

Baosteel Group Special Steel's Globalization Competitiveness

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Abstract: This article analyzes the trend of special steel development worldwide and the circumstances of international trade and discusses Baosteel's measures to sharpen its international competitive edge. Baosteel Group has made its strategic arrangement to establish a special steel manufacturing center and a special steel technical center on the basis of the existing special steel research and manufacturing capacity. In order to form a powerful global competitive capacity, it is necessary for Baosteel Group to quicken the development of special steel on its existing superiorities. According to Baosteel's strategic arrangement, a special steel manufacturing center and a special steel technical center will be established in the "Eleventh Five-Year" period (2006-2010) and the manufacturing center will be formed initially by the end of 2006. In Baosteel's strategy, the goal is to establish a quality special steel manufacturing base and a special steel research and development base for new materials, new processes and new techniques with powerful comprehensive competitive edge globally. The bases will form a core force in developing China's special steel in the future and taking more historical responsibilities for improving China's national economy and national defence construction.

Key Words: special steel, competitiveness

1 The Development trend of special steel worldwide

1.1 The situation of supply and demand of special steel worldwide

There are two basic characteristics in current situation of supply and demand of special steel worldwide.

Firstly, the practice in developed countries shows that the demand per capita for special steel constantly increases as that for common steel decreasing. With the progress of global industrialization and the development of high technology industries, the production and consumption of special steel is expanding worldwide.

Secondly, since 1970s, governments worldwide carried out their "Self-Reliance" policies overly to meet the requirement of developing their own national economy, causing the global surplus of special steel production capacity. (It is said that the current global annual

production capacity of special steel has hit 120~130 million metric tons, while the operating rate is only about 70% or so.) With the quickening of globalization of world economy in special steel manufacturing section, the manufacturers will face tougher competition.

1.2 Tendency of development of special steel worldwide

(1) When Japan and other industrialized countries in Europe and America reached the peak of steel production respectively, they took the same action in further development. They concentrated their efforts on the development of high-tech, high-value-added special steel products trying to seize bigger shares in the international market.

(2) Since 1980s, especially during the past ten years or so, many foreign special steel manufacturers have restructured and/or renovated their production lines. (Restructuring for Specialization has been carried out within the company or among companies. Renovations have been done on production lines to streamline the process flow for designated special steel products.) It was a stride forward for special steel production in specialization, economy scale, upgrading quality and intensive processing.

(3) Currently, industrialized powers are targeting low cost, high efficiency and environment-friendly in developing new techniques and processes independently to maintain their advantages in competition of cost;

(4) Since 1990s, giant companies have quickened their paces in strategic restructuring alliance among giants and mutually supplements in advantages to form more powerful competitiveness and to take the leading positions in the market and to avoid increasing risks in the market.

2 Circumstances of international trade for special steel products

With the approaching of the end of the transition period of China's entering World Trade Organization (WTO), the integration process of two markets and two resources (domestic and abroad) is accelerating. Chinese special steel manufacturers are facing a tougher, more complicated and severer competitive environment:

(1) For Chinese special steel manufacturers, the biggest uncertainties and competition come from the impact of imported goods, especially high value-added products. Though there is a tight supply of high value-added special steel products in China, the world has witnessed the surplus of production capacity for special steel. After China's entering World Trade Organization (WTO), foreign giants are targeting Chinese market to pour their high value-added special steel products. Whether Chinese special steel manufacturers can

effectively absorb the impact from abroad mainly depends on their efforts on upgrading technology and restructuring.

(2) Chinese special steel manufacturers are struggling in two markets, both domestic and abroad. The competition on price will be further intensified. Widely-applied low-end and medium special steel products (accounting for 80~90% of total consumption of quality special steel in domestic market) will be impacted comprehensively by the imported products manufactured by foreign giants in variety, quality, price, service, etc. Conventional scrap-sourced special steel manufacturers have to face the price competition from domestic special steel manufacturers with the advantages in the source of iron (adopting hot metal charging process in EAF) and key common steel manufacturers with long process flows (converter plus secondary refining).

