novel smelting process for many years. There are limits to the levels of chromite that can be treated using existing furnace technology. In addition to the limited smelting capacity, only the Anglo Platinum and Impala operations produce nickel as a final by-product. Nickel-refining capacity is severely limited.

At present there are approximately 30 new PGM projects under review in South Africa by various emerging mining companies. Most of these newer projects are expected to produce concentrates with higher chromium and nickel contents, from UG2 and Platreef ores, which would be metallurgically challenging for traditional 'six-in-line' smelters. Only some of the projects have off-take agreements with the major PGM producers. These off-take agreements are bound by the requirement that concentrates produced meet exacting specifications in terms of low chromium and nickel content.

This scenario has created an opportunity for an entrepreneurial company to commercially exploit advances in process technology to establish independent smelting and base metals refining facilities with sustainable competitive advantages in terms of capital and operating costs, and leverage that strategic platform to promote the development and mining of platinum projects in South Africa.

Conventional matte-smelting process

Description

The ore concentrate is dried in a spray drier or flash drier and is then transferred pneumatically from the drier into the furnace for smelting. Smelting is intended to separate the gangue (oxide and silicate) minerals from the sulphide minerals associated with the valuable metals. The molten sulphide minerals form what is referred to as a 'matte' that then undergoes further treatment. During smelting, some unreduced magnetite and other spinels, such as chromite, are associated with the matte and slag. Magnetite and chrome spinels sometimes form an intermediate viscous zone between the matte and slag layers, hindering the coalescence and settling of matte droplets from the slag, thereby causing an increase in entrainment. A build-up of magnetite or chrome spinels also causes a reduction in operational furnace volume.

Matte is further treated during the converting process, where air is blown into the molten matte, over a period of a few hours, in order to remove much of the iron and sulphur (primarily iron sulphide, FeS) by oxidation. The converter slag is periodically skimmed off, but the converter matte is poured out only once it has attained the desired low iron content of 1 to 3%. The required degree of iron and sulphur removal during converting is dictated by the choice of the subsequent base metals refining process. The converter slag requires further treatment, as the vigorously turbulent conditions cause the entrainment of prills of valuable converter matte, and the oxidizing conditions cause some of the valuable base metals (especially cobalt and nickel) to dissolve in the slag in an oxide form. In some cases, the slag is granulated and subjected to milling and flotation. (It used to be the case that the converter slag was typically recycled to the primary smelting furnace, but this practice is no longer widespread as it raised the level of spinels in the furnace.)

Of the sulphur entering the smelter, approximately 60% leaves in the converter gases, 20% in the furnace gases, 15% in the converter matte, and 5% in the furnace slag. The furnace gases have a sulphur dioxide (SO_2) content of around 0.4%, which is generally considered too low for efficient recovery. The converter gases, for 70% of the blowing time, have an SO_2 content of more than 4%; the overall gas SO_2 strength varies widely during converter operations (typically from 2.5 to 6%) and leads to erratic acid plant operation as well as expensive acid plant designs.

The converter matte is usually milled prior to treatment in the base metals refinery, where the copper and nickel are extracted typically by means of a sulphuric-acid leach process. In most plants, the leach residue makes up the high-grade PGM concentrate and is provided to a precious metals refinery for final separation of the pure precious metals.

Limitations

Environmental concerns have focused on the problem of SO_2 emissions, particularly the stray emissions found around the mouth of the Peirce-Smith converter. Even with a large (sometimes double) fume hood above the mouth of the converter, fugitive emissions remain a problem.

As increasing amounts of UG2 concentrate are processed, so the quantity of base metal sulphides decreases. The conventional process requires sufficient matte (at least 10% of the mass of the slag) to be present to allow for effective coalescence of droplets and collection of the valuable metals. This causes limits to be placed on the mining of ore such that only material containing more than a specified amount of nickel and copper is acceptable to the process. This limitation can be lifted only if additional collector material is available. (High-intensity smelting, with its associated greater degree of bath stirring, can alleviate this restriction to some extent.)

The UG2 concentrates contain significant quantities of chromite, which can result in the build-up of highly refractory chromite spinel layers in the furnace. This affects furnace operation, and the accumulation reduces the working volume of the furnace over time.

The intermittent batch mode of Peirce-Smith converting is not conducive to good plant operation and there is a significant move towards the development of continuous converting processes.

