As deoxidizer and alloy additive siliconmanganese and ferromanganese play an important role in the improvement of steel quality and performance in steel making. The research on production and market of siliconmanganese and ferromanganese is important for the survival and development of the industry. The research is also practical for the healthy development of steel industry as well. Statistics information on siliconmanganese market and production are given in this paper. Some opinions on the development of the industry is also given.

1. History and current status of the production and market

1.1 Excessive production is growing

The latest statistics shows that there are 1500 ferroalloy producers and around 3000 blast furnaces and electric furnaces for ferroalloy smelting in China. The total production capacity is estimated as high as 22 million pty or 25 million tpy plus the constructed project capacity. In term of Ferromanganese and siliconmanganese production there are 600 producers and 9 million tpy of capacity. In 2005 the production of siliconmanganese and ferromanganese peaked to 4.85 million tons, increased by 14.33% year-on-year.

However, the potential of ferromanganese production in China is very strong as it is easy for ferrosilicon furnaces to convert into ferromanganese smelting. The excessive production has been the problem of Chinese ferroalloy industry. Now the excessive production capacity of blast furnace ferromanganese is 36% in the world and 52% in China and the excessive capacity of siliconmanganese is 29% in the world and 65% in China. Though the Chinese authorities have taken number of measures to control the overcapacity construction the result seems opposite. It is our whish that the excessive capacity might be eliminated by the new approved policy of entering permission of ferroalloy industry.

Figure 1 Trend of production capacity, output and consumption of Siliconmanganese and Ferromanganese in China and in the world, kt

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Production</td>
<td>7628</td>
<td>7853</td>
<td>8914</td>
<td>10952</td>
<td>10422</td>
</tr>
<tr>
<td>Capacity in China</td>
<td>2500</td>
<td>3200</td>
<td>4200</td>
<td>7000</td>
<td>9000</td>
</tr>
<tr>
<td>Chinese production</td>
<td>2293.6</td>
<td>2695.7</td>
<td>3067.4</td>
<td>4242.2</td>
<td>4850</td>
</tr>
<tr>
<td>Chinese apparent Consumption</td>
<td>1744.6</td>
<td>2080.7</td>
<td>2367.4</td>
<td>3237.1</td>
<td>3900</td>
</tr>
<tr>
<td>Chinese export</td>
<td>508.8</td>
<td>624.6</td>
<td>726.1</td>
<td>994</td>
<td>545.8</td>
</tr>
</tbody>
</table>
1.2 Production is concentrated in Southwest China, North is potential
In the early years the distribution of ferromanganese production was reasonable. In 80’s Ferromanganese industry has been developed in the Southwest China where manganese ore resource is predominant. In the new millennium 70% of Ferromanganese has been produced in the 5 provinces of the Southwest China. In 2005 the output in the 5 province is as high 72% of the total output in China, increased by 19% year-on-year.

However, change takes place in recent years. The production of ferromanganese is growing in the provinces of Shanxi and Inner Mongolia in the North China. North China is the major steel production area in China with the total production of 60 – 70 million tpy. The demand for ferromanganese there is very strong. Besides, the resource for coal and electric power is abundant. The transportation for overseas manganese ore from port to plants is economic for ferromanganese smelting in North China. It is estimated that present production capacity in North China is 800 kt per year and would be 1.2 million tpy in 3–4 years. In recent years ferromanganese production in Guangxi is increased to over 1 million tpy, especially in the favorable port areas like Qinzhou.

1.3 Chinese contribution of Ferromanganese to the world
Ten years ago the annual output of ferromanganese in China was 1.9 million tons. In the millennium China became the biggest ferromanganese production country. In 2001 Ferromanganese production in China was 2.294 million tpy, which was 30.2% of the global production. In 2005 ferromanganese production in China was 10.42 million tpy, which was 46.5% of the global production. The proportion of ferromanganese production of China increased from 30% to 46.5%. In fact, China made great contribution to the growth of world ferromanganese production.
1.4 Consumption increased and market became weak
The development and the demand of steel industry in China stimulated Chinese ferroalloy industry
and the market. In recent years the recovery of world economy, especially the rapid growth of
Chinese economy stimulated the consumption of steel products. The output of global crude steel
peaked to 900 million tpy − 1 billion tpy and 1.1 billion tpy in 4 years. In 1996 Chinese steel
production peaked to 100 million tpy. The annual growth rate of Chinese steel production has
been 30 – 40 million tpy since 2001. In 2005 the output of Chinese steel peaked to 349 million tpy,
which is 31.3% of the world production(Fig. 2). The demand of the global and the Chinese steel
industry has driven ferromanganese production(Table 1).

