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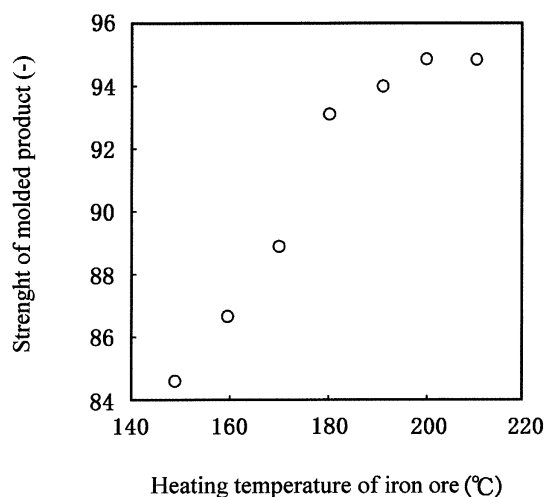
(54) **METHOD FOR PRODUCING MOLDED PRODUCT FOR FERRO-COKE**

(57) [Task] It is to propose a method for producing a molded product for ferrocoke, wherein a high-strength molded product for ferrocoke can be produced advantageously without making particular investment in facilities and inviting the operating troubles.

[Solution] In a method for producing a molded product for ferrocoke by molding a mixed starting material of coal, an iron-source material, a high-softening point bind-

er having a softening point of not lower than 150°C, and a low-softening point binder having a softening point of lower than 150°C, at least one of the iron-source material and the high-softening point binder is previously heated to not less than a temperature lower by 20°C than a softening point of the high-softening point binder to perform molding of the mixture.

FIG. 6



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Description

TECHNICAL FIELD

5 **[0001]** This invention relates to a method for producing a molded product for ferrocoke by molding coal and an iron-source material with a binder.

RELATED ART

10 **[0002]** Recently, the necessity of reducing a carbon dioxide discharge amount is strongly demanded in Japan and overseas. The carbon dioxide discharge amount is dramatically large in the iron-making industry, and a ratio of the carbon dioxide discharge amount occupied in the steel-making filed in Japan is said to be about 12% (Non-patent document 1).

15 **[0003]** It is said that the carbon dioxide discharge amount from a blast furnace for reducing an iron ore with carbon to produce a pig iron is especially high even in the iron-making factories. Therefore, an effort of reducing the carbon dioxide discharge amount is recently exercised by operating the blast furnace at a low reduction agent ratio. That is, the use of ferrocoke obtained by molding and carbonizing a mixture of coal and an iron ore is noticed as a substitute of coke in the blast furnace. As a method for producing ferrocoke is mainly considered a method of carbonizing a molded product as a raw material with a dedicated shaft furnace. In this method, the molded product is directly charged into the shaft
20 furnace, so that the molded product is necessary to have a high strength for stably producing ferrocoke.

[0004] Thus, various examinations are made for increasing the strength of the molded product for ferrocoke. For example, when the molding is performed by adding a binder, there are disclosed a method of blending a high-softening point binder and a low-softening point binder (Patent Document 1), a method of previously mixing a high-softening point binder (solid) and a low-softening point binder (liquid) prior to the addition to a raw material (Patent Document 2), a
25 method of decreasing a kneading temperature to increase a viscosity of a low-softening point binder (Patent Document 3) and so on.

PRIOR ART DOCUMENTS

30 PATENT DOCUMENTS

[0005]

Patent Document 1: Japanese Patent No. 4853090
35 Patent Document 2: Japanese Patent No. 5017967
Patent Document 3: Japanese Patent No. 5017966

NON-PATENT DOCUMENT

40 **[0006]** Non-patent Document 1: National Greenhouse Gas Inventory Report of Japan 2014, p35

SUMMARY OF THE INVENTION

TASK TO BE SOLVED BY THE INVENTION

45 **[0007]** Patent Document 1 proposes a method of agitating a starting material containing coal, an iron-source material, a high-softening point binder having a softening point of not lower than 150°C and a low-softening point binder having a softening point of lower than 150°C while heating within a range of 120°C - 240°C. This method has a feature in a point that the strength of the molded product is increased by an interaction of both the high-softening point binder and the low-softening point binder added. This method is simple, but has a problem that the effect by using both the high-softening point binder and the low-softening point binder is small.

[0008] In Patent Document 2, both the binders are previously mixed after the dissolution of the low-softening point binder, so that the interaction of both the binders becomes larger. In this method, however, since the high-softening point binder (solid matter) is added to the low-softening point binder, a solid volume ratio is increased, while both the
55 binders are somewhat blended to largely enhance the viscosity. As a result, it is necessary to highly increase a transport capacity of a gear pump for feeding a mixture of both the binders. Even if the transport capacity of the gear pump is increased, wearing of a gear inside the pump becomes quick and hence a frequency of replacing the pump becomes higher or it is liable to cause operating troubles such as blocking inside a pipe during the transport process and so on.