(3) Since China's steel industry is sustainedly developing at a high speed, the domestic market witnesses the obvious shortage of raw materials and insufficient transportation capacity. There is a serious shortage in the supply of scrap (accompanying obvious quality downgrading). Prices of key raw materials skyrocketed sustainedly. All these have driven special steel manufacturers, which normally operate in the form of mini mills, to face higher production cost, unassured quality of products, limited profit capability and weakened competitive capacity.

3 Basic countermeasures to sharpen global competitive edge and discussions on several issues

3.1 Basic countermeasures

The "Eleventh Five-year Plan" period is a critical historic period for China's special steel manufacturers to compare with the industrialized powers and catch up with and surpass them. On the basis of analyzing the development trend of special steel in the world and the circumstances of international trade of special steel and analyzing its own advantages, disadvantages, opportunities and risks, Baosteel will take the following measures to sharpen its global competitive edge:

(1) Eliminating separation within the group to form a powerful group competitiveness

According to Baosteel's strategy to being listed among Top 500 and the framework to establish three manufacturing centers (for producing special steel, stainless steel and carbon steel), Baosteel Group is restructuring its daughter companies to form a high-level, sophisticated special steel technology center and a quality special steel manufacturing center,

which consists of four specialized production lines producing stainless long products, alloy steel bars, alloy sheet strip and high alloy steel and four intensive processing centers producing bright steel products, metal products, precision cold strip and special steel tube. It is expected to build Baosteel into the core force in developing China's special steel industry with the largest-scale and the most influential leading position through sustained development in the "Eleventh Five-Year Plan" period.

(2) Implementing dual-strategy for two markets

a) To cast sight on both domestic and international markets, to focus attention on developing high-end and medium special steel products which are shortly supplied in the domestic market and to compete with foreign brands in the world market

b) To be involved with the competition in the world mainstream in the 21st century, to implement the following strategies based on optimization of product structure and technical innovation:

To produce high-end products with differentiated strategy;

To produce medium products with low-cost operation strategy;

To form the advantages of products featuring high quality and low energy consumption.

(3) Comparing with top manufacturers in the world and realizing three superior(s) in special steel manufacturing

a) Superior in quality of the product featuring higher cleanliness, higher homogeneity, higher performance, higher precision in both surface and sizes ---to fully develop the advantages in manufacturing high value-added special alloy and quality high alloy steel products.

b) Superior in the process flow---to streamline the layout of process flow and make it a more rational and flexible one by eliminating redundant steps, to catch up with or surpass the advanced world level in technical and economic data acquired in special steel manufacturing

c) Superior in meeting the demand of the market---to extend the range of intensive processing and provide near net shape products for customers, to satisfy market demands and create greater social benefits

3.2 Discussions on several issues

After China's entering World Trade Organization (WTO), Chinese special steel manufacturers are facing global competition. How to sharpen the global competitive edge is a comprehensive topic. Based on the current situation in Baosteel special steel section and its strategy for the future, ideas on several issues related with sharpening the core competitive edge and main measures are formed.

3.2.1 Optimization of sources of iron and steel

(1) Optimization of sources of iron and steel has a direct impact on quality of special steel products and production costs, which is crucial to the profits of special steel manufacturing.

According to the development plan of Baosteel special steel manufacturing center, the annual capacity will reach 2 million metric tons mainly produced in EAF-dominated mini mills. In China, scrap-sourced electric furnace steelmaking is displaying its fatal weakness due to the limits of outer supporting resources. The resource of scrap is short of supply. (The accumulated social scrap is less than one third of that of the United States.) A large amount of scrap is poor in quality containing concentrated harmful, impurity elements such as copper, tin, lead, etc., which leads to poor cleanliness of liquid steel. Therefore, it is difficult to effectively eliminate harmful residual elements in steel to meet the specifications of high- and medium-grade products. Prices of raw materials from upstream (scrap, iron, etc.) are skyrocketing, which drives the cost of electric furnace steel to escalate. Price of electricity is high in China. Profit margin in special steel manufacturing section is narrow. Optimizing the source of iron for steelmaking is a critical measure for the development of the special steel manufacturing center. A reliable, inexpensive and quality source of iron is a must for Baosteel Special Steel to compete with foreign giants and domestic manufacturers with advantages in the source of iron.

(2) Using hot charging process in EAF to replace the conventional scarp-sourced process is the trend of development of optimizing EAF process both at home and abroad.