The long processing times in the refining of PGMs result in a large lockup of precious metals. Sometimes, the value of the PGMs permanently locked up inside process units exceeds the capital cost of the units themselves.

Although the UG2 chromitite horizon was identified as containing PGMs in the 1920s, it took many years for this reef to be exploited. Traditionally, the grades were regarded as lower than those of the Merensky Reef, but more recent developments have shown that in many areas the PGM values are higher than in the Merensky Reef.

A blend of Merensky and UG2 concentrates has been smelted since the late 1970s. During the 1980s, Mintek developed a process for the treatment of UG2 concentrates without the requirement for blending with low chrome concentrate. Flotation testwork showed that a UG2 concentrate could be produced having a PGM grade of around 430 g/t, at a recovery of 87%. This was achieved with a mass pull (i.e. concentrate to ore ratio) of about 1% and a Cr_2O_3 content of 2.9%. Pilot-scale tests have shown that adequate coalescence of matte prills can be obtained by the use of a higher smelting temperature, and higher power intensity (kW/m^2 of the furnace hearth area) to increase mixing in the bath. The pilot tests led to the adoption of circular electric furnaces with three graphite electrodes for UG2 smelting, as this configuration is well suited to withstand the higher temperature and power intensity required. The slag from this operation has a PGM content too high (2.5 to 3.5 g/t) to be discarded, so it is granulated and returned to a flotation circuit for the recovery of the PGMs.

The chromite problem is seen as increasingly important, as the amount of UG2 ore being mined continues to grow faster than the amount of Merensky ore.

ConRoast process

Mintek has been working since 1994 on the development of an alternative process for base metal and PGM smelting that offers greater flexibility and is more environmentally favourable. The ConRoast process[2] is based on reductive smelting in a DC arc furnace in the effective absence of sulphur, where an iron-based alloy is used to collect the valuable metals. The original impetus for the process was environmental, but, once developed, it became apparent that the process had another significant advantage for the platinum industry in South Africa, as it was not affected at all by the chrome issues that have caused problems for the traditional 'six-in-line' smelters.

The sulphur problem

The emission of SO_2 (sulphur dioxide) from furnaces and converters is hard to avoid when using a sulphur-based process. However, the ConRoast process does not rely on the presence of sulphur, as it smelts essentially sulphur-free material in a DC arc furnace and collects the valuable metals in an iron alloy. Sulphur can be removed, prior to smelting, using a fluidized-bed roaster which is a well-enclosed vessel that produces a steady continuous stream of SO_2 that can be used for the production of sulphuric acid. Compared to the traditional matte smelting process, emissions of SO_2 can be orders of magnitude lower if the ConRoast process is used. The capital costs of acid production can also be reduced markedly.

The chromium problem

The traditional matte-smelting process imposes strict limits on the quantity of chromite (prevalent in the UG2 reef) that can be present in the smelter feed. This restricts the recovery of the PGMs in the production of ore concentrates. The ConRoast process eliminates the chromium constraint in smelting and so opens up huge opportunities in the types of materials that can be smelted, and provides an opportunity to significantly enhance the overall process recovery of PGMs (through removing the restrictions in concentrator operations).

The containment problem

As the South African platinum producers have moved increasingly to processing ore from the UG2 reef to supplement the previous production from the Merensky Reef, there have been numerous furnace failures and explosions in the industry. Even though water-cooled copper cooling systems have been introduced in recent years, the highly superheated and corrosive molten matte in traditional smelters is inherently difficult to contain. The ConRoast process is able to use a simple and robust design of furnace, because the melting temperatures of the slag and alloy are close to each other.

Benefits resulting from the implementation of the ConRoast smelting process include:

