FERRO-ALLOYS

By Ian Robinson

World production of both steel and stainless steel increased during 2002, resulting in an increase in demand and firmer prices for most ferro-alloys. According to the International Iron & Steel Institute, world crude steel production increased by 6.4% to 886.7 Mt during 2002 compared with 833.8 Mt in 2001. However, China contributed the bulk of the increase, recording an increase of 20.3% over 2001. The rest of Asia contributed most of the balance of the increase but production was relatively static in most other areas. Production rose by 2.5% in the US but only by 0.1% in the European Union (EU).

World production of stainless steel, which had suffered a sharp decline in 2001, recovered, nearly regaining the 2000 level. According to preliminary estimates, stainless steel production rose to a level of 18.8 Mt, an increase of 5.3% over 2001 when production fell by 5.8% to 17.9 Mt from 19.0 Mt in 2000. Much of the increase was driven by demand from China which continued to import large tonnages from Europe.

Carbon steel additions

Manganese and silicon are the two major alloying elements in carbon steel. Approximately 95% of the total production of manganese units is used for the desulphurisation and hardening of steel. Silicon has three applications in steel production: as a de-oxidant, as a source of energy through exothermic reactions and as an alloying addition to confer specific properties on the steel. Silicon is also used as a graphitising agent in the production of grey and ductile iron used for foundry applications.

The bulk manganese and silicon additions to steel are made in the form of the ferro-alloys: high-carbon (HC) or standard ferromanganese, silicomanganese and ferro-silicon.

Smaller quantities of manganese are added to steel in the form of refined ferromanganese. Refined ferromanganese is ferromanganese with a carbon content of less than 2%. There are three grades of refined ferromanganese: medium-carbon (MC) with a C content of 1.0-2.0%, low-carbon (LC) with a C content of 0.5-1.0% and ultra-low-carbon (ULC) which contains 0.1-0.2% C.

The trend towards the production of higher-quality steels with lower impurities, and the growth of steel production in the electric-arc furnace, has led to an increase in demand for refined ferromanganese at the expense of HC ferromanganese.

Manganese alloys

Supply disruptions combined with stronger demand to bring the manganese alloy market into balance, despite the massive global overcapacity. The alloy

business contrasts sharply with the ore business because it is highly fragmented with a low barrier to entry, whereas international trade in ore is dominated by a few large producers with access to high-grade ore deposits.

The world's largest manganese alloy producer, Eramet, which is based in France, experienced serious production problems during the year. 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 production problems at Boulogne, and at the Sauda plant in Norway, plus the depressed market for manganese alloys, resulted in Eramet's manganese division recording a loss during the first half of 2002. The manganese division accounted for 41% of Eramet's turnover during this period.

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

Strong domestic demand from the booming steel industry has stimulated dynamic growth in Chinese alloy production capacity. Data published by the International Manganese Institute highlights the growth in China's share of world manganese alloy markets. In 1997, China accounted for 27% of the world production of manganese ferro-alloys but in 2001 this share had grown to 32%. 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 producers are vulnerable as there is an overcapacity of 40-50% in the country.

Eramet expanded its presence in China through the acquisition of Guilin Ferro-Alloy Works in the Guangxi autonomous region. The previously state-owned smelter has a combined ferromanganese and silicomanganese production capacity of 150,000 t/y. Eramet already had two other manganese alloy operations in China - Shaoxing Comilog in Zheijang province with an annual capacity of 90,000t and Guangxi Co with an annual capacity of 77,000 t of ferromanganese.

A group of Israeli investors revived production of silicomanganese at a smelter in the US. Highlander Alloys bought 248,000 t of manganese ore from the US Defense Logistics Agency to provide feed for the New Haven facility which it had bought in November 2001, about two years after American Alloys had filed for bankruptcy and closed operations. Production resumed in April but closed again in June when American Electric Power cut off electricity.

However, production resumed in September after Highlander signed a power-rate deal with the utility.

There was a change in ownership of the South African ferromanganese joint venture, Advalloy, when Japan Metals and Chemicals (JMC) sold its 35% share to its Japanese partner Mitsui & Co. Advalloy was formed in June 1996 as a joint venture between Samancor (50%), JMC (35%) and Mitsui (15%) to produce refined manganese alloys.

The trend towards consolidation in the world ferro-alloys industry received a setback towards the beginning of the year when Minera Autlan, the Mexican ore and alloy producer, abandoned its quest to find a buyer. This change in strategy followed a downsizing of its workforce and operations. However, Brazil's CVRD persisted with its drive to bring all its manganese ore and alloy interests into a single global marketing structure. In November, CVRD held an auction of shares on the Sao Paulo stock exchange of its subsidiary manganese alloy producer, Cia Paulista de Ferro Ligas (CPFL), in order to be able to delist the company and proceed with its integration into CVRD's global marketing structure.

