

COBALT

By Michael Hawkins

Apparent worldwide refined cobalt demand in 2004 was about 51,400 t, an increase of 8.3% over 2003. The increase results almost exclusively from the massive increase in demand in Asia, notably by China and Japan.

Refined cobalt availability worldwide totalled 49,536 t, 4,641 t higher than in 2003.

Production

In 2004, refined cobalt production by Cobalt Development Institute (CDI) members totalled 32,711 t, 1,307 t higher than in 2003. Overall worldwide availability was 49,536 t, 4,641 t higher than in 2003. The major increase was noted in China, which increased its production to about 8,000 t, an increase of nearly 75% over 2003.

No new cobalt producers have entered the market place in the past two years although a number of existing producers have increased production to take advantage of the high prices.

In Australia, Murrin Murrin continued to have technical problems, which resulted in lower production than in 2003. In Uganda, Kasese Cobalt re-opened its cobalt refinery in May 2004 and Umicore in Belgium increased its production of refined cobalt as a result of the high cobalt price throughout 2003.

Initial reports indicate that refined cobalt availability in the first half of 2005 increased by about 12% to 26,950 t, compared with the same period in 2004. Nickel producers increased their production to take advantage of the favourable nickel and cobalt prices and Chinese production continued to increase in line with Chinese demand. Murrin Murrin continued to have technical problems, which resulted in further reductions in their production and Chambishi Metals confirmed that its production will be down in 2005 as a result of a shortfall in mine feedstock.

New production developments

In March 2004, BHP Billiton announced it would proceed with the development of its Ravensthorpe Nickel Project in Western Australia and the extension of its Yabulu nickel/cobalt refinery in Queensland. The operation is targeted for commissioning in November 2007 and will increase QNI's production to 3,500 t/y.

The increase in cobalt demand in China, coupled with its lack of domestic ores, resulted in Chinese producers seeking to secure feed materials from external sources. In 2004 and 2005, agreements were entered into, to fund the Ramu Nickel Project in Papua New Guinea and develop the former Mindoro Nickel Project in the Philippines. Also, the Chinese producer Jinchuan entered into discussions with Philnico Industrial Corp to revive the former Nonoc operations in the Philippines.

In April 2005, Jinchuan Group announced that it had completed commissioning its new 4,000 t/y refinery in China and its total capacity now stands at 6,000 t/y.

Commissioning of the Coral Bay Nickel Project in the Philippines commenced in September 2004, and in March 2005 the first shipments of mixed Ni/Co sulphides were shipped to Sumitomo Metal Mining for treatment. This operation is expected to add about 700-800 t/y of cobalt to the market.

In April 2005, European Nickel announced its first production of Ni/Co hydroxide from the pilot plant at its heap leaching operation in Turkey. Shipments of this material to BHP Billiton's Refinery in Australia commenced in June 2005. Subject to financing, construction of a full-scale plant will begin in 2006.

In March 2005, Sherritt announced that it intended to increase its nickel and cobalt production at Fort Saskatchewan in Alberta, Canada, by about 50% from increased concentrate shipments from Moa Bay in Cuba. The increased production is unlikely to reach the market until about 2007.

In October 2004, Inco announced that would proceed with its Goro Nickel Project in New Caledonia with Sumitomo Metal Mining Co and

Mitsui & Co. Production is targeted to commence in September 2007.

Inco also announced that it expects to deliver concentrates from Voisey's Bay to its Ontario or Manitoba operations by about November 2005

Formation Capital announced plans to commence production at its Idaho property in the US during 2006. Capacity of about 1,500 t/y will not be achieved until 2008.

In October 2004, a new mining code was adopted in the DRC aimed at encouraging the development of mining resources by private investors. A number of projects are currently at various stages of development but because of continuing political uncertainty in the country, it has yet to be seen whether or not financing will be available for these projects to proceed in the near future. They include: Adastra Minerals' Kolwesi Tailings Project and Metorex's Ruashi, and Etoile stockpile and mine.

In June 2005, Caledonian Mining announced that it had signed a letter of intent with a large refinery for the long-term supply of concentrates from its Nama Project in Zambia. Concentrate samples are being tested and if successful results are achieved a pilot plant will be built as soon as practicable at Nama, with assistance from the refinery.