- Significant advantages in terms of environmental impact, health, and safety
- Sulphur emissions are captured and removed from the enclosed roasting equipment in a continuous stream of sulphur dioxide gas, which is fed to a secondary plant to produce sulphuric acid for use in downstream base metal leaching operations
- The ConRoast process provides great flexibility for treatment of a range of ore types and concentrate compositions without imposing limits on the minimum quantities of contained base metals or sulphur.
- The reductive smelting conditions in the DC arc furnace remove the constraint on the allowable chromite content of the UG2 ore concentrates. In the smelting work done to date, as much as 99.5% of the incoming chromite reports to the slag.
- The fact that the ConRoast process can smelt high-chrome content concentrates with ease has positive implications for PGM companies seeking to maximize recoveries from their resource and reserve base. In order to produce concentrates with the low chrome content necessary for acceptance by traditional smelters, recoveries of PGMs are generally compromised at around 82%. By relaxing the chrome constraint, concentrator operators expect to be able to increase overall PGM recoveries to about 88% (albeit that the resulting concentrate might have a lower PGM concentration). This additional recovery of PGMs, from material that would otherwise be sent to the tailings storage facility, generates significant additional revenue. Hence, the ConRoast smelting technology permits greater recoveries from orebodies.
- The ConRoast process produces a metal alloy, as opposed to the sulphide matte produced in 'six-in-line' furnaces. The alloy (containing iron, nickel, copper, cobalt, and PGMs) can be water-atomized to produce fine particles (with a mean particle size that can be controlled to anywhere between 20 and 100 μm, depending on the prevailing conditions) that ensure very rapid leaching kinetics in subsequent hydrometallurgical processing.
- Overall the ConRoast process achieves very high metal recoveries and produces high purity metals and a clean high-grade concentrate of PGMs for precious metals refining.

Formation of Braemore platinum smelters

Independence Platinum Limited (IPt) was initially formed by Atomaer to undertake the commercial development and exploitation of Mintek's ConRoast technology, with the strategic objective of providing independent smelting and refining facilities with lower capital and operating costs for the treatment and processing of platinum concentrates, including those with high chrome and/or nickel and/or low platinum group metal values, for the development of platinum projects by emerging PGM producers in South Africa.

IPt entered into an agreement with Mintek to fund a three-year development and demonstration programme of work (to the value of US$15 million) in order to set up a smelter based on Mintek's ConRoast process, in exchange for a ten-year period of exclusive use of this technology.

Independence Platinum was acquired by Braemore Resources plc in December 2006 and renamed Braemore Platinum (BPt). Braemore Platinum will be developed as an independent, vertically-integrated platinum company using its independent smelting and base metals refining facilities as a strategic platform to promote the development and mining of platinum projects for emerging platinum mining companies in South Africa through technical co-operation, strategic alliances, joint ventures, off-take, toll-refining, and marketing agreements.

Braemore Resources plc—listed on AIM and JSE

Braemore Resources plc is a company listed on the JSE and AIM. Its two current largest shareholders are Atomaer (40%) and BAC (10%).

Braemore Resources plc listed on AIM on 10 March

2005, classified under 'Mining – General Mining', with the share code 'BRR'. The IPO raised approximately £900 000 (net of expenses).

The company was listed on the JSE on 16 July 2008.

Braemore group structure and nature of business

The principal activities of Braemore Resources are:

- Evaluating, establishing, and operating independent facilities for the roasting, smelting, and refining of sulphide concentrates containing PGMs and associated base metals from emerging platinum producers in South Africa
- Evaluating, establishing, and operating facilities for the reclamation and processing of sulphide nickel tailings.

Braemore is not currently directly involved in mining operations, but has licenses to technology that is part of the value chain, whereby the precious and base metals are further processed for recovery and ultimate sale. The company intends to expand its direct exposure to mining operations in the future, through strategic alliances or joint ventures with selected new platinum producers. Through its subsidiary Braemore Platinum Smelters, the company has exclusive rights to Mintek's patented ConRoast technology for PGM processing. Braemore intends to use this technological advantage to leverage itself into projects and strategic alliances or joint ventures with selected new platinum producers.

The company structure of Braemore Resources is shown in Figure 1.

(i) Braemore Nickel (Pty) Ltd was acquired in July 2005 and is a wholly-owned subsidiary of Braemore. The company is evaluating the reclamation and processing of sulphide nickel tailings at BHP Billiton's nickel operations located at Leinster, Mt Keith, and Kambalda in Western Australia. The company has the rights to conduct pilot test work and to complete a definitive feasibility study on BHP Billiton's tailings.

(ii) Braemore Platinum (E&W) is a holding company for Braemore Resources plc's South African investments.

(iii) Braemore Precious Metals Refiners and Braemore Platinum Resources are currently dormant but will form the platform for future growth into mining and precious metals refining.

