FERRO-ALLOYS

By Ian Robinson

Steel and stainless steel, the two end-uses which determine the level of consumption of ferro-alloys, had a year of two contrasting halves. World production of both steel and stainless steel reached record levels for the year 2000 but, after strong growth during the first half of the year, production fell sharply in the second half.

World steel production rose to a level of over 800 Mt for the first time and the International Iron and Steel Institute (IISI) estimated production at 828 Mt, an increase of 7.4% over the 771 Mt produced in 1999. However, the rapid rise in output exceeded demand by mid-year which led to an inventory build-up and a collapse in demand and prices.

Stainless-steel production followed a similar trend as demand firmed during the first half and then suddenly weakened due to excess production and a fall in the nickel price. After world production during the first half had risen by a margin of 12.4% above production in the first half of 1999, total annual production reached a level of 18.8 Mt, an increase of 9.3% above production of 17.2 Mt in 1999. Stainless-steel stockists which had been stockpiling to reduce their exposure to the escalating nickel prices began to offload stockpiled material when nickel prices started to decline.

The markets for the bulk alloys - high-carbon (HC) ferromanganese, silicomanganese, ferrosilicon and high-carbon (HC) ferrochrome showed a varied response to the fluctuations in steel and stainless steel production during the year according to the different circumstance prevailing within the different markets. Whereas the silicomanganese market was affected by increased supplies from producers based in countries with weak currencies or with export incentives, prices of HC ferromanganese remained firm as a result of the greater control over production exercised in an industry which has consolidated rapidly over the past few years. The lifting of anti-dumping duties on ferrosilicon exports to the US from some major producing countries towards the end of 1999 had a serious impact on the market, and prices of ferrosilicon in both the US and Europe weakened throughout the year. Following a destocking in the industry and cutbacks in world production of HC ferrochrome in the second half of 1999, prices rose modestly in the first half of 2000 but failed to maintain this momentum during the second half of the year as stainless-steel production declined and the availability of stainless-steel scrap increased.

Bulk Alloys in Steel

Manganese (Mn) and silicon (Si) are the two major alloying elements in carbon steel. Some 95% of the total production of manganese units is used for the desulphurisation and hardening of steel. In steel production, silicon is used extensively for de-oxidation of molten metal and as an alloying addition to confer strength and other properties. Silicon is also used as a graphitising agent in cast iron. The bulk manganese and silicon additions to steel are made in the form of the ferro-alloys: HC (or standard) ferromanganese, silicomanganese and ferrosilicon.

Manganese Alloys

The boom in world steel production and low inventories forced up prices of manganese alloys in the first quarter in both Europe and the US. *Metal Bulletin* quoted European prices of HC ferromanganese in the range DM860-900/t and silicomanganese in the range DM990-1,020/t throughout the first nine months of the year. At the end of the year the *Metal Bulletin* quotation for HC ferromanganese in Europe had risen to the range DM960-1,000/t whereas the equivalent quotation for silicomanganese had been

lowered to the range DM980–1,000/t. Prices of silicomanganese started declining in the US as early as the second quarter as excess supplies of the alloy, attracted by the strong dollar, flowed to the US.

Anti-dumping duties - or the lack of them - re-emerged as a major issue on the Japanese and US markets. Although Japanese steel production surged by 13% to 106.4 Mt last year, this did not result in a boom in domestic production of silicomanganese which remained static at about 80,000 t. In contrast, imports from China rose to about 180,000 t, representing a substantial increase of nearly 30,000 t over 1999. China accounted for about 80% of total Japanese imports of silicomanganese and this rise in imports prompted the Japanese Ferroalloy Association (JFA) to monitor Chinese imports with a view to asking the Japanese Government to re-impose anti-dumping duties. The scale of imports from China made a mockery of the import quota of 90,000 t/y which the Japanese Government had imposed in early 1998 after it had revoked the anti-dumping duties.

In early 2001 the International Trade Commission (ITC) in the US ruled that imports of silicomanganese from Brazil, China and Ukraine still pose a threat to domestic production. Anti-dumping duties are currently being applied on shipments from Brazil and China, and imports from Ukraine are under investigation.