[0009] In Patent Document 3 discloses a method of lowering a kneading temperature for suppressing penetration of a low-softening point binder into interior of particles of a starting material to increase an effect by the addition of the low-softening point binder. In this method, however, it is necessary to increase the transport capacity of the pump for feeding the binders to a kneading machine due to the increase of the viscosity in the low-softening point binder like Patent Document 2.

[0010] It is, therefore, an object of the invention to propose a method for producing a molded product for ferrocoke wherein a high-strength molded product for ferrocoke can be produced advantageously without making a particular investment in facilities and bringing about the operating troubles.

SOLUTION FOR TASK

[0011] The inventors have made various studies on the tasks inherent to the above conventional techniques and found out that a previously heated iron ore and a high-softening point binder or an iron ore and a previously heated high-softening point binder are preferably simultaneously charged into a kneading machine to easily dissolve the high-softening point binder in the kneading machine, whereby smooth interaction with the low-softening point binder can be brought out without making a particular investment in facilities to increase the strength of a molded product for ferrocoke, and as a result, the invention has been accomplished.

[0012] The invention is a method for producing a molded product for ferrocoke by molding a mixed starting material of coal, an iron-source material, a high-softening point binder having a softening point of not lower than 150°C, and a low-softening point binder having a softening point of lower than 150°C, characterized in that at least one of the iron-source material and the high-softening point binder is previously heated to not less than a temperature lower by 20°C than a softening point of the high-softening point binder to perform molding of the mixture.

[0013] In the production method of the molded product for ferrocoke having the above construction according to the invention, the followings are considered as a preferable solving means:

- (1) Iron-source particles having an average particle size of not more than 2.0 mm are used as the iron-source material, heated to not less than a temperature lower by 20°C than the softening point of the high-softening point binder, then mixed with the high-softening point binder, and thereafter mixed with the low-softening point binder having a softening point of lower than 150°C to mold the mixed starting material;
- (2) Iron-source particles having an average particle size of not more than 2.0 mm are used as the iron-source material, and the high-softening point binder is heated to not less than a temperature lower by 20°C than the softening point of the high-softening point binder, then mixed with the iron-source material, and thereafter mixed with the low-softening point binder having a softening point of lower than 150°C to mold the mixed starting material;
- (3) The iron-source material and the high-softening point binder are simultaneously charged into a kneading machine;
- (4) The iron-source material or the high-softening point binder is heated to not more than a temperature higher by 10°C than the softening point of the high-softening point binder; and
- (5) The average particle size of the iron-source material is 0.58-1.64 mm.

EFFECT OF THE INVENTION

[0014] According to the invention having the above construction, it is possible to produce a high-strength molded product without disposing a particular installation by adjusting particle size of the iron ore, previously heating the iron ore or high-softening point binder to not less than a temperature lower by 20°C than the softening point of the high-softening point binder, and simultaneously charging the heated iron ore and the high-softening point binder or the heated high-softening point binder and the iron ore into the kneading machine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a graph showing a relation between a strength of a molded product and a heating temperature of a high-softening point binder.

FIG. 2 is a graph showing a relation between a strength of a molded product in use of a high-softening point binder having a softening point of 180°C and a heating temperature of iron ore.

FIG. 3 is a graph showing a relation between a strength of a molded product in use of a high-softening point binder having a softening point of 160°C and a heating temperature of iron ore.

FIG. 4 is a graph showing a relation among an oxygen concentration of a gas for heating coal, a temperature of coal in drying, and a strength of a molded product.

FIG. 5 is a graph showing a relation between a strength of a molded product and an average particle size of iron ore.

FIG. 6 is a graph showing a relation between a strength of a molded product and a temperature of iron ore.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0016] The inventors have made various examinations and found that when a molded product for ferrocoke is produced by molding a starting material containing coal, an iron-source material and a binder, a high-softening point binder is previously heated up to a temperature close to a softening point thereof and thereafter charged into the starting material in a kneading machine and then a low-softening point binder is added thereto and kneaded, whereby a strength of a molded product in the kneading is increased. Also, it has been found that the strength of the molded product is increased by a method wherein the iron ore causing no problems in the safety and quality even in the heating to not less than the softening point of the high-softening point binder is heated instead of the high-softening point binder and coal is charged into the kneading machine and then the iron ore and high-softening point binder are simultaneously charged into the kneading machine and the low-softening point binder is added thereto. As a result, the invention has been accomplished.

Here, the softening point of the binder can be measured by a ring-and-ball method (JIS K2425).

[0017] Each of various component members used in the production method of the molded product for ferrocoke according to the invention will be described, and a relation between each component member and a strength of a molded product will be explained below.

[0018] As the nature of coal used in the invention, an average maximum reflectance R_o (JIS M8816) is 1.3%, and an ash content (JIS M 8812) is 9.3 mass%. As the nature of iron ore as an iron-source material, a total iron content is 57.1 mass% (JIS M8212). As a high-softening point binder is used a petroleum pitch having a softening point of 180°C (volatile matter: 38 mass%) or 160°C (volatile matter: 45 mass%). As a low-softening point binder is used a coal-based soft pitch having a softening point of 40°C. A mixing ratio of coal, iron ore, high-softening point binder, and low-softening point binder is 66.5 mass%, 28.5 mass%, 2 mass%, and 3 mass%, respectively. The adjustment of the particle size is performed by pulverizing into not more than 2.8 mm in full dosage of coal, not more than 3 mm in full dosage of iron ore (average particle size of 1.04 mm, which is calculated from a sum of product of a residual ratio in each sieve and an average value of adjoining sieve sizes), and not more than 1 mm in full dosage of high-softening point binder, respectively. The water content in the high-softening point binder after the pulverization is 0.3%.