Short-term purchasers of manganese alloys, which do not purchase alloys on a regular quarterly basis, were squeezed as the supply disruptions affected spot prices. *Metal Bulletin* quotations for both HC ferromanganese and silicomanganese rose from the range €480-510/t at the beginning of the year to the range €500-550/t at the end of the year.

Ferrosilicon

Imports from the CIS and China continued to dominate Western markets during 2002. Marketing manager of Spanish ferro-alloys producer Ferroatlantica, Raul Barrios, speaking at the *Metal Bulletin* 18th International Ferro-Alloys Conference in Monte Carlo, warned that, if ferrosilicon producers in the West did not take action in the face of the glut of imports from the CIS and China, they would "be faced with a slow but sure death".

Mr Barrios highlighted the growth of these countries' share of the EU market, which rose from 24% in 1998 to 40% in 2001. According to Euroalliages, the European ferro-alloys association, the Western world produced about 1.2 Mt (contained silicon) of ferrosilicon during 2001, compared with 990,000 t in China and 531,000 t in the CIS.

Mr Barrios noted that producers in the West have been feeling the effect of the low prices which are now lower than they were ten years ago. The low prices, together with rising costs, have led to plant closures in the US, Italy, Spain and Germany. The major component of rising costs has been energy which has risen to 40% of total costs compared with 25% in 1994.

Mr Barrios said that the greater dependence on supplies from the CIS and China would lead to a deterioration in the quality of products and services to customers. Producers need to work on long-term policies with clients, but also

need help, he said, from anti-dumping legislation in the EU and US, noting that China and the CIS enjoy subsidised energy.

Early in 2002, the European Court made a decision to scrap the requirement for all imports of ferrosilicon from Kazakhstan, China, Ukraine and Russia to be registered. The registration requirements were imposed in August 2001 after a court action by Euroalliages on behalf of three European ferrosilicon producers.

The US International Trade Commission (ITC) conducted a hearing in June to reconsider its 1999 ruling, which ended anti-dumping and countervailing duties on ferrosilicon from six countries because of an alleged price fixing scheme involving some domestic producers. The ITC ruled that imports of ferrosilicon from Russia, Brazil, China, Kazakhstan, Venezuela and Ukraine had not caused any harm to US industries.

Various factors, including increased domestic steel production, hydro-electric power shortages and the Chinese Government policy of closing small electric arc furnaces which produce ferro-alloys, combined to restrict availability of Chinese ferrosilicon exports during 2002. This exerted upward pressure on prices in Europe and the US and *Metal Bulletin* quotations for 75% Si ferrosilicon in Europe rose from the range €550-560/t at the beginning of the year to the range €600-620/t at the end of the year.

Stainless steel additions

Chromium and nickel are the two major alloying elements in stainless steel. Stainless steel, which is defined as steel with a minimum Cr content of 12%, represents the largest application of both chromium and nickel.

Chromium may be added to the stainless-steel charge in the form of the alloy, ferrochrome, or in stainless-steel scrap. Most ferrochrome is added as high-carbon (HC) grade or as charge chrome. HC ferrochrome, which has a Cr content of over 60% and 4-6% C, is produced from chromite ore ($FeO.Cr_2O_3$) with a high chromium:iron ratio, usually over 2:1. In contrast, charge chrome, which is produced from low-grade ores in South Africa and Finland, contains 50-55% Cr and 6-8% C.

Over 70% of world stainless-steel production comprises austenitic grades with an average Ni content of about 8%. Nickel may be added in the form of different primary products - metal, oxide or ferronickel - as well as in the form of stainless steel scrap. The type of ore being mined and the process route adopted determines which primary product is produced. Ferronickel is a preferred product for the addition of nickel to stainless steel because it contains a high proportion of iron, which is usually sold at discount prices to iron in other materials.

Ferrochrome

Stimulated by a rise in global stainless-steel production, demand for ferrochrome recovered during 2002 and prices rose from historically low levels at the beginning of the year. The improvement in outlook for

ferrochrome stimulated further foreign interest in the South African ferrochrome industry where acquiring an ownership stake offers access to both availability of abundant ore resources as well as cheap electricity.

Despite closures of substantial production capacity in South Africa, in order to bring supplies into balance with demand, total South African capacity was further boosted through the commissioning of major new production facilities. In January 2002, Assmang commissioned a closed 54 MVA furnace and pre-heater as well as a 350,000 t/y pelletising and sintering plant at its Machadodorp smelter. The new facilities doubled the smelter capacity to 320,000 t/y from 150,000 t/y prior to the start of the expansion programme in 2000.

