

## Optimization of Structure of Steel-Making in China and Its Demand on the Optimization of Ferroalloy Production

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### SUMMARY

During the process of sustained, steady and rapid development of iron and steel industry in China, close attention has been paid to the adjustment and optimization of structure with remarkable results attained. In 1997, 107.57 million tons of steel, 11.374 million tons of pig iron and 97 million tons of steel products were produced in mainland China. China has become the number one country of iron-, steel- and steel products- making in the world. In order to adapt to the requirement of the realization of two fundamental changes of socialist market economy and intensive management, optimization of the structure of technology and equipment as well as the structure of operation and management were pushed forward all-sidedly in the iron and steel industry on the basis of rationalization and specialization of the structure of products. Being an intermediate and central link of the whole process of iron and steel production, steel-making plays an important role in the optimization of structure. Concurrently with the realization of its own optimization, it promotes the optimization of iron-making and raw materials preparation as well as the optimization of steel-rolling. At the same time, since steelmaker is the principal user of ferroalloys, it will necessarily put forward new demands of optimization on ferroalloy production and ferroalloy products.

### I. Emphasis and characteristics of optimization of structure of steelmaking

With top quality, high efficiency and low efficiency as important goals, the optimization of structure of steelmaking is to improve the competitiveness of enterprise in the market and the share of products in the market on the basis of these goals. Since the beginning of nineties, emphasis has always been placed on the following five aspects:

1. Accelerate the phasing out of outdated technology and equipment, mainly open hearth and cupola.

Eliminate gradually small furnaces of backward outfit, high consumption, low efficiency and poor quality. In 1993, Chongqing Iron & Steel Company first started to shutdown its open hearth plant. Toward 1997, 21 open hearth furnaces have been phased out; output has dropped by 40%. The plan to eliminate all open hearth furnaces toward the end of the century has been worked out.

2. Optimize the structure of varieties of steel products. Eliminate obsolete types and devote major efforts to develop low alloy steels and micro alloy steels. Develop toward the field of specialization and production of clean steel with the emphasis on controlling composition within narrow range, purity, uniformity and stability.

3. With vigorous development of continuous casting as the breakthrough and complete continuous casting as the direction, achieve the combined optimization of steelmaking-treatment outside furnace (including pretreatment of iron, refining of steel and ladle metallurgy)-high efficiency continuous casting techniques. This is the strategic key point of optimization of structure of steelmaking. Since 1989, the output of continuous casting slabs has increased at a high speed of annual

rate of 5%. In 1997, the output has already reached 65.08 million tons, proportion of continuous casting reached 60.50%; the number of workshops for complete continuous casting attained 66; the optimization of structure of steelmaking and thus the pushing forward of the optimization of the structure of the whole iron and steel industry were hastened.

4. For converter production, the emphasis is placed on refining, high precision end point control, gas and waste heat recovery, refining (mainly the whole range of pretreatment of iron); for treatment outside furnace, on technological flow process of comprehensively bringing into varieties of production; for continuous casting, on high efficiency, automation, hot transfer and hot load, near end-shape continuous casting; for electric furnaces, on enlarging sizes, saving power consumption, improving the intensity of input of chemical energy, shortening the smelting cycle and linking up with refining and continuous casting.

5. Strengthen stepwise the emphasis on transformation into clean factories with the combination of treatment of dusts, waste water, waste gas pollution and comprehensive utilization. Realize the sustained development of steelmaking and form new economic growing point.

The optimization of steelmaking in China has its own characteristics due to the difference between China and developed countries with respect to conditions of environment and development, mainly manifested in the following:

1. Organize the adjustment and optimization under the condition of high speed growth of production scale. To handle properly the contradiction between development and funds for reform, everyday benefit, etc. is quite difficult.

2. That historically formed medium and small plants constitute the major part and that they can not be phased out in a short time will bring about practical difficulties to the optimization of structure. It is inevitable that unbalanced development and formation of different levels of demand and standard will exist during the optimization of steelmaking.

3. In addition to the continuation of adjustment and optimization of steelmaking itself, the next step is to place new emphasis on linking and matching the steel rolling process with respect to varieties, specification of sections, hot joining; strengthening

the treatment of environmental pollution and developing synchronously the relevant trades of ferroalloys and refractories.

## **II. Some requirements on the optimization of ferroalloy production**

In terms of output, ferroalloy production in our country has already ranked the first in the world several years ago, and amount of export has also come out in the front in the world. Now the optimization of steelmaking will again put forward new demand on ferroalloy production.

1. Firstly, the output of steel in China is going to continue its growth. From the analysis of market demand, toward 2000, steel output will reach over 120 million tons. Considering the development of low alloy steels and alloy steels, the total demand of ferroalloys will be around 2.5 million tons according to the calculation with average consumption of 15kg/t ferroalloys, but our ferroalloy output has already reached over 4 million tons in 1996. Therefore, the emphasis on production capacity is how to improve the level of equipment to give full play the potential ability of production efficiency in those existing large and medium ferroalloy plants. At the same time, the problem of reforming and eliminating those small plants with backward equipment, high consumption and low efficiency should be seriously studied. How to re-adjust the structure of the varieties of silicon and manganese ferroalloys within the above range of output according to the tendency of the development of alloy steels, low alloy steels and micro alloy steels and also according to the requirement of the universal improvement of the qualities of steel should deserve close attention. Especially the production of alloys of chromium, niobium, vanadium, titanium, boron, alkaline earth and rare earths which will have to develop and increase with the development of alloy steels, low alloy steels and micro alloy steels should be planned. In addition, in order to reduce the consumption of ferroalloys and to improve the metallurgical effects, how to develop complex ferroalloys and to phase out gradually low brand ferroalloys should be considered in full.

2. In order to adapt to the requirement of production of clean steels and the development of

techniques of steel refining, it is inevitable to develop various new varieties including ultra-pure ferroalloys, such as ferrosilicon with traces of carbon and aluminum, ferrochromium with low phosphorus and extra-low carbon, etc., some of which have already been produced and have good results.

3. Great importance should be attached to the direct production of various ferroalloys of qualified particle sizes and techniques of core wires, powders (including passivating powders) in order to reduce consumption in steelmaking and to satisfy the adjustment of alloys in various links of technology.

4. In spite of rich reserves, the raw materials of ferroalloys in China are of low grade and high content of harmful impurities. Development of techniques for treating these raw materials should be hastened.

5. Techniques of energy saving and cost lowering with saving electrical energy as the main point and

techniques of environmental protection are naturally the emphasis whereby ferroalloy production can be optimized. Especially since the optimization of steelmaking put forward more stringent demand on ferroalloy production, to supply new types of ferroalloys with high quality and low cost is a matter of concern for steelmakers. For example, complex ferroalloys from direct production in smelting furnace will have more competitiveness than those from hot mixing.

Ferroalloy production is now adapting to the requirement of the optimization of structure of steelmaking which is still deepening and has made new progress in strengthening management and intensifying the development of new technology and new techniques. We are convinced that these work will push forward the steady, healthy and rapid development of steelmaking in turn. Optimized ferroalloy production will enter the 21st century together with optimized steelmaking.