Since 1980s, hot charging process in EAF not only has been widely applied in the countries which are short of scrap and electric power (such as India, Brazil, South Africa, etc.), but also has been adopted in the countries which have sufficient resources in scrap and electric power (such as the United States, France, Belgium, Russia, Japan, etc.) as an important measure to save energy, to reduce consumption and to produce high purity steel. During past ten years, based on the successful experience from Huaiyin Steel, Shazhou Steel and Hangzhou Steel, which adopted hot metal (from the blast furnace) charging process in EAF, many other special steel manufacturers including Xingcheng Steel, Daye Steel, Benxi Steel and Laiwu Steel have adopted the hot metal charging process in EAF by using existing sources of hot metal or by establishing new blast furnaces. All of them have achieved remarkable benefits.

Hot charging process in EAF can effectively control the harmful and residual elements and obtain the following technical and economic benefits compared with scrap-sourced

process according to some foreign data:

- To obviously improve the cleanliness of liquid steel;
- To raise the comprehensive thermal efficiency by 55%
- To reduce the electricity consumption in melting by 48%;
- To raise the production efficiency by more than 20%;
- To reduce the costs of raw materials by more than 10%

According to some domestic data, the hot charging process in EAF (hot metal ratio: 30%~40%) brought comprehensive benefits in reducing the cost of liquid steel by 200-300 yuan (US\$24-36) per metric ton.

According to a rough estimation based on the expected annual capacity of 2 million metric tons electric furnace steel in Baosteel special steel manufacturing center and the cost of steel to be reduced 200 yuan (US\$24) per metric ton, the potential reduction of total cost is more than 400 million yuan (US\$48 million) (not including indirect benefits obtained from the production efficiency of electric furnaces and higher quality grades of products).

At present, some manufacturers both at home and abroad adopt direct reduction iron (DRI) to replace scrap in producing high purity steel. But there are two negative factors: one is the higher price of DRI, which increases the cost of steelmaking, the other is the longer melting cycle, which makes it difficult to match the production in the downstream continuous casting section.

Summarizing the above-mentioned, we consider that using hot metal charging process in EAF to replace part of scrap is the best choice in optimization of the source of iron and steel for special steel manufacturing after balancing quality, economy, process flows, etc.

(3) The main ways to obtain hot metal for steelmaking

There are two matured technologies in producing hot metal: one is the conventional blast furnace ironmaking process; the other one is the smelting reduction ironmaking process, which was developed in recent years. (There are 5 smelting reduction ironmaking lines in operation worldwide.) According to the results of preliminary investigations, both processes are feasible, though each of them has its specific advantages and disadvantages. Though the investment of the latter is much more than that of the former, the smelting reduction ironmaking process is a better option for Baosteel special steel manufacturing, because under the condition of Baosteel resource integration, it has wider supply channels and lower prices for its upstream raw materials for smelting reduction process (consuming lump ore/pellet and lump coal only, no utilization of sintered ore and coke), compared with blast furnace process. Besides, smelting reduction process is a new environment-friendly technology for

ironmaking.

3.2.2 Optimization of product structure

Competitiveness of a company can be concentratedly reflected in its varieties, quality and cost of products, service, capability of flexible response to the changing market and satisfaction from the customers.

To meet the demand of special steel in the future market and solve the current structural contradiction in demand and supply of special steel in domestic market, Baosteel is restructuring its special steel resources and optimizing the structure of its products. It implements a differentiated strategy for its products, i.e. to provide what others do not have, to upgrade when others have, and to provide new products when others have upgraded their products. Baosteel is quickening its pace to form the brand with its own characteristics and sharpen its global competitive edge.

3.2.2.1 Obvious contradiction of supply and demand of special steel in China and its development trend

At present, the structure of special steel products in China is irrational featuring oversupply in whole and short supply in local. The structural imbalance is worsening.

Compared with advanced countries in special steel manufacturing, the biggest gap in the structure of products is that quality special steel sheet strip ratio and the proportion of products featuring high quality, high technology and high value-added are lower. Special steel production does not match the changing demand driven by national economic development.