![Figure 2 Variation of global and Chinese steel production, million tpy](image)

<table>
<thead>
<tr>
<th>Term</th>
<th>Area or grade</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>World</td>
<td>771420</td>
<td>829740</td>
<td>848180</td>
<td>902930</td>
<td>967160</td>
<td>104632</td>
<td>110714</td>
</tr>
<tr>
<td></td>
<td>China</td>
<td>123950</td>
<td>127240</td>
<td>151030</td>
<td>182250</td>
<td>222340</td>
<td>280480</td>
<td>349360</td>
</tr>
<tr>
<td>Output</td>
<td>HC</td>
<td>1001.9</td>
<td>1050</td>
<td>1088.2</td>
<td>1111.4</td>
<td>1094.7</td>
<td>1718.8</td>
<td>1950*</td>
</tr>
<tr>
<td></td>
<td>SiMn</td>
<td>840</td>
<td>890</td>
<td>1205.4</td>
<td>1584.3</td>
<td>1972.7</td>
<td>2523.4</td>
<td>2900*</td>
</tr>
<tr>
<td>Export</td>
<td>HC</td>
<td>122.3</td>
<td>189.7</td>
<td>155.4</td>
<td>173.7</td>
<td>227.7</td>
<td>300</td>
<td>169.2</td>
</tr>
<tr>
<td></td>
<td>SiMn</td>
<td>298.5</td>
<td>362.7</td>
<td>353.4</td>
<td>450.9</td>
<td>498.4</td>
<td>694</td>
<td>376.6</td>
</tr>
<tr>
<td>Consumed</td>
<td>HC</td>
<td>885.3</td>
<td>860.7</td>
<td>892.6</td>
<td>947.3</td>
<td>893.2</td>
<td>1396</td>
<td>1600*</td>
</tr>
<tr>
<td></td>
<td>SiMn</td>
<td>541.5</td>
<td>527.3</td>
<td>852</td>
<td>1133.4</td>
<td>1474.3</td>
<td>1841.1</td>
<td>2300*</td>
</tr>
</tbody>
</table>

(*Estimate)

It is predicted that in 2006 the growth rate of the Chinese steel production would slowed down to
10% − 15% and the output of crude steel should be within 380 − 400 million tpy. The demand for
ferromanganese would be 4.4 to 4.5 million tpy, increased by 400 − 600 kt. It is predicted that the
global demand for ferromanganese and siliconmanganese would be 11 million tpy. The rapid growth of the Chinese economy and the growth of global steel production will provide spacious market for siliconmanganese and ferromanganese production. However, it is pointed out that the ratio of consumed siliconmanganese and ferromanganese in steel making has been changed with the progress of steel making technology and change of steel product structure (Table 2).

Table 2 Unit consumption of siliconmanganese and ferromanganese in steel making

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>2000</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC FeMn</td>
<td>7.6</td>
<td>5.4</td>
<td>4.7</td>
<td>3.5</td>
<td>2.52</td>
</tr>
<tr>
<td>SiMn</td>
<td>3.0</td>
<td>5.6</td>
<td>6.2</td>
<td>6.6</td>
<td>9.13</td>
</tr>
<tr>
<td>MC/LC FeMn</td>
<td>0.67</td>
<td>0.65</td>
<td>0.46</td>
<td>0.52</td>
<td>0.60</td>
</tr>
<tr>
<td>Total</td>
<td>11.27</td>
<td>11.65</td>
<td>11.36</td>
<td>10.62</td>
<td>12.25</td>
</tr>
</tbody>
</table>

Table 2 shows that the unit consumption of ferromanganese is reduced from 7.6 kg/t steel in 1998 to 2.52 kg/t steel in 2004, decreased by 200%. The unit consumption of siliconmanganese is increased from 3.0 kg/t steel to 9.13 kg/t steel, increased by 200%.

