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(54) Title: PROCESS FOR THE OPTIMIZED PRODUCTION OF IRON ORE PELLETS

(57) Abstract: The present invention describes an advantageous and effective streamlined process for the production of iron ore pellets, the green pellets replacing the burnt pellets for covering the metallic surface in "travelling grate" furnace during the burning step, the process comprising at least some or all of the steps of grinding the iron ore; filtering the crushed iron ore; mixing the filtered iron ore with at least one binder; pelletizing the mixture; drying the green pellets; transferring the pellets to the side and bottom grids of a "travelling grate" furnace equipment and screening the burnt iron ore pellets. An optimized process for the production of iron ore pellets is provided that is innovative, efficient and economical when compared to currently known processes.

PROCESS FOR THE OPTIMIZED PRODUCTION OF IRON ORE PELLETS

This application claims priority from U.S. Patent Application No. 61/674,633, titled "Process Optimized for the Production of Ore Pellets," filed on July 23, 2012, and which is incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

Aspects of the present invention relate to an optimized process for the production of iron ore pellets efficiently and economically, particularly when compared to currently known processes, once it uses the total volume of the burning machine.

BACKGROUND OF THE INVENTION

The pelletizing process is a compression or molding of a material in the form of pellets. A variety of different materials can undergo such a process, including chemicals, iron ore, animal feed, and the like. In the case of iron ore pellets, ultrafine particles are obtained by means of a heat treatment. An ultrafine fraction (below 0.15 mm) is thus found in nature or generated in the processing. The pellet can be formed in spherical clusters of various sizes ranging from 8 to 18 mm, with features suitable for feeding of reduction units, such as blast furnaces.

In all pelletizing processes of iron ores used industrially, there is a step of thermal hardening of the pellets. In one of the known processes, it is applied a furnace "Traveling Grate" type. In this case, the burning of the material takes place in a bed of pellets placed on a metallic surface with a limited working temperature, in order to avoid damages to the equipment. These limits imply lower temperatures in the layers closer to the metal surfaces; such temperatures are not sufficient to ensure a complete sintering of the particles, which does not allow filling the entire volume of the burning equipment with green pellets. In these processes, it is used to apply a layer of recirculated burnt pellets on the metal surfaces, side and bottom, in order to avoid the said problems.

The said process "traveling grate" to produce burnt pellets of iron ore requires the recirculation of 20 to 30% of the produced material to form the liner layer, side and bottom, in the metallic surfaces.

DE 4109396 describes a method of production of iron ore pellets, comprising recirculating cover elements which protect the metallic structure of the heating equipment.

So no teaching or knowledge of prior art discloses a process for pelletizing iron ores which brings a more innovative, efficient and economical solution for the metallic surfaces heating problem during the iron ore pellet's burning step, bringing inconvenience in the production thereof.

BRIEF DESCRIPTION OF THE INVENTION

In light of the above described problems and unmet needs, the present invention describes an advantageous and effective streamlined process for the production of iron ore pellets, the green pellets replacing the burnt pellets for covering the metallic surface in "travelling grate" furnace during the burning step, the process comprising at least some or all of the following steps:

a. grinding the iron ore;

b. filtering the crushed iron ore obtained from step a;

c. mixing the filtered iron ore from step b. with at least one binder;

d. pelletizing the mixture from step c.;

e. drying the green pellets from step d.;

f. transferring the pellets of iron ore to the side and bottom grids of a "travelling grate" furnace equipment.

g. Screening the burnt iron ore pellets.

Additional advantages and novel features of these aspects of the invention will be set forth in part in the description that follows, and in part will become more apparent to those skilled in the art upon examination of the following or upon learning by practice of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The following detailed description does not intend to, in any way, limit the scope, applicability or configuration of the invention. More exactly, the following description provides the necessary understanding for implementing the exemplary modalities. When using the teachings provided herein, those skilled in the art will recognize suitable alternatives that can be used, without extrapolating the scope of the present invention.

The present invention, more specifically, describes a process for the production of iron ore pellets, the green pellets replacing the burnt pellets for covering the metallic surface in "travelling grate" furnace during the burning step, the process comprising the following steps:

a. grinding the iron ore and limestone up to a size less than 0,044mm;

b. filtering the crushed iron ore obtained from step a;

c. mixing the filtered iron ore from step b. with at least sodium silicate and cornstarch and, alternatively, microsilica;

d. pelletizing the mixture from step c.;

e. drying the green pellets from step d.;

f. transferring the pellets of iron ore to the side and bottom grids of a "travelling grate" furnace equipment.

g. Screening the burnt iron ore pellets.