The world manganese industry is dominated by four major groups: Samancor, Eramet, CVRD and Associated Manganese (Assmang). The UK-based research group Roskill estimated that these four groups together control 74% of total world manganese mine production and 48% of world manganese alloy production. The move towards consolidation in the industry continued during the year as Brazilian producer CVRD proceeded with its strategic plan to bring together all its manganese ore and alloy interests in a single company.
The strong demand for manganese units during the first half of the year in response to the boom in world steel production also stimulated expansion plans by smaller ore producers. Australian manganese ore producer Perth-based Consolidated Minerals, which restarted the mothballed Woodie Woodie mine in the Pilbara region of Western Australia, produced 262,500 t of ore in its first full year of operation and plans to raise production to 300,000 t in the 2000-01 financial year.

In Mexico, Minera Autlan, the largest producer of manganese ore in North America, raised production from its Molango mines aiming to achieve an annual production rate of over 800,000 t compared with 750,000 t in 1999. It was also announced that JSC Chiaturmanganum in Georgia planned to rehabilitate its mining and concentrating operations which had been working at about 10% of capacity over the past seven years. The company aimed to produce 75,000 t of high-grade concentrates in 2000 rising to 210,000 t in 2002.

Ferrosilicon

The decision taken by the ITC in October 1999 to lift anti-dumping duties against imports of ferrosilicon into the US from Brazil, China, Kazakhstan, Russia, Ukraine and Venezuela, led to an increase in imports and downward pressure on prices. The price quoted by *Metal Bulletin* for imported 75% Si alloy on the US free market fell from the range US$0.35-0.37/lb at the beginning of the year to US$0.34-0.35/lb at the end of the year. The increase in imports forced the closure of American Alloys' production facilities in February.

Prices in Europe were also affected by the uncertainty in the US as well as the weakness of the Euro and the prospect of anti-dumping duties also being lifted on imports into the EU. The price quoted by *Metal Bulletin* for 75% Si grade in Europe was lowered from the range DM1,100-1,150/t at the beginning of the year to DM1,060-1,100/t at the end of the year.

An ongoing struggle between the two major shareholders in Norway's Fesil, the world's third largest ferrosilicon producer, continued throughout the year. The battle was waged between Globe Metallurgical of the US and the Tensil Group comprising European interests with Swiss ferro-alloy trader Gurta holding a major stake. In early 2001 the Tensil Group purchased a further 10% package of shares to give it a controlling interest of 56% of Fesil's share capital.

Early in 2000 Norway's Elkem, the world's largest ferrosilicon producer, bought nearly 10% of Fesil's shares on the Norwegian stock exchange. Elkem, which produced 320,000 t of standard 75% grade ferrosilicon during 1999, generated substantial funds through the sale of its manganese interests which would enable it to embark on an aggressive growth strategy. However, it dismissed the purchase of Fesil shares as merely “a financial decision”.

Early in 2001 the European Commission announced that anti-dumping duties on ferrosilicon from China, Russia, Kazakhstan, Ukraine, Venezuela and Brazil would be lifted. The anti-dumping duties were imposed in 1993 and 1994 and vary from 20.4% on imports from Venezuela to 74% on alloy from Kazakhstan, Russia and Ukraine. There are only three ferrosilicon producers in the EU - Sweden's Vargon, France's Pechiney and Spain's Ferroatlantica.

Bulk Alloys in Stainless Steel

Stainless steel, as defined when the chromium content reaches a minimum level of 12%, represents the major application of both chromium (Cr) and nickel (Ni). 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. The alloy produced depends mainly on the chromium: iron (Cr:Fe) ratio in the raw chromite ore ($FeO.Cr_2O_3$). HC ferrochrome, which is produced from high-grade ores in Zimbabwe, Turkey, Albania and Kazakhstan, has a chromium content of over 60% and 4-6% carbon (C). 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, represented by austenitic grades, contains nickel at an average level of about 8%. Nickel is added in the form of different primary products - metal, oxide or ferronickel - as well as in the form of stainless-steel scrap. The nature of the primary product is dictated by the type of ore being mined and the processing method used. Ferronickel usually contains 20-45% Ni with iron comprising most of the balance. Ferronickel is a preferred product for adding 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

Although demand for ferrochrome increased during the first half of the year, the rise in ferrochrome prices did not match the growth in world stainless-steel production. Spot prices of charge chrome in Europe rose from an average of US$0.40/lb at the beginning of the year to US$0.43/lb at mid-year - an increase of only 7.5% compared with the 12.4% rise in stainless-steel production. Production cutbacks by stainless steel producers and an increase in the consumption of stainless-steel scrap forced prices down after midyear to levels of about US$0.30/lb on the spot market in Europe. Although producers claimed that they had achieved roll-overs of their quarterly prices which remained officially in the range US$0.43-0.45/lb, the effective prices were much lower as producers were believed to be granting discounts on their official prices.

