FERRO-ALLOYS

By Ian Robinson

The world economic downturn, and its effect on steel production inevitably resulted in deterioration in demand for, and prices of, most bulk and noble ferro-alloys during 2001.

The major markets for ferro-alloys - steel and stainless steel - both declined in 2001 with the consequent depressing effect on demand for ferro-alloys. Although world steel production in 2001 matched the record level achieved during 2000 throughout most of the year, it fell sharply during the final quarter and, according to the International Iron and Steel Institute's provisional figures, world production in 2001 was 839.9 Mt. This was nearly 1% below production in 2000 of 847.2 Mt.

The decline resulted from the reduction in production in the Western world which offset continuing production growth in the developing countries. The largest contraction was recorded in North America where production fell by over 11% to 119.9 Mt. China strengthened its position as the world's leading producer with an increase in production of nearly 13% to 143 Mt. Japan, which suffered a decline of 3.4%, remained the world's second largest producer with a production of 102.9 Mt.

Western production of stainless steel fell by 2.5% to 17.69 Mt (according to estimates by Belgium-based independent analyst Andrew Jones), despite a sharp improvement in the final quarter. There was a marked contrast between the performance of stainless steel production in the major producing areas. Whereas production fell by nearly 20% in the US to 1.8 Mt, reflecting a substantial increase in imports, production in Europe remained stable at 6.6 Mt and Japanese production rose by over 4% to 3.7 Mt.

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. 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 ferrosilicon.

Manganese Alloys

World manganese markets continued to be characterised by overcapacity of both ore and alloy production and prices showed little movement throughout the year. Prices of metallurgical ore remained in the range US$1.94-2.03 per metric tonne unit (mtu) and the Metal Bulletin quotation for HC ferromanganese in Europe remained locked within the range DM960-1,000/t. There was only marginal improvement in the price of silicomanganese which was quoted in the range DM990-1,020/t at the end of the year. In the US, prices for silicomanganese received a boost from anti-dumping duties and the Metal Bulletin quotation rose from the range US$0.20-0.23/lb to US$0.24-0.25/lb at the end of the year.

The oversupply of manganese ferro-alloys, particularly silicomanganese, continued to drive tariff protection measures, capacity closures and consolidation in the world industry.

In early April, the sole US domestic silicomanganese producer Eramet Marietta (a

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subsidiary of Eramet Manganese, based in France, the world's largest producer of manganese ferro-alloys) filed a petition with the US Department of Commerce and the International Trade Commission to impose anti-dumping duties on imports of silicomanganese from Kazakhstan, India and Venezuela. Total shipments to the US from these three countries had tripled to 166,000 t in 2000.

In a preliminary determination in November, the International Trade Administration (ITA) of the US Department of Commerce found that imports from these three countries should be subject to anti-dumping duties as they are being sold at less than fair market value.

Several alloy producers in different countries effected cutbacks during the year as a response to weak demand. In June, Eramet Comilog announced that it would close two furnaces - in France and in Norway. This announcement followed the closure of a silicomanganese furnace at its Cairo Montenotte smelter in Italy in April. In August, Mexican manganese ore and alloy producer Minera Autlan stopped production at its plant at Tezuitlan in south-central Puebla State and blamed this decision on the depressed steel industry in the US and Mexico.

Chinese ferro-alloy producers also cut back production of both silicomanganese and ferromanganese. The Jilin Ferro-Alloy Group Co. reduced production of silicomanganese in the second half of the year in response to weak export demand, particularly from Japan and Korea. Depressed prices and debts to power suppliers forced the closure of Xiangtan ferro-alloy plant in Hunan Province, one of China's largest producers of HC ferromanganese. These closures indicated a trend for Chinese manganese alloy producers to reduce exports and focus more on domestic markets which remained relatively healthy throughout the year. China's position as an international supplier of manganese alloys is increasingly limited by its lack of domestic high-grade ore resources.

There were further moves towards consolidation in the world industry as Minera Autlan embarked on a search for a partner or buyer. The company reached a debt-structuring agreement with its creditor banks and appointed BNP Paribas as its exclusive agent in its search for a partner. Minera Autlan was reported to have approached several of the major world ferro-alloy producers but Brazil's CVRD, which had already made considerable progress in the consolidation of its manganese interests in both Brazil and France, appeared to be the leading candidate.

Ferrosilicon

Export prices from China, the world's dominant supplier of ferrosilicon, declined during the year owing to the continuing growth of production capacity. The Metal Bulletin quotation for Chinese 75% Si ferrosilicon, fob main Chinese ports, was reduced during the year from the range US$490-510/t to the range US$460-470/t.