(1) Regarding varieties, long products dominate domestic special steel manufacturing. In 2002, about ninety percent of domestic quality special steel were long products, while the rest 10% or so were flat products (alloy steel sheet strip) compared with about 60% long products and the rest 40% flat products in industrialized countries. In recent years, domestic consumption of alloy steel sheet strip increased remarkably both in volume and proportion. In 2002, the domestic consumption of sheet strip was 25% of the total consumption of quality special steel, of which less than 40% were domestic made, and most of them were imported from abroad.

(2) Regarding steel grades, the supply of quality carbon steel (including carbon structural steel, carbon tool steel and carbon spring steel) has exceeded the demand in the market; while high-grade and medium products featuring high quality, high technology and high value-added (especially some critical varieties) are short of supply in domestic market due to the insufficient manufacturing capacity, increasing demand and stricter requirements for quality. Part of them depend on imports, since they are not available from Chinese

manufacturers. According to the estimation from China Association of Special Steel Manufacturers, the annual consumption of these high value-added special steel, which normally equals 20% of the total consumption of quality special steel, were 3.5 million metric tons at the end of the Ninth Five-Year Plan period (1996-2000), and will be 4.8 million metric tons in the Tenth Five-Year Plan period (2001-2005) and 5.6 million metric tons in the Eleventh Five-Year Plan period (2006-2010) respectively.

3.2.2.2 Basic thinking to upgrade the product structure of Baosteel special steel

(1) Tactics

To make full use of advantages and avoid risks, the tactics for optimizing product structure of special steel in Baosteel are as follows:

To implement the principle of focusing on developing high-end special steel products and make a balance between proportions of high-end products and medium products;

To assure the benefits gained from development of varieties and the proper scale of production.

(2) Target

a) Structure of Steel Grade: to raise the alloy ratio up to 75% from the current 61.1%; to raise the high-alloy ratio up to 26% from the current 6.2%

b) Structure of Types of Products: to raise the sheet strip ratio up to 18% from the current 1.6%; to increase the proportion of intensively-processed products up to 23% from the current 8.6%

c) Structure of Quality Grades:

To raise the proportion of high-end products up to 45% from the current 11.3%-----The tactic is to provide what others are unable to provide.

To reduce the proportion of medium products to 46% from the current 60.2%-----The tactic is to provide products which are better than what others can provide.

To reduce the proportion of ordinary products to 9% from the current 28.5%-----The tactic is to provide new products for the market.

(3) Starting point of optimization of product structure

a) To fully play the existing advantages, focusing attention on development and production of superalloy, precision alloy, titanium alloy, special stainless steel in the forms of sheet strip and long products;

b) To fully develop the high and medium grade bearing steel, gear steel and tool & die steel, which are key special steel products produced in quantities;

c) To simultaneously develop high value-added intensive processed special steel

products, i.e. bright steel products, metal products, precision cold strips and special steel tubes.

3.2.2.3 Main measures for optimization of product structure

To take the restructuring of special steel resources within the Group as a chance, accelerating the technical renovation by adjusting the layout, eliminating the backward, optimizing the process flow and elements' allocation, to quicken the pace to form four completed modernized special steel production lines and four intensive processing centers for steel products

(1) Four hot working modern production lines

a) Alloy steel bar & wire production line with stainless steel as the core product (mainly coil)

(imported) 60t AC EAF+60t AOD×1, VOD/VD×1, LF×1→continuous casting (3-machine-3-strand billet machine) →fully continuous rolling mill

b) Alloy bar production line mainly for producing bearing steel and automotive steel

100t DC EAF+100t LF+100t VD→five-machine-five-strand continuous billet casting machine→continuous rolling mill

The above-mentioned two long product production lines are specialized production ones taking continuous casting as their cores featuring high efficiency and economy scale.

c) High alloy profile steel production line for producing nickel based alloy, titanium alloy, high alloy tool & die steel, etc.

Special metallurgy (vacuum induction furnace, vacuum consumable electrode furnace, electroslag remelting furnace) plus EAF for special steel → ingot casting → forging/blooming→semi-continuous rolling mill (to renovate the existing open-train mill) or forging (with newly-installed one high speed forging press and one finish forging press)

d) Special alloy and alloy sheet strip production line

Electric arc furnace plus second-phase special metallurgy→continuous casting (slab casting machine) +partial ingot casting / hammer cogging→ (to-be-built) Steckel mill

These two production lines are mainly used for producing nickel based alloy, titanium alloy, high alloy tool & die steel, special stainless steel, etc. The preserved ingot casting, forging and blooming processes in these two lines make them more flexible in dealing with diversified sizes, small quantity and hard-to-deform alloy steel.