India's Nicomet announced that it was increasing its cobalt production to 60 t/mth immediately. The company plans to increase production to 75-90 t/mth by the end of the year. Similarly, Rubamin announced that it was expanding cobalt production to 500 t/y, beginning in November 2005.

In Brazil, Companhia Niquel Tocantins announced plans to increase production to 1,420 t/y. On July 1, 2005, Companhia Vale do Rio Doce (CVRD), announced plans to start construction of its Vermelho nickel mine operations in northeastern Brazil in February 2006. The mine is projected to start production in 2008, and will produce 45,000 t/y of nickel and 2,800 t/y of cobalt using high pressure acid leaching technology.

Other projects, which are at the exploration, pre-feasibility or feasibility stage have been in the news

in the past year. These include: Weda Bay's Indonesian Halmehera Project; Geovic's primary cobalt deposit in the Cameroons; Pearce Matheson Group's Malborough nickel/cobalt deposit in Australia; Dynatec's nickel/cobalt project in Madagascar; Fortune Minerals Nickel Co's gold/cobalt/bismuth project in Canada and Baja Mining's El Boleo copper/cobalt/zinc deposit in Mexico.

Demand

According to the CDI, worldwide demand in 2004, as derived from import/export figures, exceeded 50,000 t. The increase in demand was almost exclusively seen in Asia, particularly Japan, China and South Korea.

Reports of a decline in sales to the battery sector, during the first half of 2005, suggest that this apparent demand may include some stocks in consumer's hands at the end of 2004. In spite of these reports initial figures suggest that the apparent worldwide demand increased to about 29,000 t in the first half of 2005. The increase was almost exclusively noted in Japan, China and South Korea although about a 7% increase was also seen in the US.

The massive increase in demand in the past two years has mainly been in chemical applications, which today account for 50% of the worldwide cobalt demand. By far the greatest growth has been in the rechargeable battery sector, which now accounts for about 21% of worldwide demand. Large increases have also been seen in catalysts used in the plastics and textile industries.

Demand for superalloys increased by about 10% in the first half of 2005 as a result of the continued recovery of the commercial airline industry following the terrorist attack in New York in 2001. Smaller increases were noted in the hard metals and other chemicals sectors.

New developments in demand

Rolls Royce estimates that 96,000 new civil aircraft engines will be required in the next 20 years. The major growth will be seen in China. Cobalt will continue to be a major material in superalloys, so

that demand is projected to increase steadily during this period.

The high price of cobalt over the past two years has resulted in battery manufacturers making strenuous efforts to develop batteries based on alternative materials.

Umicore and Sanyo announced plans to produce lithium-ion batteries using a combination of nickel, cobalt and manganese, containing up to three times less cobalt than traditional cobalt-based batteries. These batteries are reported to have the equivalent properties of conventional batteries based solely on cobalt.

During the past year, global demand for Li-ion batteries has grown rapidly as a result of the increase in demand for mobile phones, portable PCs and electronic devices. The global demand for mobile phones is expected to reach two billion by 2006.

In spite of the reduced cobalt content in the newly developed Li-ion batteries, demand for cobalt is expected to continue to grow (albeit at a slower rate) in the next few years. To meet the anticipated demand, Tanaka Chemicals announced it will increase its production capacity of cobalt, nickel and manganese in October 2005 by over two and half times current levels.

There has been a significant increase in interest in hybrid vehicles during the year. Plans to introduce new models of hybrid vehicles into the market over the next couple of years were announced by Toyota, General Motors, Daimler Chrysler and Ford. Toyota also plans to commence production of its Prius in conjunction with a Chinese partner. Analysts estimate that hybrid vehicles could consume between 2,000 and 3,800 t/y of cobalt by 2010, and between 5,500 and 8,500 t/y by 2015.

Interest in gas-to-liquid (GTL) technology, which uses cobalt as a catalyst, has also increased significantly in the last year.

Major developments to turn natural gas into clean-burning diesel fuel in Qatar were announced. The Oryx plant under construction will be the largest in

the world and is due to commence production in 2006. By 2011 GTL plants in Qatar are projected to produce 300,000 bbl/d of liquid fuel.

Sasol in South Africa also announced that it is studying possibilities of establishing GTL plants in Iran, Australia, Venezuela, Russia and Indonesia.