(iv) Braemore Platinum Smelters (Pty) Ltd has been in business since November 2006. The company is evaluating, establishing, and operating independent base metals refining facilities for the smelting and refining of PGM-containing sulphide concentrates from emerging platinum producers in South Africa using the ConRoast process. The company is in the process of completing a definitive feasibility study for the erection of the first 10 MW ConRoast smelter which will be situated on the Western Limb of the Bushveld Complex. Current smelting operations are based at Mintek.

(v) Braemore Resources plc was listed on the JSE on 16 July 2008.

Partnership with Mintek

Mintek is a statutory research council constituted in South Africa, and a leading metallurgical research organization with worldwide recognition, engaged in the development, commercialization, and promotion of technologies for the processing of minerals worldwide. Through Mintek, many ground-breaking metallurgical process developments have evolved.

By encouraging Mintek to generate much of its own revenues as a result of reduced government subsidies, this world-class research organisation has become a commercial leader in terms of metallurgical test work and commercialization of innovative mineral technology.

It is this foresight that has resulted in the commercial

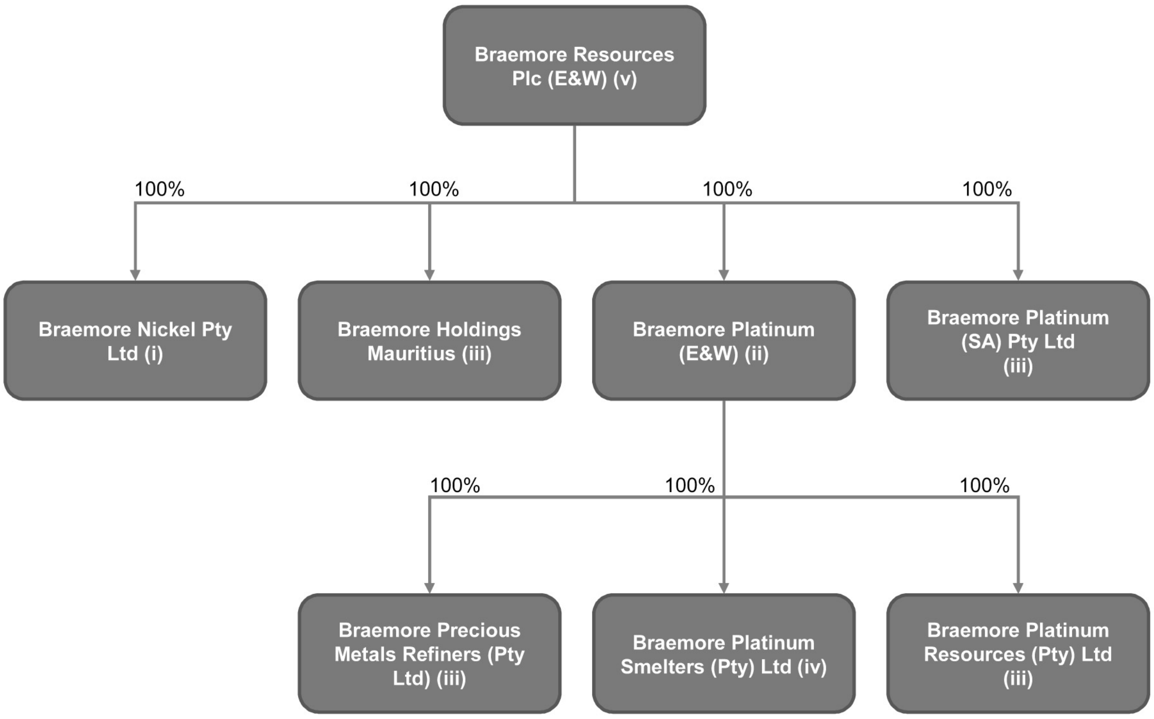

Figure 1. Company structure of Braemore Resources

development of its patented ConRoast technology – which might have the same impact on the PGM industry as the introduction of SX-EW had to the copper industry, or CIP to the gold industry, improving recoveries and significantly reducing operating costs. ConRoast technology is at the forefront of the emergence of the next wave of PGM production from South Africa from the chrome-rich UG2 reef and nickel-rich Platreef.

