Production procedure optimization in iron and steel enterprise

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Abstract

Green manufacturing is an effective way of realizing the sustainable development strategy. From the view of evolution of production chain and goods value, energy-saving, cleaner production and green manufacturing of iron and steel industry is discussed and the importance of system optimization of steel manufacturing process is stressed. Connotation of green manufacturing for the iron and steel was explained, the function of steel production process for green manufacturing was discussed and the content system of implementation of green manufacturing for the iron and steel enterprise was established. Finally, the steel production process was optimized. The function of iron and steel manufacturing procedure are broaden-manufacturing function of steel product, function of energy conversion and function of waste recycling, which will enhance enterprise's competitiveness and sustainability.

Keywords: production process optimization, iron and steel enterprise, green manufacturing, resource, environment protection

1 Introduction

Iron and steel industry is a raw material manufacturing industry, which produces iron and steel, belongs to essential industry in national economy. The iron and steel products are very important structural material and the biggest functional material in output up until now. It is the foundations of industry, agriculture, communication and transportation business and national defence industry. As an industrial family of our country, iron and steel enterprise is not merely the consumption rich and influential families of energy and resource, a large number of particulate matters, SOX, NOX, greenhouse and wastewater are released in its production process, so it becomes environmental heavy polluter. With the issue of ISO14000 environment management serial standards , OHSASl8000 occupational health and security sanitary standard series , green products authentication mark, the connotation of the market competitiveness of iron and steel enterprise is developing constantly, is not merely the competitions of quality, price now, not even the competition for centre of quality and variety, but reflect the green degree of the products, that is to say comprehensive competitions of such multifactor in many aspects as price ,cost , quality ,variety , capital retrieves time ,product supply time, course service , environmental friendship. Iron and steel enterprise, in order to get the market competitiveness, one of the most important proposition (fundamental proposition) facing the new century is taking sustainable development using advanced green manufacturing technology.

Green manufacturing is a modern manufacturing mode that synthesisly considers environmental impact and resource consumption, its essence is embodiment of a sustainable development strategy of human society in the modern manufacturing industry [1]. A key way to improve environmental friendship of iron and steel production process is the source control strategy consumed and polluted, namely green manufacturing mode is adopt to manage steel production process, controlling and technological innovation.

2 Connotation of green manufacturing for the iron and steel enterprise

Green of iron and steel industry is concrete embodiment of the green manufacturing concept in the steel and iron industry. It is not merely cleaner production, reflects the thoughts of ecological industry and recycling economy yet, namely reduction, utilizing and recycling. The following respects are reflected concretely [2].

1) Raw materials: use little iron ore and other natural mineral resource, use many renewable resources, develop the new energy with little use non-renewable energy, use the new water and fresh water resource little.

2) Production process: fully utilize resource and energy, discharge few disposals, pollutant and include the poisonous substance quality, do not use the noxious substance.

3) Products: low environmental load of the products, low pollution or non- polluting environment, increasement the service life and service efficiency of the products, reduce the pollution load to the environment of products, easy recovery and circulation use after the products scrap.

(4) Relationship with other trades and the society: offer remaining energy and by product to the society; dissolve the social offal, for instance waste steel and

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waste plastics, form the ecological chain of industry with other industry effectively. Please read through the following sections for more information on preparing your paper. However, if you use the template you do not have to worry about setting margins, page size, and column size etc. as the template already has the correct dimensions.

The iron and steel enterprise belongs to a procedure manufacturing industry. Its essence of iron and steel manufacturing process is an integrative product manufacturing system effectively and orderly collecting conversion of matter state, control of matter nature and control and management of material flow. There are influences in different levels and varying degrees on environment from a large number of materials, products flow, energy conversion processes, and diversified forms of discharge, disposal and waste materials. The input and output of the production process of iron and steel enterprise is shown as Figure 1.