[0019] Although the main iron-source material is iron ore, the term "iron-source material" used herein means to use not only the iron ore but also the other iron-source material such as iron-making dusts and so on. As the high-softening point binder can be used ASP (asphalt pitch) or the like, while SOP (soft pitch), PDA (propane deasphalted asphalt) and so on can be used as the low-softening point binder.

[0020] The kneading machine used in the invention is a high-speed agitating type mixer having an effective volume of 75 L. A molding machine is a double-roll type molding machine having a roll size of 650 mmφ x 104 mm. The feeding of the starting material to the rolls is performed by gravity charging, in which a flow rate of the starting material into the rolls is adjusted by up-and-down movement of an adjusting plate disposed on the top portion between the rolls to control a molding pressure. The molding is performed under a circumferential speed of 0.2 m/s and a linear pressure of 4-5 t/cm in the rolls. The molded product has a size of 30 mm x 25 mm x 18 mm (6 cc) and an egg-type form.

[0021] The strength of the molded product is evaluated from a residual ratio of not less than 16 mm after the rotation of 30 times at a rate of 20 rotations per 1 minute with an I-type drum testing machine (cylinder of 130 mm in inner diameter x 700 mm) (ID strength 30/16).

[0022] In the production method according to the invention, a relation between a heating temperature of the high-softening point binder and a strength of the molded product is examined in the case of previously heating the high-softening point binder. The drying and heating of the starting material is performed as follows. The pulverized coal is heated up to 150°C in an atmosphere having an oxygen concentration of 1%. The iron ore is heated up to 150°C in an air atmosphere. Each material is charged into a kneading machine at a predetermined amount. The high-softening point binder heated to four temperature levels of 160°C (20°C lower than the softening point of the high-softening point binder), 170°C (10°C lower than the softening point), 180°C (same as the softening point) and 190°C (10°C higher than the softening point) is charged into the kneading machine immediately while rotating main rotation blades of the kneading machine. As the high-softening point binder is used a binder having a softening point of 180°C. A low-softening point binder heated up to 160°C is added at a predetermined amount and kneaded. A kneaded mass is discharged from the kneading machine after the end of the kneading, in which a time from the addition of the low-softening point binder to the discharge is 90 seconds. The discharging temperature in the kneading machine is 170-175°C. The kneaded mass is immediately charged into a double roll type molding machine to produce briquettes.

[0023] FIG. 1 shows an influence of the heating temperature of the high-softening point binder upon the strength of the molded product. As the heating temperature of the high-softening point binder is increased, the strength of the molded product is increased. The temperature of the kneaded mass is not more than the softening point of the high-softening point binder. However, once the high-softening point binder is heated to a temperature approximately equal to or higher

than the softening point, the high-softening point binder is somewhat softened, so that it is guessed that the swelling or dissolving of the high-softening point binder is promoted in the mixing with the low-softening point binder and the interaction of both the binders is increased to improve the function of the binders.

[0024] The low-softening point binder is dissolved (120°C due to the restriction of the test device) and 33 mass% of the high-softening point binder is added to the weight of the dissolved low-softening point binder to perform hot filtration. When the filtrate is analyzed by a high-frequency induction coupled plasma (ICP), a metallic nickel not included in the low-softening point binder but being an ingredient of the high-softening point binder is detected from the filtrate. That is, it is cleared that the ingredient of the high-softening point binder is eluted into the low-softening point binder. In this analysis, it is considered that although the temperature of the low-softening point binder is low, the dissolution of the high-softening point binder is promoted as the mixed temperature of the high-softening point binder and the low-softening point binder is increased. Therefore, it is considered that the strength of the molded product is increased as the heating temperature of the high-softening point binder shown in FIG. 1 is increased.

[0025] Next, the iron ore showing no nature change even in the heating in air at a higher temperature is heated to five temperature levels of 160°C (20°C lower than the softening point of the high-softening point binder), 170°C (10°C lower than the softening point), 180°C (same as the softening point), 190°C (10°C higher than the softening point), and 200°C (20°C higher than the softening point) instead of previously heating the high-softening point binder. As the high-softening point binder is used a binder having a softening point of 180°C. The iron ore heated to a predetermined temperature is mixed with a predetermined amount of the high-softening point binder for 30 seconds, which is charged into a kneading machine together with a coal material previously heated to 150°C. Then, a predetermined amount of a soft pitch is added thereto and kneaded immediately. A kneaded mass is discharged from the kneading machine after the end of the kneading, in which a time from the addition of the low-softening point binder to the discharge is 90 seconds. The discharging temperature of the kneaded mass is 170-175°C.