Objectives of Braemore platinum smelters

Under the auspices of the ConRoast Technology Agreement with Mintek, Braemore Platinum Smelters is set up to evaluate, develop, and operate independent smelting and refining facilities for the processing of concentrates containing PGMs and base metals. The company has the following objectives:

- To demonstrate and introduce more efficient process technology with a lower cost structure in terms of capital and operating costs, in the smelting and refining of metal sulphide concentrates containing platinum group metals and base metals
- To meet the projected shortage in smelting and refining capacity emerging from the development of platinum projects by junior resource companies in the platinum industry in South Africa, especially those of historically disadvantaged South Africans
- To provide smelting and refining facilities and capacity for the treatment and processing of metal sulphide concentrates containing platinum group metals and high chrome values which would not be totally amenable to treatment and processing at existing smelters and refining complexes in South Africa
- To provide for participation in the ownership of Braemore Platinum Smelters by and for the benefit and economic empowerment of historically disadvantaged South Africans.

Braemore strategy

Braemore's objective is to develop into a top-ten international producer of nickel and PGMs by growing assets and earnings from the production of nickel and PGMs through the acquisition, development, mining, and processing of mineral resources and exploiting advances in process technology to reduce capital and operating costs in the extraction and production of nickel and PGMs.

Braemore continuously investigates nickel and PGM opportunities internationally. The ability to process complex or difficult concentrates using ConRoast technology has increased the range of projects that Braemore can consider.

With a positive outlook for demand on both nickel and PGMs, primarily driven by underlying base load demand in the West and emerging demand in China and India, Braemore looks forward to unlocking the considerable potential of its projects in both South Africa and Australia and emerging as a significant producer of these important metals.

Status of Braemore Platinum's Conroast testwork

A wide range of metallurgical testwork has been carried out during the past two years.

Small-scale roasting and smelting tests on a range of PGM concentrates have been completed at Mintek. Pilot-plant roasting testwork has been carried out successfully by Technip[4] in the USA, and by Outotec[5] in Germany, in order to demonstrate the viability of the roasting process and to obtain sufficient engineering data for the design and costing of the full-scale equipment. The demonstration roasting of 300 tons of PGM-bearing flotation concentrate (containing about 7% sulphur) in Germiston has also been completed, in preparation for further smelting testwork using this material.

The ConRoast process produces an iron-rich alloy. After tapping the alloy from the furnace, it needs to be produced in a physical form that is conducive to further processing. Water atomization or granulation of the molten alloy can be used for this purpose. Testwork was carried out at Atomising Systems Ltd[6] in the UK that successfully demonstrated the production of fine powders that are very suitable for further hydrometallurgical processing. Granulation is currently routinely carried out on the alloy produced from the Mintek smelter.

The alloy product from the DC arc furnace requires iron removal. The two principal options that have been explored are to do this either pyrometallurgically (by converting) or hydrometallurgically (by leaching).

Small-scale converting tests of the PGM alloy have been conducted at Mintek[7]. Some preliminary pilot-scale converting work has also been done at Mintek. A few conceptual designs of various converting options have been prepared.

A comprehensive leaching test programme has been undertaken, and a conceptual design has been prepared for a hydrometallurgical pilot plant.

Braemore has, so far, met the contractual milestones set by Mintek.

Braemore Platinum's projects

Braemore Platinum is proceeding with the implementation of plans for the commercialization of ConRoast initially through the Mintek smelter in Randburg (Johannesburg) and then through the development and operation of 10 MW, and ultimately 35 MW, independent smelting and base metals refining facilities in South Africa.

1.5 MW smelter

A demonstration-scale 1.5 MW furnace was in operation for Braemore at Mintek from the end of September 2007 (when Braemore initiated a five-year lease on the smelter) to 8 August 2008, when it was shut down for an upgrade to double the capacity of the plant. (This smelting operation was a continuation of that previously used for the smelting of revert tailings[3] from 2004 to 2007.) The smelter incorporated an externally electrically heated rotary kiln drier to remove moisture from the feed material prior to smelting. The 3 m diameter furnace smelted various difficult concentrates at a nominal throughput of 1 000 tons per month. In just over ten months of operation, 9 500 tons of feed material was smelted, resulting in the production of approximately 840 tons of alloy. In the first nine months of operation, approximately 15 000 ounces of PGMs (4E: Pt, Pd, Rh, Au) were produced in granulated alloy form. A summary of the first three quarters of operation is shown in Table I.