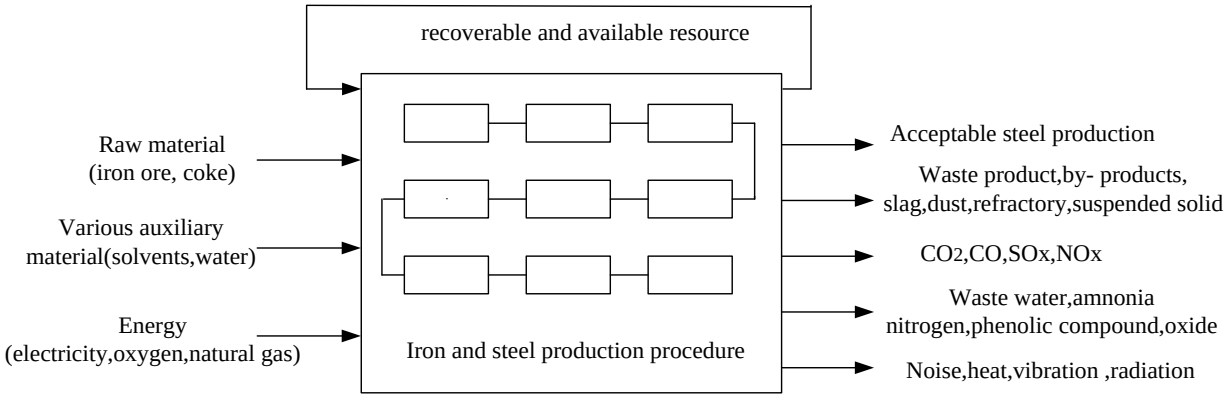

FIGURE 1 Input and output of iron and steel production process

Production of iron and steel enterprise has relatively strong dependence on mineral resource and energy, consumes a large number of energy and material and emits various kinds of incomplete material and wastes side by side. Influence degree on the environment is multi-level that all kinds of discharge materials produced in the steel production process. Generally speaking, the influence surface that the steel production process gas discharges involves the global range, such as CO_2, SO_X, NO_X, these materials are presented the accumulating on quite great degree in the atmosphere, have enormous influence such as the greenhouse effects, acid rain. It is influenced that the liquid taking place in every process discharges and grows river system basin, the ocean or the underground aquatic products in the production process. And such factors as all kinds of slag, dust, noise and vibration, influence the life or healthy of attendants and residents of relevant communities on quite big degree.

It is from the viewpoint of ecological industry chain combining effectively ecology with economics, the steel materials are studied from mining ,manufacturing , use until discarding , retrieve , the recycled impact on ecological environment in the whole course of green manufacturing in iron and steel enterprise, production method , technological route , technological process are recognized and evaluated further, all kinds of production procedure technologies , discharge course and control technology in production process, a series of professional technique environmental protection from harmful discharge [3]. It is shown in Figure 2. The goal of green steel and iron industry should be rationalization of utilization of resources, few quantization disposal, pollution-free or low pollution to the environment, form a ring of the ecological chain of social industry finally.

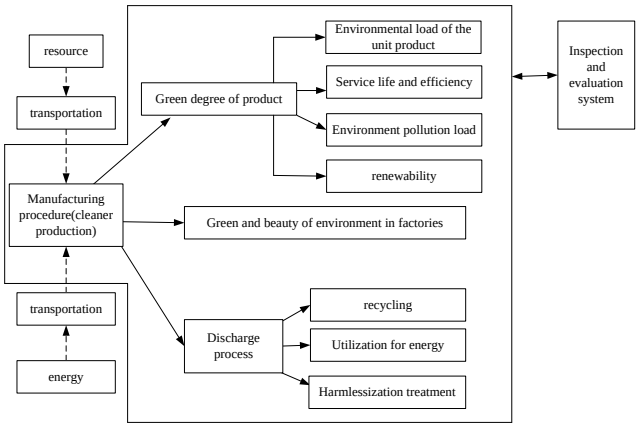

FIGURE 2 Connotation of environmental protection of iron and steel enterprise

3 Function and system of iron and steel production process on the basis of green manufacturing

The steel and iron industry in the 21st century can be interpreted as coordination and optimization production system considering social whole energy-conservation, reducing social environment load Green steel life cycle system [4], shown as Figure 3.

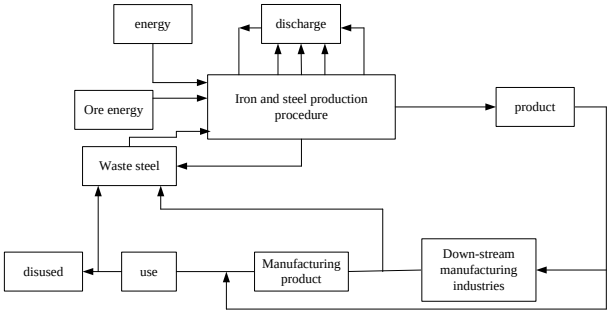

FIGURE 3 Life cycle of green steel

Therefore, the green steel production procedure should possess the following 3 kinds of functions.

1) Manufacturing function of iron and steel product. This is basic function of iron and steel produce, namely turning raw materials and energy into steel with high quality, low costs, little environmental and meeting user's demand.

2) High-efficient energy conversion function. Energy flow input has not been totally used by the iron element flow in the steel production process, should mean its recycling too through all kinds of conversion technologies that has reduced the environmental load of the society correspondingly.