[0026] FIG. 2 shows an influence of the heating temperature of the iron ore upon the strength of the molded product. As the heating temperature of the iron ore is increased, the strength of the molded product is increased. When the discharging temperature of the kneaded mass is 170-175°C, the viscosity of the low-softening point binder remains unchanged, so that it is considered that there are no differences in the dispersibility of the low-softening point binder. The temperature of the high-softening point binder previously mixed with the iron ore is increased by increasing the temperature of the iron ore, so that the swelling or dissolving of the high-softening point binder is promoted in the mixing with the low-softening point binder, and it is guessed that the interaction between both the binders is increased to improve the function of the binders. When a target value of the strength of the molded product is set to 85, it can be seen that the iron ore is necessary to be heated to not less than a temperature lower by 20°C than the softening point of the high-softening point binder.

[0027] A test is conducted by changing the high-softening point binder having a softening point of 180°C with a petroleum-based binder having a softening point of 160°C. The iron ore is heated to five temperature levels of 140°C (20°C lower than the softening point of the high-softening point binder), 150°C (10°C lower than the softening point), 160°C (same as the softening point), 170°C (10°C higher than the softening point) and 180°C (20°C higher than the softening point). The discharging temperature of the kneaded mass is 155-160°C. FIG. 3 shows an influence of the heating temperature of the iron ore upon the strength of the molded product. Although the discharging temperature of the kneaded mass is somewhat lower than the softening point of the high-softening point binder, as the heating temperature of the iron ore is increased like in FIG. 2, the strength of the molded product is increased. It can be seen that when the iron ore heated to a temperature lower by 20°C than the softening point of the high-softening point binder is used, the strength of the molded product is decreased, while a target value of the strength of the molded product (ID strength 30/16) of not less than 85 is kept. Even in the case of using the binder having a softening point of 160°C, it is considered that the interaction of the high-softening point binder and the low-softening point binder is increased by mixing the iron ore heated to a temperature equal to or higher than the softening point with the binders.

[0028] In FIG. 2, the high-softening point binder is indirectly heated by heating the iron ore. Then, coal is heated instead of the iron ore. FIG. 4 shows a relation among an oxygen concentration in a gas for heating coal, a coal temperature in drying, and a strength of a molded product. The heating time is 30 minutes. As a heating gas is used a mixed gas of nitrogen and oxygen. When the oxygen concentration is made up to 5% at a coal temperature of 150°C, the strength of the molded product can be kept at a target value of not less than 85. However, when the coal temperature is not lower than 160°C, the target strength of the molded product cannot be attained at an oxygen concentration of 2%. The reason why the strength of the molded product is decreased by increasing the oxygen concentration and the coal temperature is considered due to the fact that the coal surface is oxidized by the heating treatment and the wettability between the binder and coal is deteriorated by oxidation of the coal surface to lose the adhesion function of coal by the binder. In the actual process, it is difficult to always keep the oxygen concentration of not more than 2%, so that it is desirable to heat the iron ore or the high-softening point binder.

[0029] When heat is transferred from the high-temperature iron ore to the high-softening point binder, it is necessary to consider the heat transfer of a short time, so that a value of $k \cdot A/r [J/s/K]$ in the following heat conduction and transfer

equation (1) is important:

$$Q = (K \cdot A/r) \cdot \Delta T = k \cdot (6 \cdot w/\rho/D)/r \cdot \Delta T \quad \dots (1)$$

, wherein Q is a heat transferring rate [J/s], k is a heat conductivity [J/s/m/K], A is an area per unit weight of iron ore [m²], r is a radius of a high-softening point binder [m], ΔT is a temperature difference between iron ore and high-softening point binder, w is a weight of iron ore [kg], ρ is a density of iron ore [kg/m³], and D is a diameter of iron ore [m].

[0030] From the equation (1), it is anticipated that the heat transferring rate is primarily decreased with the increase of the iron ore diameter, so that the increase of the iron ore diameter becomes disadvantageous in the heating of a short time. Now, the kneading and molding test is conducted by changing a pulverizing particle size of iron ore. The test is performed in eight particle size levels within a range of 0.42-2.17 mm as an average particle size of iron ore. Table 1 shows sieve mesh used (JIS) and each particle size composition. Coal previously heated to 150°C is charged into a kneading machine, and then a high-softening point binder having a softening point of 180°C and iron ore heated to the softening point of the high-softening point binder are simultaneously charged into the kneading machine while rotating main rotation blades in the kneading machine at a low speed. A predetermined amount of a low-softening point binder is added immediately after the completion of the charging, agitated for 90 seconds, and then discharged from the kneading machine to perform molding (Case-A). As a comparison for the test, the iron ore, binder and iron ore are separately heated to 180°C and charged into the kneading machine (Case-B).

