MANGANESE

By Ian Robinson

A 6.4% rise in world production of steel to 886.7 Mt boosted demand for manganese in 2002. Supply disruptions combined with stronger demand to bring the manganese alloy market into better balance, despite the massive global overcapacity. Prices of metallurgical ore (48-50% Mn) remained within the range US$1.94-2.03 fob per metric tonne unit (mtu) throughout the year but alloy prices increased and the *Metal Bulletin* quotations for both high-carbon (HC) ferromanganese and silicomanganese rose from the range €480 – 510/t at the beginning of the year to €500 – 550/t at the end of the year.

World producers

In a presentation in June 2002, BHP Billiton highlighted the contrast between the highly consolidated manganese ore business and the fragmented alloy business where there is a low barrier to entry.

Total world production of ore is at an annual level of about 6 Mt of contained manganese. International trade in manganese ore is dominated by four companies which produce high-grade ore (with a Mn content of over 35%). Together, BHP Billiton, Eramet, Assmang and CVRD produce about 50% of world production.

BHP Billiton, which produces ore in both South Africa and Australia, is the leading producer with a 22% share of the global market. Eramet of France, which controls the Comilog operations in Gabon, is in second place with a 12% share, followed by Brazil's CVRD and South Africa's Assmang, both with 8% shares. The CIS and China produce low-grade ore for domestic production of alloys, each with an 11% share of the world market.

China and the CIS are the largest world producers of manganese alloys with shares of 28% and 17%, respectively, of total world production of about 7.5–8.0 Mt (including ferromanganese, silicomanganese and manganese metal). A large proportion of Chinese production is based on imports of high-grade ore and during the first half of 2002 Chinese imports of ore increased by 26% to 980,000 t over imports during the first half of 2001 (780,000 t).

Actual world production of manganese alloys is well below production capacity and Metal Bulletin Research (MBR) estimates that total world production capacity is 11 Mt/y, split approximately 50/50 between ferromanganese and silicomanganese.

The four leading producers of ore, (as noted above) which together account for half of world production, only have a combined 27% share of world alloy production. Eramet is the largest single world producer of manganese alloys with a 12% share, followed by BHP Billiton with a 9% share.

BHP Billiton

BHP Billiton, the world's largest producer of manganese ore, raised production of both ore and alloys by substantial margins during the second half of 2002. Ore production was increased by 19% to 2.15 Mt and alloy production by 16% to 365,000 t.

The group's manganese division, Samancor Manganese, has mining operations in the Hotazel area in the Kalahari Manganese Field in South Africa and on Groote Eylandt (Gemco), an island off the coast of Australia's Northern Territory.

Samancor's metallurgical operations in South Africa are located in three centres – at Meyerton, where subsidiaries Metalloys and Advalloy produce manganese alloys, and at Nelspruit and Krugersdorp, where subsidiary Manganese Metal Co. produces manganese metal. In Australia, manganese alloy is produced at Temco's Bell Bay operation in Tasmania.

Samancor operates two mines in the Kalahari manganese field, which contains the world's largest known terrestrial resource, representing some 80% of total world resources. The group's Hotazel mines comprise the Mamatwan opencast operation and the Wessels underground operation. Mamatwan upgrades a portion of its ore production to produce sinter products which supplement its sales of ore.

The sinter plant has an annual capacity of 1.0 Mt and increased production in 2002 to about 900,000 t from about 700,000 t in 2001. About 40% of the production of sinter is exported and the balance is sent to the Metalloys smelter at Meyerton.

Ore from both South Africa and Australia is blended to produce the optimum feed blend for both the South African and Australian alloy operations.

Mamatwan is the group's lowest unit cost producer, followed by Wessels with Gemco the highest cost producer. Ferromanganese producer Metalloys is very low on the cost curve and Temco is a little higher but it is still a relatively cheap producer.

The group is making higher profits from its sales of ore than from its alloy operations and in South Africa only about 35-40% of its ore production is consumed in the group production of alloys at Metalloys. Samancor has embarked on an intensive programme to improve productivity on its mines and, as part of this campaign, an integrated software programme was introduced on both Hotazel mines during the year.

There was a change in ownership of BHP Billiton's partners in the Advalloy joint venture adjacent to Metalloys when Japan Metals & Chemicals (JMC) sold its 35% share to its Japanese partner Mitsui & Co. Advalloy was formed as a joint venture in 1996 between Samancor (50%), JMC (35%) and Mitsui (15%) to produce refined manganese alloys.

Ore projects
New projects to develop ore resources proceeded in both South Africa and Australia.

In South Africa, Assmang's Nchwaning No.3 shaft complex is scheduled for completion by the end of 2003. The complex will have a life in excess of 20 years and will supply the total estimated sales requirement for high-grade ore.