3) Large social disposal treatment and disseverment function. A large number of social disposals can be dissolved and treated by making use of steel production procedure. For example, waste steel of different sources can be deal with. Waste steel is an important regenerated resource, and has important meanings in economizing natural resources, reducing the energy and raw materials consumption, reducing the environmental pollution, lowering costs and increasing employment. Waste steel be utilized to produce 1t steel economizing the 1.3t iron precise powder, reducing energy consumption of 350kg standard coal and 1.4t CO_2. A large number of waste plastics are deal with, including injection through the draught of the blast furnace and hot pressing and pack into coke oven treatedly. Waste plastics with 1t are injected in blast furnace can produce the same amount of heat as 1t oil (whether Germany blast furnace can deal with 90,000 tons of waste plastics every year).Waste tire can be deal with, namely the tire can be carried on the deep cold treatment, crush , separate treatment or burning by electric stove utilizing liquid nitrogen from the oxygen machine in the steel factory. Social rubbish can be deal with, namely a large number of social rubbish in the special-purpose incinerator deal with by what the usable steel factory familiar with burning principle and the steel plant gas. Community wastewater and sewage can be deal with near community sewage in usable huge water process system of steel plant.

Green manufacturing of iron and steel enterprise should be from such respects as environment in the factory, supply of material and energy, optimization of production procedure and discharge of production process, reduce resource consumption and environmental pollution from the whole life cycle course of the steel products production process. Its main content system is shown as Figure 4.

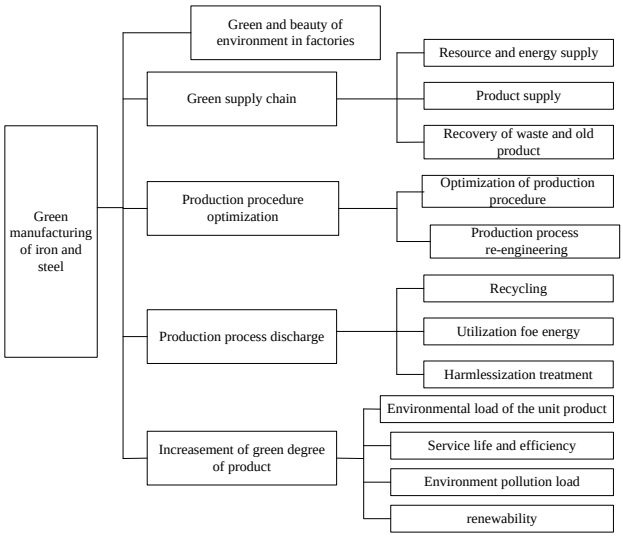

FIGURE 4 Main content system of green manufacturing of iron and steel enterprise

4 Production procedure optimization of iron and steel enterprise

4.1 WHOLE LIFE CYCLE MANAGEMENT OF IRON AND STEEL PRODUCT

The whole life cycle management of the iron and steel products carries on controlling technology research on the whole life cycle of the products information flow of real-time steel with the thought of the green manufacturing. Its data management mode solves steel products production process, order management; quality design, stock control, and contract retrieve of waste steel systematically. Through the whole life cycle data management of steel products effectively, strong support function is offered to improve the green degree of the iron and steel products.

It is the important embodiment in the society of iron and steel industry with friendly environment to pay attention to the performance of the steel and products, design method and retrieve to recycle. Green degree friendly to the environment that compared with other materials the steel and products demonstrated in many respects. At the same time, some indexes of green degree can be used in the friendly degree of relative environment among more different steel too.

4.2 GREEN COUNTERMEASURE OF STEEL AND IRON INDUSTRY

Whether Chinese iron and steel industry could really become the green process industry with ecological nature, the key lies in whether there is green countermeasure suiting our country's national conditions. According to the actual current situation and characteristic of the steel and iron industry and his environment of our country, the

main countermeasure that the China iron and steel industry develop along the green direction are shown as following:

1) Optimization of the iron and steel production procedure;

2) Improvement resources and energy service efficiency, reduce water consumption per ton molten steel, improvement the circulation service efficiency of water;

3) Control the discharge of the iron and steel manufacturing process;

4) Recycling, utilization for energy and harmlessization treatment;

5) Improve the green degree of the steel products, such as small environmental load of the unit product, having long service life and high efficiency of the products, little environmental pollution load and good renew ability of steel products;

6) Formation the ecological chain of industry and give play to the social friendly function with relevant trade;

7) Performance and the perfection green principles and policies.