China has an annual production of some 1.0 to 1.4 Mt of ferrosilicon, which is approximately half annual world production, estimated at about 2.6 Mt. Domestic demand is only about 800,000 t/y leaving between 200,000 t/y and 600,000 t/y available for export. Most developed countries have stopped the production of ferrosilicon and, therefore, do not impose import tariffs. Japan is the largest market for Chinese exports, usually taking over half of the total.

The Chinese industry has been characterised in recent years by the rapid growth of new production capacity in the middle and western regions where power costs are about one-third less than in the east. Some 200,000 to 300,000 t/y of new capacity has been built over the past two years.

Bulk Alloys in Stainless Steel

Stainless steel (defined as steel with a minimum chromium content of 12%) represents the largest 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. HC ferrochrome, which has a Cr content of over 60% and 4-6% carbon (C) is produced from chromite ore ($FeO.Cr_2O_3$) with a high chromium:iron (Cr:Fe) 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 nickel 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 processing 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

Prices of HC ferrochrome and charge chrome fell steadily throughout the year. The Metal Bulletin quotation for lumpy charge chrome, basis 52% Cr, in Europe declined from the range US$0.43-0.45/lb at the beginning of 2001 to end the year in the range of US$0.29-0.32/lb - a fall of over 30%. This decline reflected the cutback in stainless steel production in the Western world as well as high volumes of stainless steel scrap imported from countries of the former Soviet Union (FSU). However, during the final quarter of the year the combination of a rise in stainless steel production, extensive cutbacks in ferrochrome production and lower stainless scrap utilisation rates, promised to stabilise the market and lead to a recovery in prices in 2002.

The year was characterised by cutbacks by producers as they struggled to bring supply into balance with demand. Producers in southern Africa (South Africa and Zimbabwe), which together contribute over 50% of world ferrochrome production, reduced production sharply. In March, Zimbabwe Alloys announced the shutdown of low-carbon (LC) ferrochrome production at its Gweru smelter because of poor markets and growing debts. In May, Xstrata announced the shutdown of two furnaces at its Rustenburg smelter in South Africa, in addition to two which had been closed during 2000. In May, Xstrata also closed two furnaces at its Wonderkop smelter. After closing four furnaces at the Tubatse smelter East Plant in January, Samancor closed down its Palmiet smelter in November, thereby reducing its operating smelters to three.

There were also significant closures elsewhere in the world. In Kazakhstan, Kazchrome effected a 25% cut in production from the start of the year. In India, Facor closed a 50,000 t/y charge chrome plant and other Indian companies which closed capacity included Ispat Alloys, Tata Iron and Steel (Tisco) and Jindal Ferro-Alloys.

In a presentation at Metal Bulletin's Southern African Ferro-Alloys Conference held in South Africa in February 2002, analyst Andrew Jones estimated that the total annualised reduction in world ferrochrome production through furnace closures in 2001 amounted to nearly 1,500 t. This figure is equivalent to over 30% of the International Chromium Development Association's (ICDA's) estimate for world production of HC ferrochrome/charge chrome in 2000 - 4,834 t.

The low prevailing prices during 2001 rendered it more difficult for European ferrochrome producers to compete with imports from South Africa, and output was irregular from Elkem's Rana plant in Norway during the year. In its latest annual report Elkem announced that it had budgeted to account for the possible closure of the 175,000 t/y smelter.

Despite the weak demand in 2001, South African ferrochrome producers maintained their faith in the continuing growth in demand in line with growth in stainless steel, and development of major greenfield and

brownfield projects proceeded. Two new projects came on stream during the second half of the year and two other projects are currently under construction. Two new furnaces were commissioned at Xstrata's Wonderkop smelter as part of a production joint venture between Xstrata and Samancor in June and August. The joint venture has a total annual capacity of 180,000 t, including production from the recovery plant. This expansion has made Wonderkop the world's largest single-site ferrochrome facility.

The other major brownfield venture completed in South Africa during the year comprised a new 54 MVA closed furnace with an annual production capacity of 120,000 t and a 350,000 t/y pelletising plant at the Machadodorp facility of Assmang's fully-owned subsidiary Feralloys. Samancor is also building a 520,000 t/y pelletising plant at its Tubatse smelter, which is planned to increase alloy production capacity by 50,000 t/y. The new facility is expected to be commissioned during 2002.