In September, new producer SA Chrome and Alloys opened its 235,000 t/y smelter at Boshoek. The smelter comprises two 54 MVA closed submerged arc furnaces with charge pre-heating and a 520,000 t/y pelletising and sintering plant.

The new production capacity commissioned in South Africa in 2002 partially offset the substantial capacity closures implemented during 2001 and earlier. The two giant ferrochrome producers in South Africa, Xstrata and Samancor Chrome, both reduced production in 2001 by nearly a quarter from levels of over 1.0 Mt/y, to 860,600 t (Xstrata) and 790,000 t (Samancor).

In a presentation to investors in mid-year, Xstrata estimated that 1.3 Mt of annual production capacity around the world had been idled, of which about half would never be restarted. ‘Temporary closures’ of 630,000 t, all in South Africa, would be restarted at the appropriate time when demand recovered.

Xstrata warned in September that it was looking at the possibility of restarting idle capacity as demand increased, and Samancor raised production in the final quarter of 2002 by a margin of 12% relative to the final quarter of 2001. This increase was due to “increased market demand prompting the restart of idle furnaces”. In early 2003, the marketing manager of Xstrata South Africa, Jeff McLaughlan, said South African ferrochrome producers would probably operate plants at more than 90% of design capacity in 2003 compared with 75% in 2002.

On August 6 2002, Mitsubishi Corp. became the first Japanese company to acquire control of a South African ferrochrome producer when it concluded an agreement to secure a further 44.1% share of Hernic Ferrochrome, thereby raising its holding to a controlling stake of 53.5%.

Two aspirant foreign entrants into the South African ferrochrome industry also appeared during 2002. India's leading steel producer Tata Iron and Steel selected Richards Bay, South Africa as its preferred site for a smelter to produce HC ferrochrome based on imports of high-grade ore from India. The decision to build the smelter at Richards Bay followed a study of the feasibility of establishing a smelter at Gladstone in Queensland, Australia, and was based on South Africa’s competitive power costs plus tax incentives. The

drive to establish a smelter offshore to smelt high-grade ore from India was sparked by the closure of a 50,000 t/y smelter at Jamshedpur in India as a result of high power costs. Local sources reported that Tata had stated that it wanted to commence construction before the end of 2003.

Another new aspirant ferrochrome producer in South Africa, Transvaal Ferrochrome (TFC), announced in early 2003 that it is planning to establish a mine and adjacent smelter on the western belt of the Bushveld Complex in the Marikana area about 25 km west of Brits. The company is planning to raise capital on the Australian Stock Exchange.

India exported a record level of 400,000 t of chrome ore and 600,000 t of concentrates during the period April 2001 - March 2002. Most of the chrome exports are sold to Chinese producers of ferrochrome via trading group MMTC. The high level of exports of ore and concentrates contrasts with the declining level of exports of HC ferrochrome and charge chrome. These were projected to fall below 100,000 t during the period April 2002 - March 2003 and compare with exports of over 150,000 t/y in recent years. The current low level of exports reflects low prices, which are too low to make production viable for most Indian producers owing to the their high power costs.

Prices of charge chrome remained static during the first half of 2002 in the range US$0.27-0.29/lb of contained Cr. This was the lowest level for over 30 years. However, the pressure of rising demand in response to the growth in stainless-steel production, and the strengthening rand which eroded the effective rand price actually received by the South African producers, eventually forced the charge chrome price to move upwards. Prices were rolled over in the second quarter but rose by three cents in the third quarter, which represented a reversal of the price decline which had persisted since the beginning of 2001. The upward momentum continued into the December quarter when prices rose by a further three cents to the range US$0.32-0.34/lb.

Ferronickel

Ferronickel producers continued to increase production and proceed with plans for further expansions. About 20% of world nickel output is in the form of ferronickel produced by smelting garnierite ore (hydrated silicate of magnesium and nickel) which occurs in the saprolite zone of laterite deposits.

Production at Eramet's Doniambo plant in New Caledonia rose by 1% to 28,898 t of contained nickel in the first half of 2002. The continuing ramp-up of production from Line 2 at BHP Billiton's Cerro Matoso smelter in Colombia resulted in an increase of nearly 20% to 23,300 t (Ni content) in the second half of 2002 compared with the second half of 2001 (19,500 t).