3 MW furnace

The Mintek smelter has recently been expanded to 3 MW, effectively doubling its capacity. An industry-standard flash drier and pneumatic feed system has also been added to the

Table I
Mintek's 1.5 MW furnace production summary for first nine months (Oct 2007 – Jun 2008)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
Tons smelted	849	943	972	826	986	1057	837	884	944	8 297
PGM in alloy (4E) (oz)	1 333	2 622	2 309	2 071	1 615	1 153	933	1 197	1 746	14 979
PGM (4E) in slag (g/t)	2.1	1.0	1.0	0.6	0.5	0.3	0.7	1.5	1.0	0.9
Built-up recovery	97%	99%	99%	99%	99%	99%	98%	97%	99%	99%

plant. Commissioning of the 3 MW (4.25 m diameter) furnace is scheduled for September 2008. The 3 MW furnace is expected to smelt 2 000 tons of concentrate per month, or 24 kt/a. Together with an expected increase in feed grade, Braemore expects the increased capacity to result in an annual production of about 60 000 oz of PGMs.

10 MW furnace

A definitive feasibility study for a 10 MW furnace in the Rustenburg area was completed by TWP Consulting in July 2008. This 10 MW furnace is designed to smelt 80 kt/a of concentrate. This furnace is planned to start up at the end of 2010.

35 MW furnace

A second feasibility study for a plant incorporating a fluidized bed roaster and a 35 MW furnace (for Platreef application) is also under consideration. This 35 MW smelting and refining facility would be capable of processing at least 360 000 tons per annum of PGM-containing sulphide concentrates, to extract and produce up to 30 000 tons of nickel metal, 15 000 tons of copper metal, and 1 000 000 ounces of PGMs in a high-grade PGM iron alloy for subsequent precious metal refining.

Conclusions

The changing nature of the mix of platinum ores likely to be mined in the future requires new independent smelter capacity applying new smelting technology that can accommodate difficult concentrates, especially those with a high chromite content. Braemore Platinum with its proven and patented ConRoast smelting technology, exclusively licensed from Mintek, has the ability to process these concentrates.

Metallurgical testwork for the demonstration of the full ConRoast process has proceeded successfully. Work done to date has included fluidized bed roasting, water atomization of alloys, converting for iron removal, and a comprehensive programme of hydrometallurgical testwork.

Braemore Platinum will be proceeding with the implementation of plans for the development and commissioning of independent smelting and base metals refining facilities in South Africa. This will be done in a staged approach, commencing with demonstration smelting on a commercial scale at Mintek, which is already underway.

Braemore has become a new PGM producer, having smelted 9 500 tons of PGM-containing feed materials over a ten-month period in a 1.5 MW furnace at Mintek. In the first nine months of operation (to end June 2008), approximately 15 000 ounces of PGMs (4E: Pt, Pd, Rh, Au) were produced in granulated alloy form. This operation allowed Braemore to start generating a cash flow at an early stage of the project. Sales contracts for future delivery of smelted PGM alloy have been entered into with a number of refiners and PGM producers. During this period of operation, the sulphur dioxide (SO_2) emissions from the smelter were negligible, with the off-gas from the stack averaging two parts per million (ppm).

The Mintek furnace has been upgraded to 3 MW, thereby doubling its capacity to allow it to smelt 2 000 tons per month.

The results of the definitive feasibility study for the 10 MW furnace are expected to be released soon, followed by a decision about proceeding with the construction. It is currently planned that a decision will be made around the end of the third quarter of 2008 for a dedicated 10 MW smelter to be constructed on a suitable site to facilitate the large-scale processing of purchased chrome-rich or other difficult PGM concentrates. A furnace of this rating is designed to process 80 000 tons of PGM ore concentrate per year. This will be the first independent smelter and should be commissioned around the end of 2010.

Acknowledgement

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Richard holds a National diploma in Extraction Metallurgy from the Technikon Witwatersrand and a bachelor of Arts degree from UNISA, he worked for Anglo Platinum for over 25 years and was Manager Metallurgy at Rustenburg Platinum Mines-Union Section and Regional Advisor - Metallurgy for the Western Mines Division. He was appointed as CEO for Independence Platinum in 2006 and Chief Operating Officer for Braemore Resources Plc in June 2007.