A new company, SA Chrome & Alloys, will bring a new smelter on stream during 2002 comprising two closed 54 MVA furnaces and a 520,000 t/y Outokumpu pelletising and sintering plant. The new smelter will have an annual production capacity of 240,000 t and the chromite feed for the smelter will be a mixture of tailings from the UG2 (Upper Group 2) chromite seam which is mined for platinum from Impala Platinum's operations, and ore from SA Chrome's Horizon mine.

Indian ferrochrome producers struggled to survive in the face of restricted access to chrome ore, intense competition on domestic markets and high power costs. The Orissa government decided not to allocate available leases of chrome-bearing ground to five privately-owned ore and ferrochrome producers, and granted the entire area to state-owned Orissa Mining Corporation (OMC). However, Jindal Steel & Power Co., with its own captive chrome ore mines, proceeded with the construction of a 100,000 t/y smelter with two 24 MVA furnaces. Most of ferrochrome will be sold to sister company, stainless steel producer Jindal Strips.

In contrast, Tata Iron & Steel (Tisco) continued to investigate opportunities to build a smelter overseas in a country with lower production costs than India. Initially Tisco looked at siting the project in Australia, then looked at Mozambique and at the end of the year it was reported that it was planning a 120,000 t/y plant at a coastal location in South Africa.

Ferronickel

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.

Several new ferronickel projects are being planned as nickel producers prepare to raise production capacity to match the expected rise in demand in line with the growth in world stainless-steel production.

Speaking at the inaugural New Caledonian nickel conference in Noumea, New Caledonia in June, commodity specialist at Macquarie Bank Jim Lennon said that the global nickel industry is facing a serious shortfall in production in the medium term as demand in China and the former Eastern Bloc grows at an unprecedented rate. Investment in new nickel projects has been delayed partly because of the limited success of the first generation of pressure acid leach (PAL) plants in Australia. The importance of New Caledonia, which possesses about 25% of world nickel reserves, will grow as new projects are being planned on the island.

Two major new projects were approved for development on the island during the year - Inco's Goro Nickel project at the southern tip of New Caledonia and the expansion of SLN's mining and smelting capacity. Falconbridge of Canada and its partner Soc. Minière du Sud Pacifique (SMSP) also commenced trial mining at Koniambo.

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The Goro project will treat limonitic ore, which is not amenable to smelting, using pressure leaching, but both the SLN expansion, and the Koniambo project will smelt saprolitic ore to produce ferronickel. Both SLN and Falconbridge consider the PAL route too risky at this stage.

The SLN expansion will increase annual production capacity of contained nickel in ferronickel from 60,000 t to 75,000 t through the replacement of one of the three existing furnaces at Doniambo and upgrading its ore resource at the Tiebaghi mine in the island's northern province. SMSP and Falconbridge plan to build a 60,000 t/y ferronickel plant on the coast at Koniambo.

The plans to increase capacity to process more ore on New Caledonia in order to produce more nickel in the form of ferronickel or nickel metal has impacted on ore supplies to Japanese ferronickel producers Pacific Metal and Nippon Yakin. In January, SMSP announced its intention to suspend shipments of ore to Pacific Metals. However, Pacific Metals found a solution to its ore supply problems when it concluded a long-term contact with Indonesia's PT Aneka Tambang (Antam) with effect from June 1, 2001.

Growth in ferronickel production in South America could rival that in New Caledonia. BHP Billiton completed the Line II expansion at its Cerro Matoso ferronickel project in Colombia in January. This expansion will raise annual production capacity to 54,000 t. After bringing its Loma de Niquel project on stream early in 2001, Anglo American concluded a feasibility study on its Barro Alto project in Brazil's Goiás State during the first half of the year. Anglo plans to raise Loma de Niquel's production to 16,000-18,000 t/y of nickel contained in ferronickel from the end of 2002, sustainable for a period 30 years. However, Barro Alto has the potential to be twice the size of Loma de Niquel with a production of 40,000 t/y of nickel in ferronickel over a 20-year period.

Barro Alto would substantially increase existing production of ferronickel in Brazil derived from Anglo's Codemin mine, also in Goiás State. Codemin's reserves are near depletion at the current annual output of 7,000 t.

At the end of October, Falconbridge shut down its 32,000 t/y ferronickel smelter at its Falcondo subsidiary in the Dominican Republic for an anticipated three months as a result of the poor demand from stainless steel producers. Production in 2001 was estimated at about 21,000 t of nickel contained in ferronickel.

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.