The excessive production continues when the consumption continues increasing. Now the surplus production capacity in China is over 10 million tpy. The operation rate is only 40%. As result of surplus production the competition in price of ferroalloys has been intense and the weak market would continue for long time. Most producers will be in loss status for long time. The price peaking in late 2003 and in 2004 was only exceptional.

5. Critical ferroalloy export

Ferroalloy export started in 80’s. The government encouraged processing trade of ferroalloys before 2004. As result the export of siliconmanganese and ferromanganese continued increasing. The proportion of exported siliconmanganese and ferromanganese varied in 22% – 26% of the production in 1998 – 2005.

The rebate of export duty and processing trade were cancelled in 2004 and the export duty was re-imposed in 2005 according to the macro control policy of the Chinese government. As result the export of siliconmanganese and ferromanganese in 2005 was 545.8 kt, decreased by 45% year-on-year. It was only 12.56% of the production of the year. The trend of export volume and price is shown in Figures 3 and 4.

It is believed that appropriate amount of export are feasible to relax the competition of ferroalloy in the domestic market. However, it is pointed out that the restriction of ferroalloy may result in loosing the overseas market share.

Figure 3 Export trend of Siliconmanganese
1.6 Dependence of ferromanganese production on overseas ore

According to the statistics the total reserve of manganese ore of China is 650 million tons. The reserve in the Southwest China is over 500 million tons, which is 82% of the Chinese reserve. Though China’s reserve of manganese ore ranks in front in the world the grade of the ore is relatively low and the impurity content is high. The average manganese content in the major manganese ore producing country is as high as twice of the content of the Chinese ore or even higher. The annual output of the Chinese manganese ore is around 4 – 5 million tons. However, the quality and the quantity of the ore can not satisfy the growing demand of Chinese steel industry for siliconmanganese and ferromanganese.

China started importing manganese ore since 1984 as supplemental resource. Till 1994 the import volume varied in 300 kt – 1,000 kt tpy. In the period of 1994 –2000 the import varied in 1.0 –1.6 million tpy. In the past 4 years the import of manganese ore increased from 1.7 million tpy in 2001 to 4.58 million tpy in 2005. China became the biggest manganese ore consuming country in the world. The rapidly growing demand of manganese ore drove manganese ore price growing. It certainly influenced on the domestic production of ferromanganese. Now, manganese ore import of China shared 35% of the global manganese ore export(Figures 5 and 6).

Figure 5 Trend of manganese ore import of China, Unit: $10 \times 10^3$ tpy
1.7 Influence of electric power supply

Electric power supply is essential for ferroalloy smelting. The electric power consumption of ferroalloy smelting shares 1% of the national electric power generation. Power supply has been a key factor of ferroalloy production. In 2003~2004 power supply in China was extremely critical. It resulted in substantially ferroalloy price growing. The construction of electric power generation has been sped up in recent years. 66020 MW power generator was put into grid in 2005. Since Sept. 2005 the electric power supply has got relaxed to some extent.

The electric power supply will get further improved as another 72000 MW of power generators will be put into the grid. In 2006 the power supply turns to balance and the deficient supply of electric power would end. It is expected that the power supply would not refrain ferroalloy production anymore in future. The excessive production capacity will be modified when market requires. This provides opportunities as well as challenge for ferroalloy producers in future.

However, power price is still a major limiting factor for most Chinese ferroalloy producers. Compared with overseas countries the power price in China is relatively higher. The macro control policy of the state government has strengthened the administration of power supply for ferroalloy industry. The power price for high energy consuming had been enhanced. Now 30% of the production cost comes from electric power consumption.

1.8 Advantage of overseas producers
Beside Chinese producers, there are about 60 ferromanganese and siliconmanganese producers in 20 countries. The annual production of these producers is around 5 million tpy.

The production capacity of the major producer is over 100 kt. The maximum capacity of the company is over 1.2 million tpy. The size of most ferromanganese furnaces is 30 – 70 MVA. The maximum size is 105 MVA. Advanced close and semi-close furnaces technique, furnace gas recovery and fume cleaning techniques are applied in most furnaces. The regulation for environment protection is strict. However, the common size of the furnaces in most Chinese companies is less than 12.5 MVA. The backward production equipment of low efficiency still exist in China. Therefore, the overseas companies with the advantage of equipment, high efficiency, low power tariff and manganese ore resource predominates in the competition.