Aspects of the present invention relate to a streamlined process for the production of iron ore pellets, the green pellets replacing the burnt pellets for covering the metallic surface in "travelling grate" furnace during the burning step, comprising the following steps:

a. grinding the iron ore and limestone or dolomite, preferably, in order to get a CaO/SiO2 ratio in the dry pellet of about 0.15, preferably 0.90 or above. The addition of lime is mainly to ensure metallurgical quality of the final product. The grinding step results in a product with about 90% of the material less than 0.044 mm and a specific surface area of about 1800 cm^2 / g. The grinding is *via* a vertical wet ball mill and some auxiliary equipment such as, press rolls. The wet grinding can be done in a closed circuit with hidrociclones or opened circuit. If the closed circuit is used, the grinded product can be sent to a thickener for dewatering, increasing the solids content in the pulp of about 20 to 75%. In the case of wet grinding in open circuit, the final material can be sent directly to the tank of homogenization.

b. filtering the crushed iron ore obtained from step a, to reduce moisture to about 9%;

c. mixing the filtered iron ore from step b with at least one binder. This is a critical step to the process and involves combining iron ore with sodium silicate

with a molar ratio of SiO2/Na2O = 2.40 and corn starch, preferably gelatinized, and microsilica, ultra-fine (100<0.044 mm) and its percentage by weight of SiO2 (% SiO2> 99%), additionally. The following demonstrate the functionality for the binders used:

i. The sodium silicate is critical to the compressive strength of the dried green pellets.

ii. Cornstarch is decisive for the quality of the green pellets, wet and dry. When in the production of the green pellet, the cornstarch has the role of controlling the pelletizing process due to its high capacity to absorb water.

iii. The microsilica improves the performance of sodium silicate.

The ratios of binders in the mix, on a dry basis, must comply with the following:

i. Sodium Silicate: from 1 to 4%, but preferably 3%.

ii. Corn starch: from 1 to 2%, but preferably 1.5%.

iii. Microsilica: maximum of 0.50%, but preferably 0.30%.

d. pelletizing the mixture from step c.;

e. drying the green pellets from step d. Drying is preferably done in static bed dryers under temperatures of about 150°C, in order to ensure the polymerization of sodium silicate, avoiding losses of the cornstarch during the process. The resistance of the dried green pellet must be at least of 60 daN / p so it is resistant to the handling and loading in the "traveling grate" pelletizing furnace. At this step, the heating rate is preferably controlled to avoid the appearance of cracks in the pellets, which impairs their resistance.

f. transferring the pellets of iron ore to the side and bottom grids of a “travelling grate” furnace.

g. Screening the burnt iron ore pellets.

The present invention provides the following advantages face to the prior art techniques:

i. Total use or high use of the volume inside the pelletizing equipment of the green pellets, thus increasing its productivity;

ii. It is no longer necessary to recirculate the burnt pellets discharged from the metallic surface as in the prior art processes, then forming the liner layer,

increasing the productivity of the metallic surface;

iii. Optimization of the energy power in the process, thus reducing the production costs.

In this sense, the main innovative characteristics of the present invention are:

i. In the mixing step c, the use of conventional binders combined with other organic binders or auxiliary materials in order to confer resistance to the green pellets during the handling and/or transferring to the side and bottom grids and feeding the furnace;

ii. The green pellet produced with the mixture of the step c, instead of being transferred to the burning furnace, is sent to a dryer. Thus the dried product is resistant enough to be transferred (about 100 to about 80 kg / w) to the side and bottom grids of the "travelling grate" furnace equipment.

iii. The dried green pellets is fed into the side and bottom grids of the "travelling grate" furnace equipment, thus replacing the burnt pellets used in the prior art, and unloaded in the oven as a product and following the normal flow known.

The examples given above are preferred variations of the process object of this invention and should not be construed as limitations. In this respect, it should be understood that the scope of the present invention covers other possible variations, being limited only by the contents of the attached claims, including the possible equivalents.

CLAIMS

1. Process for the production of iron ore pellets, the green pellets replacing the burnt pellets for covering the metallic surface in "travelling grate" furnace during the burning step, the process comprising the following steps:

a. grinding the iron ore and limestone up to a size less than 0,044mm;

b. filtering the crushed iron ore obtained from step a;

c. mixing the filtered iron ore from step b. with at least sodium silicate and cornstarch and, alternatively, microsilica;

d. pelletizing the mixture from step c.;

e. drying the green pellets from step d.;

f. transferring the pellets of iron ore to the side and bottom grids of a "travelling grate" furnace equipment.

g. Screening the burnt iron ore pellets.

2. Process, according to claim 1, wherein the grinding step a comprises a ratio of limestone or dolomite which ensures that the pellet has the ratio of CaO/SiO_2 <0.20 or> 0.90.

3. Process, according to claims 1 and 2, wherein the limestone comprises a mixture of calcium carbonate ores and the source of MgO comprises olivine, magnesite, serpentinite or industrial wastes which are rich in MgO.

4. Process, according to claims 1 to 3, wherein sodium silicate comprises the molar ratio of SiO2/Na2O in the range between 1 and 4%, preferably 3%.

5. Process, according to claims 1 to 4, wherein the gelatinized corn starch is added in the range between 1 and 2% but preferably 1.5%.

6. Process, according to claims 1 to 5, wherein the super fine microsilica (100% <0.044 mm) with high content of SiO2 (%SiO2>99%) is added to the mixture in the range between 1 and 2% but preferably 1.5%.

7. Process, according to claims 1 to 5, wherein the green pellets are dried under the temperature of 150°C.