Table 1

Sieve mesh (mm)	Weight ratio on sieve (%)							
	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8
5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.75	0.0	0.0	0.0	0.0	0.0	0.0	7.0	12.0
4.0	0.0	0.0	0.0	0.0	3.1	9.0	10.0	13.0
2.8	0.0	0.0	0.0	4.9	6.9	8.0	7.0	12.0
2.0	0.0	0.0	8.1	9.9	13.0	8.0	7.0	9.0
1.4	0.0	10.2	13.0	14.2	11.7	10.0	9.0	7.0
1.0	6.3	12.8	17.2	14.0	13.1	15.0	8.0	7.0
0.71	13.1	12.0	14.8	12.7	12.2	12.0	9.0	8.0
0.5	16.6	9.5	7.0	9.1	10.5	10.0	7.0	6.0
0.3	17.0	10.3	6.9	7.2	6.3	5.0	8.0	7.0
0.15	14.0	11.2	8.5	5.5	7.1	7.0	7.0	5.0
0.106	11.2	7.0	6.2	5.2	4.8	5.0	6.0	4.0
0.09	7.8	6.0	5.0	5.1	4.3	4.0	6.0	4.0
0.075	4.2	6.7	5.1	4.7	2.8	3.0	4.0	3.0
0.045	5.0	7.2	5.1	4.3	2.1	2.0	3.0	2.0
-0.045	4.8	7.1	3.1	3.2	2.1	2.0	2.0	1.0
Average particle size (mm)	0.42	0.58	0.86	1.04	1.26	1.42	1.64	2.17

[0031] Coal previously heated to 150°C is charged into a kneading machine, and a high-softening point binder having a softening point of 180°C and iron ore heated to the softening point of the high-softening point binder are simultaneously charged into the kneading machine. A predetermined amount of a low-softening point binder is added immediately after the completion of the charging, agitated for 90 seconds, and discharged from the kneading machine to perform molding (Case-A). As a comparison for the test, the iron ore, binder and iron ore are separately heated to 180°C and charged into the kneading machine (Case-B).

[0032] FIG. 5 shows a relation between a strength of a molded product and an average particle size of iron ore. In Case-B, when the average particle size of iron ore is not more than 1.26 mm, the strength of the molded product is

increased as the average particle size becomes larger, while when the average particle size exceeds 1.26 mm, a tendency of somewhat decreasing the strength is observed. In Case-A, when the average particle size of iron ore is not less than 1.64 mm, the strength of the molded product is largely decreased, and the difference to Case-B becomes large. Assuming that the average particle size of iron ore purely exerts on the strength of the molded product in Case-B, the reason why the difference of the strength between Case-A and Case-B becomes larger at the average particle size of iron ore of not less than 1.64 mm is considered due to the fact that the temperature rising of the high-softening point binder is small and the interaction with the low-softening point binder becomes small.

[0033] As seen from the results in FIG. 5, the average particle size of iron ore is necessary to be not more than 2 mm in the invention. When the average particle size is as fine as 0.42 mm, total outer surface area of iron ore particles becomes larger, and the outer surfaces are covered with the binder, and hence the amount of the binder is lacking, and the strength may be decreased. The average particle size of iron ore of not more than 2 mm has no problem from a viewpoint of heating the high-softening point binder, but is preferable to fall into 0.58-1.64 mm.

EXAMPLE

[0034] A high-speed agitating type mixer having an effective volume of 375 L is used as a kneading machine in this example. A molding machine is a double-roll type molding machine having a roll size of 715 mm ϕ x 424 mm. The feeding of the starting material to the rolls is performed by gravity charging, in which a flow rate of the starting material into the rolls is adjusted by up-and-down movement of an adjusting plate disposed on the top portion between the rolls to control a molding pressure. The molding is performed under a circumferential speed of 0.2 m/s and a linear pressure of 3-4 t/cm in the rolls. The molded product has a size of 30 mm x 25 mm x 18 mm (6 cc) and an egg-type form. A mixing ratio of coal, iron ore, high-softening point binder, and low-softening point binder to the total weight of the materials is 65.8 mass%, 28.2 mass%, 2 mass%, and 3 mass%, respectively. The particle size of coal is not more than 2.8 mm in a full dosage, and an indirect heating type kiln is used in the dry heating of coal, and a direct heating type kiln is used in the iron ore. A temperature of coal is 150°C in an outlet of the kiln and 148°C prior to the charging into the kneading machine. An oxygen concentration in an atmosphere of the kiln is 0.8%. A rotation number of the kiln and a flow rate of a heating gas flowing in the kiln are determined so as to render a time from an inlet of the kiln to a discharge from the kneading machine into about 30 minutes.

[0035] The iron ore before the charging to the kneading machine is heated to seven temperature levels of 150°C (30°C lower than the softening point of the high-softening point binder), 160°C (20°C lower than the softening point), 170°C (10°C lower than the softening point), 180°C (same temperature as the softening point), 190°C (10°C higher than the softening point), 200°C (20°C higher than the softening point), and 210°C (30°C higher than the softening point). As the high-softening point binder is used a binder having a softening point of 180°C. An average particle size of iron ore is 1.04 mm. After the addition of the iron ore and low-softening point binder, a low-softening point binder is charged and kneaded for 90 seconds. After the end of the kneading, molding is conducted immediately. FIG. 6 shows a relation between a strength of a molded product and a temperature of iron ore. When the heating temperature of iron ore is not lower than 160°C (a temperature 20°C lower than the softening point of the high-softening point binder), the strength of the molded product is confirmed to be higher than the target value.