Assmang aims to make the No.3 shaft the lowest cost underground manganese mine in the world. The new shaft system, which comprises a decline and two vertical shafts, will shorten the distance between the shaft and the working faces and will access ore at a depth of about 400 m on the other side of a major graben fault structure situated between Nos.2 and 3 shafts. Problems associated with ground conditions and the commissioning of the 2.2 km long decline have caused the final estimated cost to completion to rise by R68 million to R585 million.

The No.3 shaft will supply Assmang's Cato Ridge manganese alloy plant, some 60 km inland from the port of Durban, with a higher-grade feed, enabling it to reduce production costs. The ore will have a higher manganese/iron ratio than current production from the No.2 shaft, and less variability in specifications.

Assmang increased sales of both ore and alloy during the second half of 2002. Sales of ore (excluding intra group) rose by 7.1% to 409,000 t relative to the first half of 2001 (382,000 t) and sales of ferromanganese rose by 13.5% to 96,9000 t compared with 85,400 t.

In Australia, Consolidated Minerals raised the resource base of its Woodie Woodie project in Western Australia by 3.0 Mt. This project supplies about 5% of world production of high-grade ore and ships up to 350,000 t/y of 48% manganese ore to various markets, including China, Japan, South Korea, Taiwan and eastern Europe.

The company claims that it will be able to maintain its current production level for a period of ten years rather than the six years originally anticipated. The ten-year operation plan will begin in 2003 and the revised mining and production schedule has been developed in line with the expanded exploration programme.

In India, the Indian Planning Commission's working group on ferro-alloys called for further exploration of manganese ore deposits to reverse dwindling reserves of high-grade ore. The group said that no new reserves had been found over the past 50 years in India although the tonnage of reserves classified as 'proven' has increased from 28 Mt to 40 Mt. The group recommended that more exploration should be done to bring more probable and possible reserves into the proven category.

Production of manganese ore in India has been falling. In the 1995–1996 fiscal year, production was 1.84 Mt but this fell to 1.56 Mt in 2001-2002.

Manganese alloys

The year was characterised by supply disruptions to the world's largest manganese alloy producer, Eramet of France, and the increasing influence of China on world manganese alloy markets.

Eramet has a manganese alloy capacity of over 1.1 Mt/y from ten production sites in France, Norway, China and the US. In March, the larger of the two furnaces at its Boulogne ferromanganese plant in France suffered a breakdown. The HF7 blast furnace has an annual capacity of about 250,000 t of a total plant capacity of 375,000 t/y. A few weeks after it had re-opened, an explosion forced it to close again in June.

The HF7 furnace at Boulogne was re-opened in September 2002, but problems elsewhere in the group resulted in further loss of production. The FD12 ferromanganese furnace at Sauda in Norway was relined during the second half of the year and production was disrupted at Eramet's plant at Marietta, Ohio in the US following the breakdown of a crane.

International Manganese Institute (IMnI) Secretary-General, Ann Tremblay, highlighted the growth of China's share of world manganese alloy production. Institute data showed that in 1997 China accounted for a 27% share of world manganese alloy production but in 2001 this share had grown to 32%. Metal Bulletin Research (MBR) analyst Amy Bennett has pointed out that integrated manganese producers such as BHP Billiton and Eramet which produce both ore and alloy have fostered the growth in Chinese alloy production through exports of ore to China. In the past, integrated producers had attempted to restrict their exports of ore to China to protect their own alloy markets against excessive Chinese exports but "discipline on the ore producers side has eased off".

China is trying to rationalise its industry and close smaller, inefficient producers but these measures are being offset by efforts by the central government to develop the country's western provinces. However, in a presentation at the *Metal Bulletin* 18th International Ferro-Alloys Conference at Monte Carlo in November, vice president commercial of ores and alloys at Eramet Comilog, Vincent Trelut, warned that Chinese production of manganese ferro-alloys could collapse as only between five and ten producers in China are profitable and the other 800 or so are vulnerable as there is an overcapacity of 40-50% in the country.

Eramet expanded its presence in China through the acquisition of a third smelter – the Guilin Ferro-Alloy Works in the Guangxi autonomous region. Guilin has a capacity of 120,000 t/y of high-carbon ferromanganese from three blast furnaces and 20,000-25,000 t/y of silicomanganese from two electric furnaces. Eramet now has a production capacity of over 300,000 t/y in China.

After China, the CIS produces the largest share of world production of manganese alloys. There were significant moves towards consolidation of the industry in Ukraine when the Privat Bank business group bought two ferro-

alloy plants from the Metallurgia group. One of these plants was Zaporozhye, the country's largest producer of ferromanganese, which gave Privat Bank near total control of Ukraine's ferromanganese production.

Privat also owns 13% of the Nikopolsky ferro-alloys plant which produces approximately 70% of Ukraine's total silicomanganese production and has close ties to Ukraine's main manganese ore mines, Marganets and Ordzhonikidzevsky. The acquisition of Zaporozhye sparked talk of an alliance with Nikopol and, on an even grander scale, a move towards a union of manganese producers in the region, involving four Russian plants, one Kazakh, three Ukrainian and a Romanian plant.