Research on New Technology Development of Reducing Silicon by Iron

Xiao-feng YANG and Hong-yan ZOU
Kunming Vocational and Technical College of Industry, Kunming 650302, Yunnan, China;

Keywords: Silicon reduce, Reverse flotation, Iron, Concentrate.

Abstract. A great importance of silco-reduction and increasing of furnace burden to the improvement of iron-making, economic results is analyzed. The present research status of the new technology of raising iron and reducing silicon in Chinese iron and steel enterprises is discussed. The authors discuss how to develop China’s mineral processing industry, and point out the way forward, countermeasures and some concerned problem.

Introduction

With the rapid development of the national economy, China's industrial and infrastructure consumption of mineral resources was rapid growth year after year. China's steel industry has experienced more than 60 years of development, Steel production has reached the largest of the world, and still growing rapidly. Iron ore is the most important material of iron and steel enterprises. although every year mining scale reaching more than 240 million tons, low-grade, difficult to handle and a large number of foreign iron ore into the face of increasing competitive pressure. In the market economy, Iron and steel enterprises in pursuit of higher economic efficiency, profit and energy saving and emission reduction, higher quality of iron ore is required.

New Requirements for Iron Ore

China has proposed "make bigger and nicer iron ore market" from 2002. Bigger mean maximum efficiency and to achieve deep processing. Even if the mining area is scattered, but also needs centralized grinding, sorting and deep processing. Only in this way can scale, achieve product quality and cut costs. Must have the funds, adopt the mode of joint management, gather funds, expand the scale of enterprises, take the joint, mergers and reorganization of the road of development. Only in this way can we fully utilize new technologies, new processes, new equipment and automation, can we greatly improve labor productivity in order to achieve the full and reasonable use of resources and to meet environmental protection requirements, in order to deepen the processing of products and enhance the efficiency of enterprises to create condition.

So-called "fine" is to be implemented on the basis of a high starting point for technology, product quality of high-grade. Mainly include the following content:

Product Quality Improvement

Blast furnace production, in order to achieve high quality, low consumption, high yield and longevity of the target, the furnace into the raw material "concentrate." Concentrate means the material’s physical and chemical properties is better fulfill the requirements of blast furnace smelting. In the blast furnace, achieve a reasonable distribution of gas flow and low slag amount, in order to achieve the furnace intergrade and high gas utilization, slag volume and slag as much as possible to reduce the heat required to achieve high yield, low fuel consumption.

Improve the Quality and Reduce Impurity

Reducing the amount of coke in the blast furnace is an important part of reducing the cost of ironmaking. Reducing ironmaking costs is also the most critical part of reducing the cost of steel products, since ironmaking costs currently account for almost 60% of the cost of steel products. Because of the low grade of iron, China's blast furnace slag is much higher than the world's advanced
level. The most effective way to reduce the amount of slag is improve the grade of iron ore, reduce the silica, in order to reducing the amount of lime added for slag. Lime in the materials often exist in the form of calcium carbonate, consumpt much more endothermic in decomposition process.

To achieve this goal, iron ore mining enterprises must get rid of the past only in the context of rational grade and recovery rate of old ideas, to improve the quality of iron ore concentrate from the scope of the expansion to reduce the cost of steel and the challenges of the world market to study a wide range. Of course, in this context, should also adopt new processes, new processes and new equipment, reduce manufacturing cost. In China, Anshan Iron and Steel Company, Gongchangling Iron Mine do the best in this domain, Iron concentrate grade is greater than 68.8%, silica less than 4%. Other iron and steel enterprises have begun this research and technological transformation.

Production of High Quality Pellets

Pellets is the most reasonable method for fine grinding concentration in the current, and used for metallurgy furnace. The use of pellets is essential from the standpoint of concentrate and a reasonable burden structure. From the current development trend of blast furnace ironmaking in the world, the proportion using of pellets has increased from 30% to 70%. As the world's annual production of more than 15% long-term growth and annual output has reached 48 million more than the direct reduction of iron production, almost all high-quality pellets as raw materials. In addition, from the environmental protection point of view, located in large cities and densely populated areas of steel mills, sinter production has been strictly limited. In Western Europe and other developed countries are no longer allowed to build a new sintering plant, China's Shougang has started production and limited production. Pellet production is generally carried out in less populated mines, and the pellet process itself produces much less dust than sinter production.

Production of pellets, the industry can deep processing for iron ore, and increase economic efficiency of enterprises, iron ore resources is also a reasonable and effective use, which has been foreign advanced iron ore proved by the enterprise. The basic structure of the process model is the "Mining-Beneficiation-Pellet ", limited concentrate output, and is mainly to meet the needs of iron and steel production pellets. It is important to note here that mine-produced pellets must be of good quality, on the one hand, to meet transport needs, and on the other hand, to meet the requirements for ironmaking, not just the production of pellets.

In order to achieve the above objectives, China's iron and steel industry must be structural adjustment, deep-level technological transformation, as far as possible the use of advanced technology and large-scale efficient equipment, the implementation of technical high starting point, the quality of high-grade. To achieve scientific and rational high-efficiency mining and fine grinding deep election, the production of high-quality pellets. On this basis, a significant increase in labor productivity, reduce consumption, in order to achieve the development of China's iron ore intensive and modern, in the market economy and competition with foreign iron ore mining industry in the revitalization of China.