Shareholders in Indonesia's PT Aneka Tambang (Antam) with operations at Pomalaa in the southeast of the island of Sulawesi, approved a plan to secure funding for its new FeNi III smelter which will more than double Antam's annual capacity to 26,000 t of contained nickel. The new smelter will add 15,000 t/y of nickel capacity compared with the two existing smelters which

each have a capacity of about 5,500 t/y. Construction of the new smelter is expected to begin in 2004 and will cost about US$300 million.

Eramet plans to spend about €200 million on expanding production of ore at its Tiebaghi mine in northern New Caledonia, from 300,000 t/y to 1.0 Mt/y, and on increasing output at its Doniambo smelter, from 61,000 t/y to 75,000 t/y by 2006. One of Doniambo's three electric furnaces will be modernised, and will necessitate its shutdown for five months during the second half of 2003.

Noble ferro-alloys

The term 'noble alloys' refers to alloys used in smaller quantities and which are relatively expensive compared with the bulk alloys. They are sold in pound or kilogram units rather than tonnes, and include ferro-molybdenum, ferro-vanadium, ferro-niobium, ferro-titanium and ferro-tungsten.

Most ferromolybdenum is used in the production of low-alloy engineering steels but a significant proportion is consumed in stainless steel and other iron and steel applications.

After rising steadily during the first four months of 2002, prices of ferro-molybdenum in Europe exploded during May. The rise in prices was driven by a decline in the level of imports from China.

China is a major supplier of ferro-molybdenum to Europe and in early February the EU Council of Ministers voted to impose definitive anti-dumping duties of 22.5% on all imports of ferro-molybdenum from China. The complaint was lodged by Euroalliages on behalf of the European ferro-molybdenum producers. The period covered by the investigation was October 1999 to September 2000. The European Commission found that the volume of dumped imports had increased by 70% to 13,257 t during the investigation period, compared with 1997.

The reduced level of exports of ferro-molybdenum from China resulted from the squeeze on supplies of concentrate feed to the converters because of a government crackdown on illegal mining and the closure of several smelters. A shortage of concentrates also developed in the West as a result of production cutbacks at copper mines in North and South America where molybdenum is produced as a by-product of copper.

A further factor placing pressure on world supplies of ferro-molybdenum was the closure of a Japanese smelter, Awamura Metal Industry, in August 2001. This contributed to an increase in Japanese imports of ferromolybdenum at the expense of molybdenum oxide.

Prices started to rise in Europe towards the end of 2001 and Western material containing 65-70% Mo rose from under US$7.00/kg at the beginning of 2002 to the range US$7.50-7.80/kg by the end of April. Over the same period, the price of Chinese material containing 60% Mo in Europe rose from about US$6.00/kg to the range US$6.70-7.00/kg.

A third factor, in addition to the squeeze on concentrate supplies in both China and the West, became apparent in May and ignited an explosion in prices of ferro-molybdenum in Europe. This was the rundown of stocks in Rotterdam, both of ferro-molybdenum and molybdenum oxide. Alloy stocks had been built up ahead of the imposition of anti-dumping duties on ferromolybdenum, and Chinese suppliers subsequently switched more of their oxide production to Europe because it does not attract anti-dumping duty. Oxide may be used as an intermediate product for the production of alloy.

The prices of alloy in Europe rose in May to levels of over US$18.00/kg for 65-70% Mo material, and to over US$17.00/kg for 60% Mo material, before easing in the face of consumer resistance. The price of Chinese 60% Mo alloy in Europe retreated to below US$7.00/kg before the end of the year.

The long-standing excess production of vanadium was alleviated by reduced output from Russia and by rumours of reduced output of vanadium pentoxide in Australia where Xstrata was reported to be considering the closure of its Windimurra mine. This operation has the capacity to produce 17 Mlb/y of pentoxide although it has only been operating at 50-70% of capacity since coming on stream in late 1999.

In South Africa, a new project to produce ferro-vanadium was delayed when Nippon Denko postponed the start-up of a joint venture with Highveld Steel and Vanadium at Highveld's works until June 2003. It is planned to ship 3,500 t/y from the joint venture to Japan, enabling Nippon Denko to switch output of ferro-vanadium at its Hokuriku plant in western Japan to other alloys.

In the US, the ITC continued to investigate the application of anti-dumping duties on imports of ferro-vanadium after it made a preliminary finding in January of damage to the US industry from imports from China and South Africa.

Prices for both vanadium pentoxide and ferro-vanadium rose during the first half of the year before being forced down by oversupply during the second half. However, prices rallied before the end of the year in response to rumours of the Windimurra closure. After falling from a level of about US$9.00/kg V (basis 70-80% V ferrovanadium) in mid-year to under US$7.50/kg during the third quarter, prices recovered to over US$8.00/kg by the end of the year.