Following a trade agreement in late 1999 which opened a duty-free tariff quota for ferrochrome from South Africa of 515,000 t/y, the EU reduced the existing general duty-free quota to 1,035 Mt of ferrochrome in order to remove the risk of 'injurious effects' on EU producers and to allow South Africa “the full benefit” of its quota.

The collapse in ferrochrome demand during the second half of 2000 necessitated cutbacks by ferrochrome producers in order to bring demand and supply into closer balance. All the South African producers cut back production through furnace closures, starting with an announcement by Samancor in August that it would take 80,000 t/y of capacity out of the market over the next six months to repair linings on four of its furnaces. Samancor was followed by Hernic Ferrochrome which closed two 37 MVA furnaces to repair the tapholes. Subsequently, Feralloys decided to close one of its three furnaces at its Machadodorp plant, taking a further 45,000 t/y capacity out of production. Xstrata then closed two furnaces at its Rustenburg plant with a combined capacity of 130,000 t/y for 'normal maintenance'. In January 2001 Samancor continued to cut back production when it started to shut down four of its six furnaces at its Tubatse works.

Producers in other countries, including Kazakhstan, Norway and Japan, also closed HC ferrochrome capacity during 2000 or early 2001. In Kazakhstan, Kazchrome cut production capacity by 80,000 t/y through the closure of three furnaces, one at its Aktyubinsk plant in September and two at its Aksu plant in October.

Higher exports of ferrochrome from China aggravated the oversupply in the world industry. Metal Bulletin Research (MBR) estimated that Chinese exports grew from about 57,000 t in 1999 to about 120,000 t in 2000. This increase was facilitated by a sharp increase in ore imports, particularly from India, and MBR estimated that China imported about 1.16 Mt of chrome ore during 2000 compared with 820,000 t during 1999.

Indian ferrochrome producers with chrome ore mining leases for captive consumption started to investigate potential new export markets for ore surplus to their needs. Historically, Indian chrome ore has been exported mainly to China with smaller quantities supplied to Japan. In addition to exploring new potential markets for ore exports, Tata Iron & Steel Co (Tisco) also investigated opportunities to establish overseas alloy production facilities.

Despite the cutbacks in the industry, South African ferrochrome producers embarked on new projects, which will further consolidate South Africa's position as the dominant world-producing country. In June, Samancor and Xstrata, South Africa's two largest ferrochrome producers, formed a production joint venture to expand production capacity at Xstrata's Wonderkop facility near Rustenburg to exploit Samancor's ore reserves which will be mined by Xstrata through its Kroondal mine. The joint venture will comprise two new 45 MVA submerged-arc furnaces, an

agglomeration plant and a metal-from-slag recovery plant with a total annual capacity of 120,000 t.

Associated Manganese (Assmang) is developing a new mine and plant at Dwarsrivier some 150 km north east of its smelter at Machadodorp. The new mine will supply ore for the smelter which is being expanded from an annual capacity of 125,000 t of ferrochrome to 300,000 t through upgrading three 24 MVA furnaces to 30 MVA and the installation of a new 54 MVA furnace with a pre-heater and 350,000 t/y pelletising plant.

In March 2001, Hernic Ferrochrome and newcomer SA Chrome & Alloys announced a proposed merger which would create the third largest ferrochrome producer in South Africa with an annual production capacity of about 500,000 t. SA Chrome has commenced construction of a smelter at Boshoek, about 25 km north-west of Rustenburg. The project will use the Outokumpu process route and the plant will comprise two 54 MVA furnaces and a 520,000 t/y pelletising and sintering plant. The smelter will have an annual production capacity of 235,000 t of charge chrome.

Ferronickel

Ferronickel production is continuing to increase as Billiton proceeded with the expansion project at its Cerro Matoso operation in Colombia, Anglo American's Loma de Niquel in Venezuela commenced production in the final quarter of the year and Eramet conducted an investigation about whether to expand production at its Doniambo smelter in New Caledonia.