Up to now, in China, there is no sophisticated production line for producing high alloy hot rolled products and special steel sheet strip featuring diversified sizes, small quantity and

hard-to-deform. To establish the above-mentioned two production lines are the key strategic measures for Baosteel special steel in restructuring its products.

(2) Four intensive processing centers for steel products

a) Bright Steel Product Processing Center (equipped with three cold working process flow routes, i.e. cold-drawing, grinding and turning plus calendaring) .

b) Metal Product Processing Center (consists of production lines for oil-quenched spring steel wire, PC compressor wire and strand wire, high performance steel cable and coated steel wire, stainless steel wire and stainless steel strand wire) .

c) Precision Cold Strip Processing Center (including a new primary cold strip line to be built and an expanded precision cold strip line) .

d) Special Steel Tube Processing Center (Currently it mainly produces stainless seamless steel tube. It preserves the potential to produce hot extruded steel tube, titanium tube and corrosion-resisting alloy welded tubes) .

3.2.3 Optimization of the structure of process flow — Selection of Production Mode for Special Steel

Special steel production is a complicated systematic engineering. Selection of producing mode depends on the structure of products, and it will directly influence the competitiveness of a company (especially in production cost).

During the past two decades, great changes have taken place in the mode of special steel production due to the progress of science and technology and the development of metallurgical technology. Quite a part of production of special steel has been shifted from the mode of ingot casting plus blooming process to the mode of continuous casting process.

3.2.3.1 Production modes for special steel worldwide

There are three rational, matured and typical modes in special steel production worldwide;

(1) The first mode is a four-step process flow route with continuous casting as its core.

The characteristics are as follows:

a) To realize specialized production featuring high efficiency (energy saving) and rational scale;

b) Compact process flow route;

c) Limitation: Currently this mode is adopted only for producing medium alloy steel, low alloy steel and austenitic stainless steel in bars and wires with large quantities. It is not economical for producing products in small quantity with frequently changed sizes. It is not suitable to produce difficult-to-form special alloys which can not be produced via continuous casting and high alloy steels with microstructures of martensite and ledeburite.

(2) The second mode is a combined one, which combines mode one and ingot casting and forging processes and its downstream special rolling mill.

The characteristics are as follows:

a) With all advantages of Mode One, plus a certain proportion of ingot casting capacity to produce some multi-variety, small amount and hard –to-deform high alloy steel grades, part of which can not be produced with continuous casting process;

b) To be able to produce forged products.

(3) The third mode is a combination of full continuous casting (Mode One) and partial ingot casting---blooming/hammer cogging (Mode Two).

The characteristics are as follows:

This mode is similar to Mode Two. The only difference is that it can make the best use of existing blooming mill to produce the steel grades which are currently difficult to produced in continuous casting process.

3.2.3.2 Basic thinking and main measures for optimizing the structure of special steel process flow in Baosteel

(1) Basic thinking

a) Principle

Based on the existing equipment and the designated structure of products, Baosteel is optimizing its structure of process flow routes suitable for a wide variety of products. It well balanced economy scale for special steel manufacturing and flexibility for producing high alloy steel featuring multi-variety, small batch quantity and hard-to-deform with a combination of continuous casting process and ingot casting process.

b) Viewpoint

The advantages formed in technology intensive and specialized manufacturing special steel is well-known to all. It represents the trend of development of special steel manufacturing. Because of the immature market economy in China, Chinese special steel manufacturers are unable to specialize their production lines for all products immediately. It takes time for them to integrate with the outside world completely. There shall be a good transitional plan to bridge the gap between the past and the future.