The most important development on world markets during 2001 was the imposition of provisional anti-dumping (AD) duties against imports of Chinese ferromolybdenum into the European Union (EU). The European Commission imposed duties ranging from 3.6% to 26.3% on Chinese producers effective August 8. Imports from China have expanded rapidly in recent years to a share of approximately 50% of the European market. Imports of Chinese ferromolybdenum into Rotterdam fell from an average of 2,000 t/mth to 740 t/mth in September, the first month after the duties were imposed. The combined effects of weak world demand and the EU's AD duties forced several Chinese ferromolybdenum producers to cease production, including China's largest molybdenum processor Jinduicheng Molybdenum Mining Corp.

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(JDC) which stopped production at its works in Shanxi Province.

Despite weak demand, prices of ferromolybdenum in Europe remained stable during the second half of the year in the range US$6.20-6.80/kg following smelter closures in China and a shortage of Chinese concentrates due to the government crackdown on illegal mining.

The AD duties on imports of ferromolybdnum from China offered some protection to European producers which had faced the threat of closure and the prospect that the European industry would follow the example of ferrotungsten where all the European producers have closed down and the EU is totally dependent on imports. However, the Austrian producer Treibacher is planning for the long-term and is introducing a new product - Molyquick - which is now being produced in test batches. It is claimed to be more homogeneous than standard ferromolybdenum and is produced in briquettes so there are fewer fines and it dissolves faster in the steel melt. Treibacher has two electric arc furnaces (EAFs) for the production of ferromolybdenum and has an annual output of approximately 3,500t of molybdenum contained in ferromolybdenum. Treibacher estimates the world market for ferromolybdenum at 45,000 - 50,000 t/y of contained molybdenum.

World consumption of vanadium remained strong during the first half of 2001 and prices improved slightly. Metal Bulletin quotations for vanadium pentoxide rose from the range US$1.35-1.40/lb V2O5 in Europe at the beginning of the year to the range US$1.42-1.50/lb at the end of June. The quotation for ferrovanadium in Europe rose from the range US$7.80-8.15/kg to US$8.30- 8.50 at the end of June.

However, weakness re-appeared in mid-year due to excess supply, concerns regarding world steel production and the start of the northern hemisphere holidays. The decline persisted throughout the second half of the year and vanadium pentoxide prices fell to the range US$1.10-1.15/kg at the end of the year and the ferrovanadium quotation slipped to the range US$6.27-6.45/kg. These prices were below the low point of the most recent slump in the vanadium market in December 1999 when ferrovanadium and vanadium pentoxide fell to levels of US$7.45/kg and US$1.25/lb.

The decline in prices of pentoxide and alloy reflected the massive world oversupply and leading US vanadium producer Strategic Minerals Corporation (Stratcor) predicted that world oversupply would continue until high-cost production ceased. Speaking at Ryans Notes, Ferroalloys Conference in Orlando, Florida, in October, vice-president commercial Bob Bunting estimated world annual capacity at some 280 Mlb and asserted that “under the laws of normal economics” lower cost production from steel slags, oil, ashes and catalysts should prevail. He noted that by-product vanadium is already out of the ground and in a higher concentration than is found in any ore. He lamented that primary vanadium ore from South Africa and Australia has been pushed into world markets with the objective of replacing other low-cost production and concluded that rationalisation in the industry would only occur “when producers from primary vanadium ore wake up to the fact that by-product vanadium is always the lowest cash route”.

However, the major primary Western producers - Xstrata and Highveld Steel and Vanadium - declined to make large-scale cutbacks and the only substantial reduction in supplies to the Western world resulted from the cutback of Chinese production of 80% V ferrovanadium by Panzihua Iron & Steel Group and Jinzhou Ferroalloy Group. Chinese steel producers tend to use predominantly 50% V ferrovanadium and the bulk of 80% alloy production is exported.

Not only has South Africa maintained its production of pentoxide at high levels but it

has also moved decisively in recent years to become a major world producer of ferrovanadium. Xstrata, which produces pentoxide from two operations in South Africa and Windimurra in Australia, has succeeded in expanding its role as a primary vanadium producer in competition with steelmakers in South Africa, Russia and China. Since commissioning its ferrovanadium plant at its Rhovan operation in South Africa in July 2000, it has also become a leading world producer of the alloy. Its South African rival Highveld, which moved downstream into ferrovanadium some years before Xstrata, took a further step in August last year to expand its role as an alloy producer. It announced that it would initiate a detailed feasibility study, together with Japan's Nippon Denko and Mitsui, aimed at establishing a joint venture in South Africa for the production and sale of ferrovanadium.

The world oversupply of ferrovanadium culminated in the filing of an anti-dumping petition in the US in November, against imports from China and South Africa.

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