About 20% of world nickel production is produced in the form of ferronickel. Ferronickel is produced by smelting garnierite ore (hydrated silicate of magnesium and nickel) which occurs in the saprolite zone of laterite deposits.

Prices of ferronickel are not quoted but are negotiated between producer and consumer (ie stainless-steel producers). The major factor which determines the price of ferronickel is the price of nickel on the London Metal Exchange (LME). After rising to a five-year high of over US$10,000/t in March, prices declined throughout most of the rest of the year to end the year at below US$7,200/t.

Eramet, based in France, is the world's largest producer of ferronickel. The Doniambo smelter has a capacity of 62,000 t/y and, despite labour problems in the first quarter of the year, production in 2000 rose to 57,463 t compared with 56,642 t in 1999. Consideration is being given to expanding capacity to 70,000 t/y with full capacity to be reached in 2002.

Cerro Matoso raised its production by 2% to 28,902 t of contained nickel in ferronickel during the financial year ended 30 June 2000. The mine completed a second line in its smelter towards the end of the year, several months ahead of schedule. This line will raise total smelter capacity to about 55,000 t/y.

Anglo American brought its Loma de Niquel mine on stream in December when it poured its first metal. Production from the open-pit mine will be at a level of 20,000 t/y of nickel in ferronickel during the first five years of its life and 16,000 t/y thereafter. About three-quarters of its production will be exported to stainless-steel mills in Europe and the balance to the US.

Noble Ferro-Alloys

The term ‘noble alloys’ refers to alloys, which are used in smaller quantities and are relatively expensive compared with the bulk alloys. They are sold in pound or kilogram units rather than tonnes and include ferromolybdenum, ferrovanadium, ferroniobium, ferrotitanium and ferrotungsten.

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.

Chinese imports continued to be a major factor on the European market during 2000. In October, the European industry group EuroAlliages filed an anti-dumping complaint to the European Commission against ferromolybdenum imports from China. EuroAlliages claimed that Chinese imports had increased their market share from 17.5% in 1995 to over 40% in 1999 and to 48.8% in the first quarter of 2000. About two-thirds of Chinese molybdenum exports are sent to Europe and total exports of ferromolybdenum in 1999 were 38,585 t compared with 12,650 t in 1995.

At the same time as EuroAlliages filed its complaint, Jinduicheng Molybdenum Corp. (JDC) announced that it would stop production for one month and at the annual meeting of the Chinese Molybdenum Producers Association, six other Chinese producers also agreed to cut supplies. However, these announcements were met with scepticism by the industry in Europe because of the large molybdenum stocks in Europe and the fact that similar announcements had been made many times before without having any effect on the market.

Prices of Chinese ferromolybdenum exports to Europe fell from about $6.70/kg fob main Chinese ports in May to $6.00/kg by the end of the year but rallied to $6.50/kg in early 2001 as Chinese ferromolybdenum producers cut back production as a result of a shortage of molybdenum oxide feed.

The ferrovanadium market reflected the oversupplied pentoxide market with the European price of 70-80% V grade weakening throughout the year, from a level of around US$13/kg to a level of about US$8/kg. Although world production of vanadium pentoxide (V_20_5), which is the basic primary product from which ferrovanadium is produced, probably reached a record level in 2000 of over 140 Mlb as a result of the record world steel production and the increasing unit consumption of vanadium per tonne of steel, an oversupply prevailed throughout the year.

The oversupply was exacerbated by the decline in the steel market in the second half of the year and forced prices of pentoxide down to record lows. The average quarterly price of US$1.39/lb achieved by the world's largest producer, Highveld Steel and Vanadium of South Africa, in the fourth quarter of the year, was the lowest for over five years.

There appears to be no short-term solution to the oversupply situation ruling in the world vanadium industry. Russia and China continue to export large quantities to the West and the two largest Western producers, Highveld Steel and Xstrata, remain locked in a battle for supremacy with neither prepared to take production cuts on the scale required to bring the market into balance.

Both Highveld and Xstrata continued to expand production capacity during 2000. Highveld is upgrading its No. 1 kiln from a capacity of 180 t/mth to 250 t/mth. Xstrata, which has two vanadium operations in South Africa. [Vantech and Rhovan], acquired total control of the Windimurra operation in Western Australia when it bought Precious Metals Australia's 40% stake.

In the third quarter of the year Xstrata commissioned a ferrovanadium plant at its Rhovan facility. This plant has an annual capacity of 7,500 t