New Technology of Reducing Silicon

Qi Dashan Concentrator

Qi Dashan concentrator poor hematite quality upgrading of silicon beneficiation process improvement project in November 2002 by the identification of Anshan. Engineering fully operational by the end of 2001. After 9 months of operation, the concentrate grade reached 66.56%, and the grade of the second concentrate reached 67.12%, 3.1% and 3.7% higher than that before the transformation. The content of silica in the concentrate was reduced to 4.5%.
Diao Juntai Concentrator

After two consecutive grindings of the ore, the second overflow by the weak magnetic separation and strong magnetic separation, the two constitute mixed magnetic concentrate, and then through the reverse flotation obtain the final concentrate; tailings of weak magnetic through the strong magnetic separation tails, magnetic machine tails and anti-flotation tails form the comprehensive tailings. The comprehensive index is concentrate grade 67.50%, recovery rate is 75.00%.

Dong Anshan Concentrator

The beneficiation is divided into two stages: continuous grinding by secondary hydrocyclone, coarse grained product by spiral chute, fine particle by weak magnetic separation, strong magnetic separation and reverse flotation. Both coarse and fine particles yield the final concentrate. The comprehensive index is 64.50% of concentrate grade, metal recovery rate is 65.00%.

Wai Toushan and Nan Fen Concentrator

Before the transformation process, the iron concentrates is 67.0-67.5%, and SiO₂ content is 6.5% in the WaTouShan and NanFen two concentrator of Benxi Iron and Steel. After the mineralogical study, it is found that 10.40% of the continuous iron particles exist in the iron ore, and 30.68% of the single gangue exists in the gangue part. With these organisms and gangue, In the iron concentrate, the main reason is the magnetic agglomeration in the magnetic separation process, resulting in magnetic and non-magnetic mechanical inclusions, the use of conventional weak magnetic separation equipment to select the depth is not enough. Therefore, to further improve the grade of its concentrate and reduce impurities, must use efficient separation equipment and technology, effectively separated from the iron ore body and gangue, even the body and gangue further fine grinding re-election, and further improve the degree of monomer dissociation, in order to achieve iron concentrate to reduce silicon to iron.

The third section of magnetic concentrator concentrator screening equipment from 0.2mm fine screen to 0.15mmGPS efficient high-frequency vibrating screen, and strengthen the fine sieve screening operations, improve screening efficiency. Sieve products under the magnetic separation column sorting, concentrate by the pulsating magnetic separator to further selected; and magnetic column overflow and screen products into the magnetic separator re-election to remove tailings, magnetic concentrate regrinding and high frequency fine screen composed of closed loop.

Iron ore grade increased from 67% to 70%, silica content is 3.5%, the cost of mineral processing increased by 25 yuan/t, the cost of iron can be reduced 150 million yuan / year, and recover the cost of process transformation by six months which showing a huge economic benefits.

Process Transformation of Miao Gou iron Ore

MiaoGou iron ore properties is complex, very fine disseminated extent. The original process is very long and high energy consumption. grade of iron is 60%~63%, SiO₂ content is up to 8.75%. After the process of transformation, Using magnetic screening machine, washing machine selection and high-frequency vibrating screen and other equipment, use whole process of magnetic separation was modified, Iron content of iron concentrate reached 65.00%, SiO₂ decreased to 6.83%, achieve the purpose of improve the concentrator comprehensive economic benefits.

Before the transformation, using the three-stage grinding, the basic process of magnetic separation is reasonable, but the magnetic separation process in the number of times, not only is a long process, production management is difficult, high consumption, it is important that the magnetite After a magnetic separation, it is magnetized once, coercivity increases, remanence increases, and each sorting does not after an effective demagnetization, magnetic and non-magnetic inclusions intensified, and the finer the particle size, the more serious mechanical inclusions. Although the number of sorting more, but the sorting effect is not satisfactory.
In order to improve the grade of concentrate to 65.00%, at the same time to improve a section of the ball mill handling capacity, and to simplify the process as much as possible to facilitate the maintenance operation, Miaogou start a new process, while testing the new sorting equipment in 2004. After inspection and testing, magnetic screening machine and selected washing machine both can increased concentrate grade by 2% ~5%. And on-site industrial tests were carried out on the basis of the experiment. Select the magnetic screen as the old series of iron and steel to improve the transformation of the key equipment, selected washing machine as a new two series to improve the grade of the key equipment, together with the MVS-type high-frequency vibration mesh screen, the composition stage grinding, Magnetic separation process and achieved better concentrate index.

Summary

Improve the iron content and reduce silicon is a huge system engineering, also a common problem, long-term development has important economic and social effects for the iron and steel industries. High-quality iron concentrate can provide concentrate for the ironmaking, significantly reduce the cost of iron, deepen the product structure. In order to achieve the above objectives, China's iron and steel industry should carry out structural adjustment, deep-level technological transformation, as far as possible the use of advanced technology and large-scale efficient equipment, the implementation of technical starting point, the high-quality. To achieve scientific and rational high-efficiency mining and fine grinding deep election, the production of high-quality pellets. On this basis, a substantial increase in labor productivity, reduce consumption, in order to achieve the development of China's iron ore intensive and modern, in the market economy and competition with foreign iron ore mining industry in the revitalization of China.

References