The number of GTL facilities is expected to increase markedly in the next few years. Views differ as to the amount of cobalt that will be required for this application.

A number of potential new applications have been announced in the past year.

A group of engineers at the University of Delaware, US, has discovered a cobalt-containing auto exhaust catalyst that rivals the performance of traditional catalysts based on precious metals.

The researchers demonstrated that catalysts containing 5% cobalt and 15% barium are as effective as catalysts containing 1% platinum.

DePuy Spine Inc announced that the US Food and Drug Administration (FDA) approved the Charité artificial disc, a device that treats severe low back pain by replacing a damaged or worn spinal disc with an artificial one. The artificial disc comprises two end plates made of high-quality cobalt chromium alloy with an ultra-high molecular weight polythene sliding core placed between them.

Cordis Endovascular announced the US launch of the PALMAZ® BLUE™ Transhepatic Biliary Cobalt Chromium Stent, the latest advancement in balloon-expandable stent technology. The stent, manufactured from a cobalt alloy enhanced with tungsten, is stronger than stainless-steel stents, and uses less metal. It is designed to provide physicians with increased radiopacity, low profiles and superior flexibility and deliverability.

Health, safety and the environment

In the past year, REACH procedures for the implementation of the EU New Chemicals Management Policy have progressed rapidly. The REACH Proposal drawn up by the EU Commission was sent to the European Parliament for

consideration at the end of January 2005. Three European Parliament committees are currently scrutinising the proposal and various amendments proposed by the industry. The three committees will vote on the proposal between August and October, and the European Parliament will have a final vote in November 2005. Following the European Parliament review, the EC will consider any amendments and draw up a new proposal for submission to the European Parliament for final approval. Implementation of this legislation is scheduled for the first half of 2007.

During 2004, the EU Commission Working Group on the classification and labelling of Dangerous Substances, agreed that cobalt nitrate, cobalt carbonate and cobalt acetate be classified as dangerous for the environment, very toxic to aquatic organisms and may cause adverse effects in the environment (N, R50-53).

The EU CMR classification and labelling Group also agreed that all soluble cobalt compounds (cobalt chloride, cobalt nitrate, cobalt acetate, cobalt sulphate and cobalt carbonate) be classified as Category 2 for reproductive toxicity and cancer (R49) and that Category 3 may cause irreversible effects for mutagenicity (R68)

Price

The year 2004 opened with the continued perception of a pending shortage of cobalt as demand increased rapidly. This resulted in the cobalt price rising steadily in the first quarter of the year peaking at US\$25.50/lb and US\$28,50/lb for high- and low-grade metal respectively by mid March. Thereafter, the price eased slightly and settled at about US\$26.00/lb where it remained until the end of June. As prices rose in the first quarter, the differential between the high and low grade cobalt quotation widened to about US\$2.50/lb reflecting a tightness in supply of high-grade metal, which is needed by the superalloy and re-chargeable batteries sectors.

In the second half of 2004 prices declined slowly as consumers realised there was no shortage of metal and producers began to reduce their inventories to maintain sales, so that by the end of the year prices had fallen to about US\$19.40/lb and US\$18.50/lb for high- and low-grade metal respectively.

In the first half of 2005 the price of cobalt continued to fall, reaching US\$13.30/lb and US\$12.20/lb for high- and low-grade metal respectively at the end of June. However, there were several reports of low-grade metal being sold below US\$12.00/lb during June. The decline in price was attributed to consumers, particularly in the battery sector, liquidating inventories in the first half of the year.

In July, prices began to rise again as consumers returned to the market and by the end of the month prices had risen to US\$14.10/lb and US\$12.70/lb for high- and low-grade metal respectively.

National stockpile

The Defense Logistics Agency (DLA) continued to sell cobalt from the US National Stockpile. At the end of June, 2005, its stock of uncommitted cobalt totalled 4,234,395 lb (1,920.69 t) and its committed stocks totalled 101,797 lb (46.17 t).

The 1,920.69 t of uncommitted cobalt in the stockpile are likely to be sold by mid 2006 after which the DLA will cease to be a supplier of cobalt to the market.

In June 2005 the DLA announced it was temporarily stopping sales of high-grade UMK and Inco cathodes. If this hold on sales is maintained, sales of cobalt from the US National Stockpile could cease before the end of 2005.