4.3 GREEN KEY TECHNOLOGIES OF STEEL AND IRON INDUSTRY

The green countermeasure of iron and steel industry is relied on green technology heavily, only adopt green technology, could guarantee the implementation of the green countermeasure, and then the green strategic objective can be realized finally. There are implementing green key technology from 3 levels. (1)Popularization and promotion a batch of ripe energy-conversation and environment-protective technology. For example, coke dry quenching technology, TRT, electricity generated by the blast furnace gas, retrieve of the converter coal gas, regenerative type clean combustion, high-efficiently casting and nearly end shape casting in succession, coal injection of blast furnace, longevity of the blast furnace and renewability of LD slag.(2) Investment and development a batch of effective green technology, such as dealing with the waste plastics in blast furnace and coke oven, flue gas desulfurization, and tailings disposal technology for metal mines.(3) Exploration a batch of future green technology, such as melting iron-smelting technology and new energy development technology, the new-type coke oven technology, society's friendly offal treatment technology dealing with the old and useless tire, rubbish incinerator. Green manufacturing procedure in iron and steel enterprise is integrated further on above basis.

4.4 ENERGY-CONSERVATION AND CLEANER PRODUCTION OF THE STEEL AND IRON INDUSTRY

Optimization of the steel manufacturing procedure improves the market competitiveness of the steel, contribute to the environment again friendlily and sustainable development. The global steel factory is regarding the most effective technology as motive force actively, then the steel manufacturing procedure develops with the direction from the intermittence constantly - stop - long procedure to the compactness - melt accurately in succession – shorten procedure. In fact, it is the course of using a series of power-saving technologies and cleaner production technology, so it is the embodiment of source administration even more. Proceed from height of procedure global optimization, simpler summation that but not proceed from unit process , individual equipment transformation briefly, comprehensive result can be got with maximum material obtaining rate, energy efficiency optimization and minimum manufacturing process time. Certainly, cleaner production is got and the result of environmental load reduced at the same time.

The iron and steel enterprise produces a large amount of waste gas, wastewater, and waste residue with usable heat from raw materials, coking, fritting in the production process of iron-smelting, steel-making, casting in succession and rolled steel. There are intermediate products with usable energy and semi-manufactured products among every process at the same time. It is one of the signs of enterprise's green degree to fully retrieve and utilize the energy. In the energy consumption of various kinds of industry stove, the remaining energy of the waste gas accounts for 15% - 35%, waste gas after cleaning is a good energy with easy transportation and use after combustion and no environmental pollution.

Green manufacturing is a new comprehensive strategy, which preventing the pollutant from turning into in the course of resource and production. The iron and steel enterprise green manufacturing is studied from course science, procedure technology and project, choose the resource, energy and product design rationalization, develops production technology, technical equipment, procedure of manufacturing with friendly development environment rationally, the contradiction between environment pollution and sustainable development is settled well. Its intension is mainly to deal with energy circulation at first in discharging the materials, the energy, recycling treatment and harmless treatment as small as possible finally.

1) Energy circulation is dealt with again. Concentration on chemistry is metallurgical mainly, especially chemical energy and physics heat in the iron-smelting system of the blast furnace in exhaust gas as a good energy treatment craft in converter, electric stove and steel rolling heating furnace.

2) Recycle treatment and utilization again. Treatment and utilization of materials with iron-content and available resource in converter and electric store mainly.

3) Harmless treatment. For example, concentrate on water treatment and water-saving technology mainly, the treatment technology of exhaust gas (especially flue gas desulfurization) preventing producing and treatment technology of other harmful gas.

At present, from the view of energy-conservation, cleaner production and environmental protection, the water-conservation, closed circulation and sewage treatment technology, hot water community of water of the steel factory supply technology are worth causing the special attention.

6 Conclusion

The development of iron and steel enterprise of 2l century faces severe challenge of lightening the environmental load of the earth. So, the iron and steel industry must transform from the manufacturing industry offering steel products simply to green manufacturing industry, from offering the function of steel products simply to the energy conversion function of playing a role in the production procedure, from rich discharge and influential family to minimum discharge and deals with some social disposals. The green of the Chinese iron and steel industry must have excellent structural adjustment procedure carrying on green key technology from 3 levels, integrated as manufacturing procedure green for the iron and steel enterprise, so as to ensure and realize the conversion of above-mentioned functions, actively promote the cleaner production and green process of the steel and iron industry of our country. It is the only way that the steel and iron industry faces new century to take the green road. Only in this way, the steel and iron industry of our country can have sustainable development, could march towards the steel powerful country.

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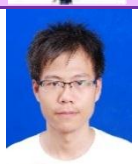

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