Among the demands for special steel products, the medium and low alloy steel (such as structural steel for automobile, bearing steel, etc.) are widely applied with large quantity. Relatively speaking, the total amount of high alloy steel needed in the market is not a big sum, but it features diversified grades, multi-variety and multi-size. Normally high alloy steel has to be made in small lot according to the signed contract by the complicated process flow and equipment. Currently, it is an extreme risk for a Chinese special steel manufacturer to produce high alloy steel products only, so the economy scale is hard to form, which means that big investment in this section does not bring big economic returns, and a manufacturer has

difficulties in rationally allocating its constant cost in this section. Therefore, it is necessary for a special steel manufacturer to have a proper coverage of its products (including variety of steel grades and interval of sizes) with a proper amount. The economy scale is essential for a special steel manufacturer to pursue its sustainable development strategy.

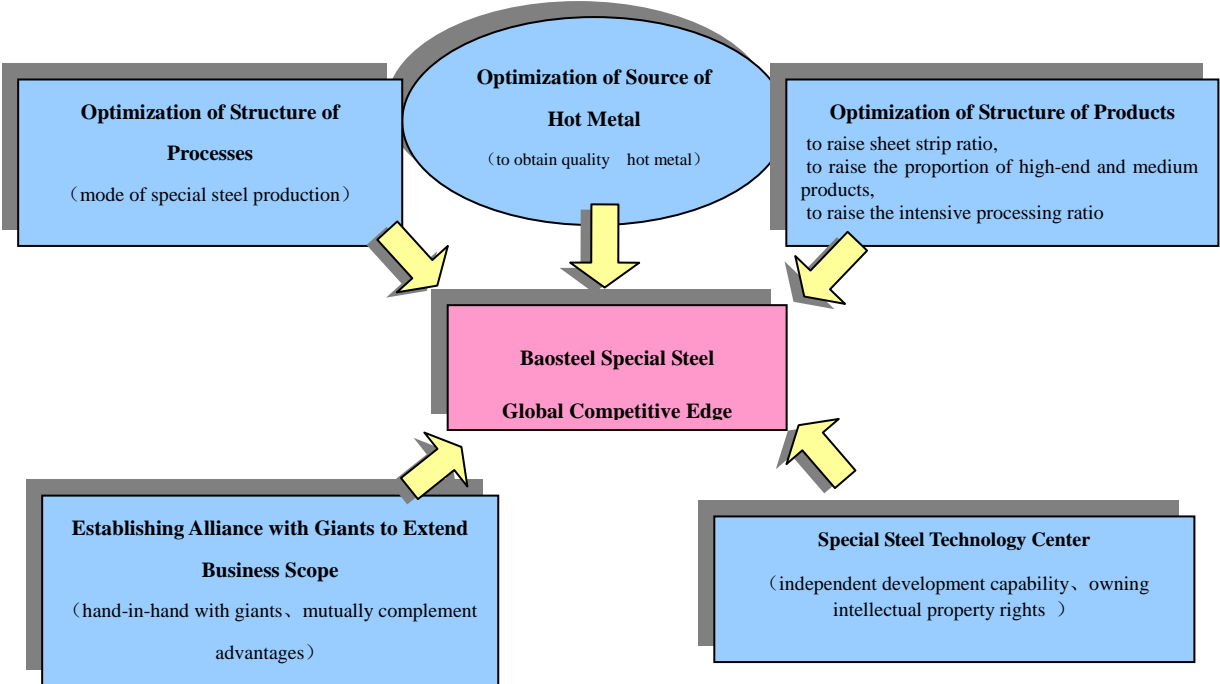
(2) Main measures

a) To assure an economy scale featuring high quality and low cost, the four-step process flow route with high efficiency and low consumption will be adopted to produce widely applied special steel grades which can be manufactured with continuous casting machine.

b) A complicated process flow route, which consists of the existing small electric furnace + secondary refining or special metallurgy(vacuum induction furnace, vacuum consumable electrode furnace, electroslag furnace)→ingot casting→blooming or forging→speciality rolling mill(integrated the existing open-train mill), will be adopted to produce hard-to-be-cast, hard-to-deform high alloy steel and special alloy and other special steel with diversified variety and small quantity. Local renovation and technical upgrading will be done on existing equipment to fully develop high technology, high value-added nickel based alloy, titanium alloy and high alloy tool & die steel to create a world famed brand with Baosteel’s own characteristics.

4 Conclusion

Baosteel is going to take following measures to sharpen its global competitive edge in special steel section:



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