INDUSTRIAL APPLICABILITY

[0036] According to the production method of the molded product for ferrocoke according to the invention, it is made possible to produce a high-strength molded product without using a particular facility and to provide a high-strength molded product suitable as a molded product used in the production of ferrocoke.

Claims

1. A method for producing a molded product for ferrocoke by molding a mixed starting material of coal, an iron-source material, a high-softening point binder having a softening point of not lower than 150°C, and a low-softening point binder having a softening point of lower than 150°C, **characterized in that** at least one of the iron-source material and the high-softening point binder is previously heated to not less than a temperature lower by 20°C than a softening point of the high-softening point binder to perform molding of the mixture.
2. The method for producing a molded product for ferrocoke according to claim 1, wherein iron-source particles having an average particle size of not more than 2.0 mm are used as the iron-source material, heated to not less than a temperature lower by 20°C than the softening point of the high-softening point binder, then mixed with the high-softening point binder, and thereafter mixed with the low-softening point binder having a softening point of lower

than 150°C to mold the mixed starting material.

- 5 **3.** The method for producing a molded product for ferrocoke according to claim 1, wherein iron-source particles having an average particle size of not more than 2.0 mm are used as the iron-source material, and the high-softening point binder is heated to not less than a temperature lower by 20°C than the softening point of the high-softening point binder, then mixed with the iron-source material, and thereafter mixed with the low-softening point binder having a softening point of lower than 150°C to mold the mixed starting material.
- 10 **4.** The method for producing a molded product for ferrocoke according to any one of claims 1-3, wherein the iron-source material and the high-softening point binder are simultaneously charged into a kneading machine.
- 15 **5.** The method for producing a molded product for ferrocoke according to any one of claims 1-4, wherein the iron-source material or the high-softening point binder is heated to not more than a temperature higher by 10°C than the softening point of the high-softening point binder.
- 20 **6.** The method for producing a molded product for ferrocoke according to any one of claims 1-5, wherein an average particle size of the iron-source material is 0.58-1.64 mm.