2. Outlook and suggestion
The growth rate of Chinese and global economy and steel production is slowing down. Ferromanganese market is influenced thereby. The macro-control policy is influencing on the Chinese steel industry and ferroalloy industry. Series regulation like differential power tariff, policy of entering permission for ferroalloy enterprises, rectification of ferroalloy enterprises, cancellation of duty rebate for ferroalloys and other policy were presented by the Chinese authorities. It is expected the problems like overlapping construction, surplus production, waste of resource and pollution should be solved. The policy is helpful to the development of Chinese ferroalloy industry. On the other hand, the macro-control policy resulted in increasing production cost of ferroalloy and refraining of ferroalloy export. The balance of demand and supply in the domestic market has been influenced. The price for ferroalloys has dropped down.

The excessive production capacity of steel industry becomes a serious problem of the development. The surplus capacity of steel production is now over 120 million tpy. The surplus capacity including the potential expansion might be as high as 170 – 200 million tpy. The price of steel products also influences on the price for ferroalloys. The price for rolled steel is declining since mid 2005 as result of excessive production. The profit space for steel producers is limited. In the mean time the steel producers press the purchased ferroalloy price. Both the prices for steel and for ferroalloys are dropping.

In the overseas market the ferroalloy production in Russia, Ukraine and other East European countries has been resumed. The major ore suppliers in the world started to invest in ferroalloy production. The surplus supply occurs in the international market. Overseas ferroalloys at low prices now start to impact the Chinese market.

The professional predicted that the Chinese GDP growth rate would be kept at 9%. But the ferroalloy production is already excessive. In the past 5 years the production capacity of siliconmanganese and ferromanganese was expanded by 4 times and the output was tripled. The production and the capacity already exceeded the demand in the market. Though the market bounced in late 2003 it turned to weak again in late 2004.

What is the future of ferromanganese producers? What can the producers do in future? Here are our opinions.

2.1 Strategy cooperation with overseas ore suppliers
The development trend of the Chinese economy will continue in 2006. It is predicted that the growth rate in 2006 will remain at 9%. The growth rate of steel production will be 10% – 15%. The production of the Chinese crude steel will peak to 380 million tpy. The production of siliconmanganese and ferromanganese will peak to 5 million tpy. Mean while, the import of manganese ore will also peak to 5 million tpy. In the meaning of consumers, the producers of ferromanganese are the “god” of the ore suppliers. It is suggested that the overseas manganese ore resource companies should establish long
term strategy cooperation with those powerful ferromanganese producers in China to get double win.

2.2 Strategy partnership with powerful steel groups
The supply of ferromanganese to steel companies is the trade target of ferromanganese producers. Now, the domestic steel industry is under the process of restructure and consolidation. It provides opportunities for ferroalloy companies to establish stable strategy partnership with those powerful steel groups. It is essential for the survival of ferroalloy industry and for a stable market. On the other hand appropriate amount of export is an important measure to balance the domestic market. Multi-channel of export is significant to a stable production.

2.3 Consolidation and industry restructure
The disadvantage of the Chinese ferroalloy industry is in small production scale, unreasonable distribution of the companies and backward facilities. In order to improve the industry the backward companies must be removed from the market. At present consolidation of ferroalloy industry and improvement of the management will result in powerful group and in industry restructure. The companies should strengthen their strategy cooperation to increase the ability of competition in the domestic and the international market. It is suggested that the authorities should take new measures to encourage the consolidation of companies and to form powerful group in order to increase the competition ability of ferroalloy industry.

2.4 Technology innovation and development of new products
The development of new products to adapt the technology progress of steel industry is the demand of steel industry. The development of new products is helpful to increase the additive value of the ferroalloys and increase the core competition capability. It is important to develop new siliconmanganese and ferromanganese products with low phosphorous, low sulfur and low carbon and to introduce new process technology. The progress of ferromanganese production should make new contribution to improve the purity of steel and to upgrade the steel products. The ferroalloy producers should also pay attention to technology innovation and catch up with the world advanced technology in energy saving, resource saving, environment and recycling of material. In this way the Chinese ferroalloy industry will be developed toward a strong industry.