FIG. 1

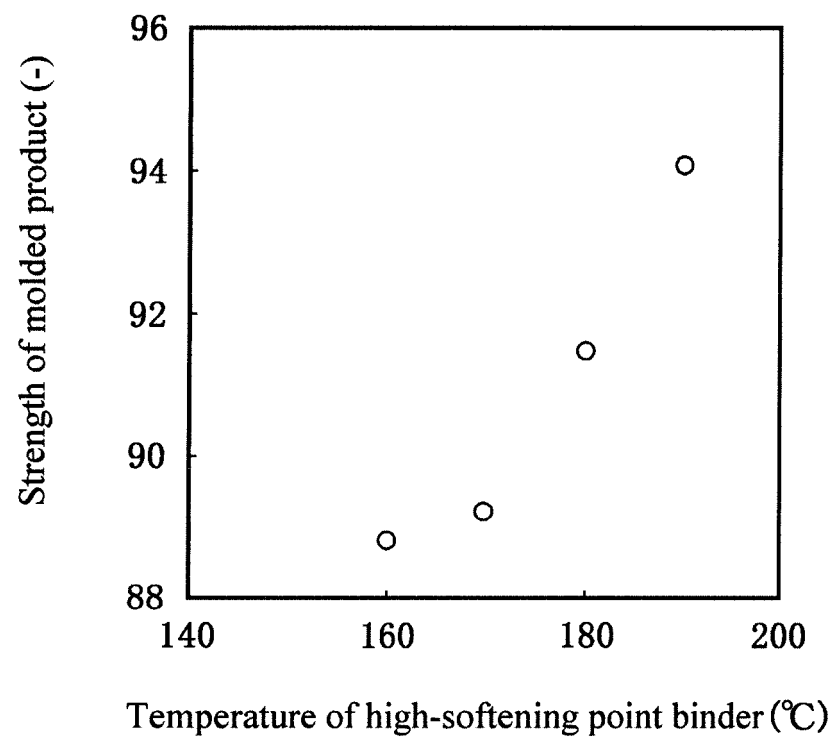


FIG. 2

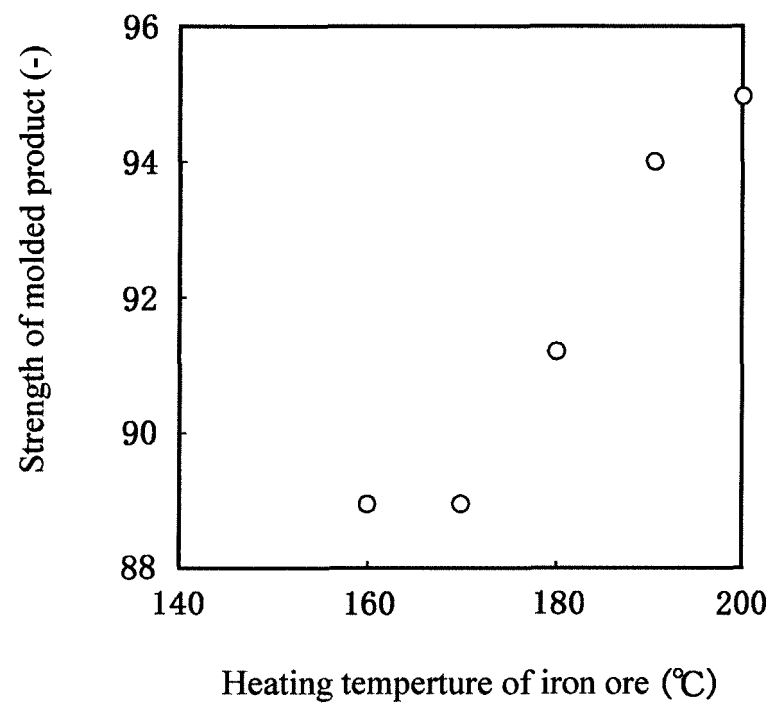


FIG. 3

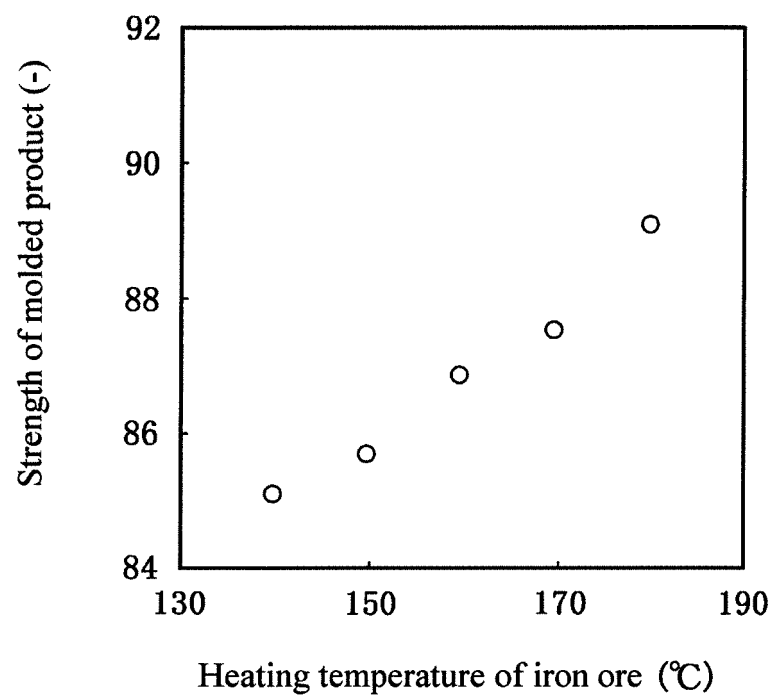


FIG. 4

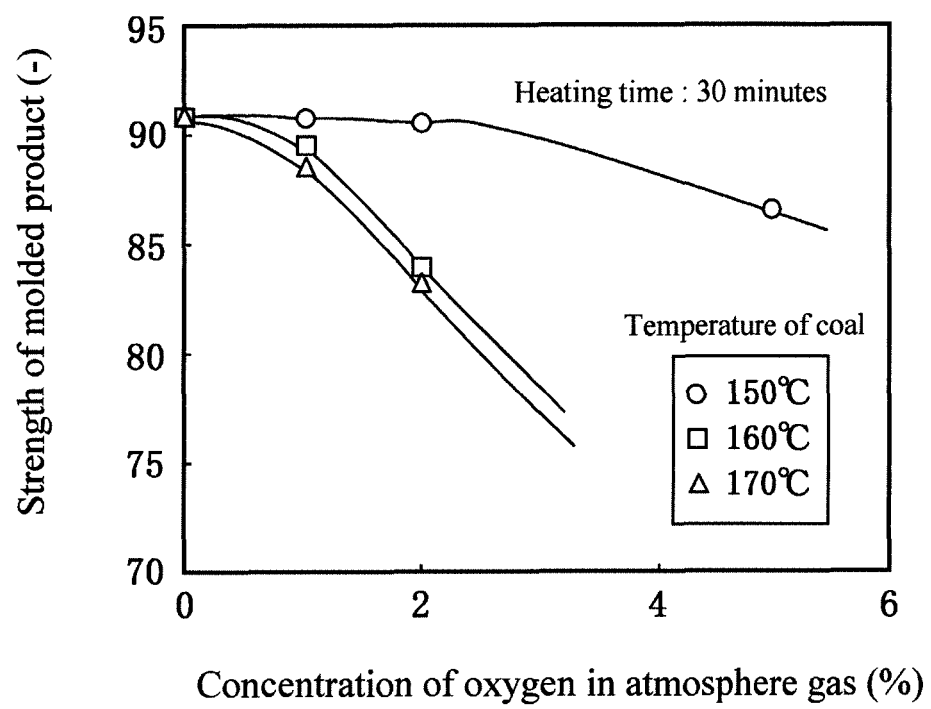


FIG. 5

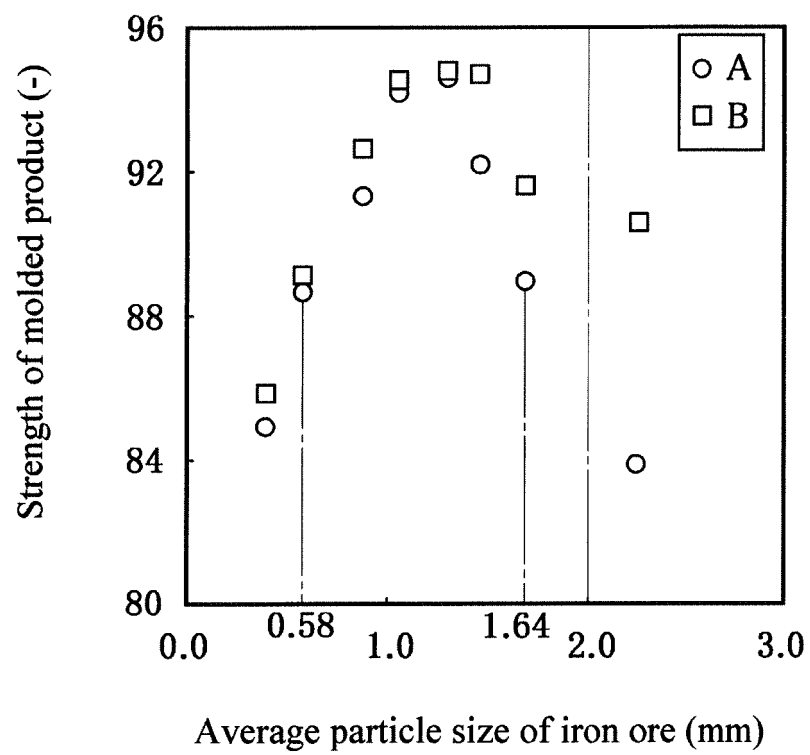
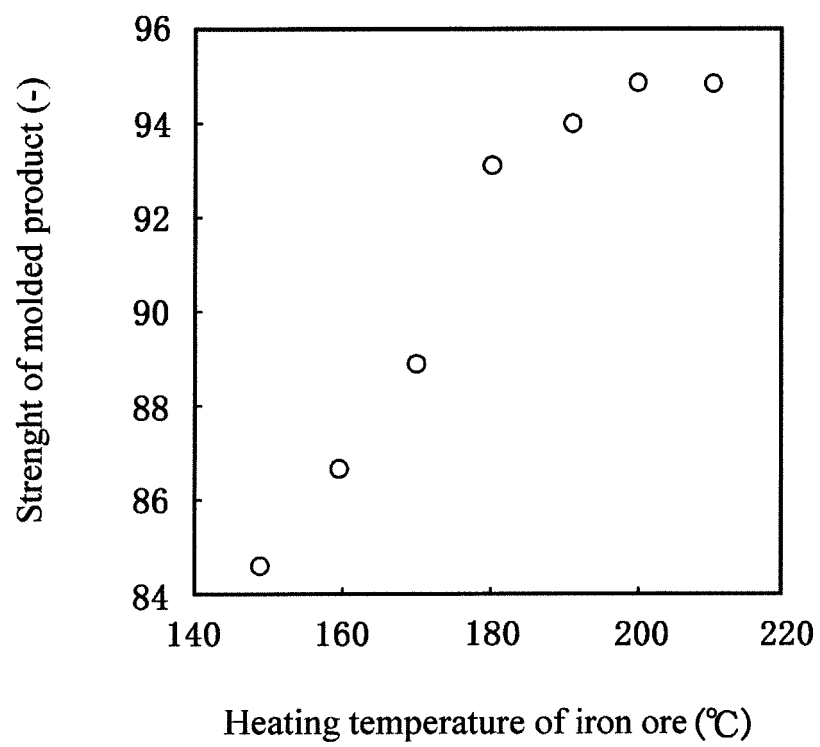


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2016/067521

A. CLASSIFICATION OF SUBJECT MATTER

C10B53/08(2006.01)i, C10B57/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C10B53/08, C10B57/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
 Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 2007-277489 A (JFE Steel Corp.), 25 October 2007 (25.10.2007), claims 1 to 4; paragraphs [0017] to [0020] (Family: none)	1, 4, 5 2, 3, 6
A	JP 2013-234239 A (JFE Steel Corp.), 21 November 2013 (21.11.2013), claim 1; paragraph [0052] (Family: none)	1-6
A	JP 2011-32371 A (Kobe Steel, Ltd.), 17 February 2011 (17.02.2011), claim 1; paragraph [0083] (Family: none)	1-6

☐ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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Date of the actual completion of the international search
31 August 2016 (31.08.16)Date of mailing of the international search report
13 September 2016 (13.09.16)
 Name and mailing address of the ISA/
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4853090 B [0005]
- JP 5017967 B [0005]
- JP 5017966 B [0005]

Non-patent literature cited in the description

- *National Greenhouse Gas Inventory Report of Japan*, 2014, 35 [0006]