Patent 512658 overview of Sumitomo Metal Company

Method for manufacturing sintered ore

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Problem to be solved

To provide a method for manufacturing sintered ore by which productivity can be increased in improving gas permeability of a raw material charged layer, even when using an increased amount of limonite with a high content of crystallization water.

Solution

In the method for manufacturing the sintered ore, an iron ore, a carbon material, an auxiliary material and return fines are used, and the raw materials are separated by two lines for manufacturing and treating granulated products. The method includes the steps of: carrying out moisture conditioning and mixing of the raw materials composed of the auxiliary material containing MgO (e.g. Brucite, dolomite, etc.) in a high-speed agitating mixer 1; granulating the same to coarse particles with an average particle size of 3–20 mm with a pan pelletizer 2 (separated pelletizing line); and loading pseudo particles (main pelletizing line) produced by granulating the remaining raw materials and the coarse particles into a sintering machine 6.

Method for manufacturing of sinter product, that raw materials are iron ore, carbon material, auxiliary material and returned ore from sinter facility. The raw material, which consists mainly a MgO contain auxiliary, a magnesium hydroxide mineral, is pelletized to the size of 3-20 mm by using high speed mixer under the control of humidity. And by the sinter operation above mentioned sized auxiliary material is charged to the sinter facility with the another raw material, the rest of the components, which is also agglomerated to pseudo grain sized coarse particle.

Points regarding about Brucite

Recently, increasing use of limonite (such as Pisolite ore, Maramanba ore), it is regarded that bad air permeability at the charged material and lower product yield ratio in the furnace as questionable. The reason of this phase is the bad permeability in the charged raw materials, because limonite has much more water of crystallization, therefore called “high crystal water ore”, will be a high porous after the decomposition of crystal water by the heating. As the result the material can easy melt and the high viscosity of melted material will go up enough to block the opening in the charged materials. That is the reason of inconvenient air permeability in the shaft.

Furthermore when more amount of limonite is used, especially at the lower part of charged raw material, where over heating occurs, open space is easily filled up by high viscosity melting materials, and it brings a worse air permeability and lower productivity of sinter product. And it is supposed that the reason of worse air permeability is an increasing water content zone, which is formed under the combustion area, and it helps a collapse of pseudo particle.

There are some kind of MgO contain auxiliary materials, namely, Dolomite, that main contents is $CaCO_3$ and $MgCO_3$, Serpentine that main content is $Mg_3Si_2O_5(OH)_4$, Brucite that main content is $Mg(OH)_2$ and Magnesite that main content is $MgCO_3$. In these kind of the auxiliary materials, serpentine is not recommended, because it brings SiO_2 to the sintered material, while MgO is supplied.

Picture 1 shows an outline of sinter production facility according to this invention. There are two separated pelletizing system lines. A High-speed mixer 1 is used for the mixing and control water content for the MgO contain auxiliary added raw materials and pan-pelletizing machine 2 products the sized coarse material which size is average 3–20 mm. And raw material except the component with MgO contain auxiliary material is pelletized in the 2nd pelletizing machine 3a and by the pelletizing machine 3b, both machine are dram type, pseudo coarse material is formed.

At the next, this pseudo coarse material and former sized coarse material from machine 2 was transported to the hopper 4 and charged to sinter machine. Both sized materials are mixed on the belt conveyer to the hopper 4 and dropped in the hopper. In this invention the both material are charged to the sinter machine directly without through any kind of final mixer to the pelletizing machine. Charged coarse material and pseudo coarse material are discharge at the end of hopper 4 by roll feeder 5 and inserted to the pallet 6a on the sinter machine 6 through sloping chute, while both materials are mixed in this process line.

The filled raw sinter material layer which is made by pseudo coarse material and sized coarse material on the pallet 6a is ignited by ignition furnace 7 and a burning zone is formed. Because the air is blown from upper to lower, burning zone moves from upper to lower of raw material layer and this layer changes to sintered cake by the combustion heating and discharged from the end of sinter machine 6.

Generally, as the MgO contain auxiliary material, Dolomite is widely used, which is called CaO-MgO auxiliary material. And Serpentine, which contains high ratio of SiO_2 and MgO, main ingredient is $Mg_3Si2O_5(OH)_4$ mineral, and called SiO_2-MgO auxiliary material. But Serpentine is not recommended from the point of the reduction of slag and gives a surplus SiO_2 in sintered ore while MgO is supplied.

As other MgO contain auxiliary material, Brucite and Magnesite are known. Both materials are high MgO auxiliary material, that MgO content exceeds over 40%. Brucite has lower content of CaO to compare with dolomite and lower content of SiO_2 to compare with Serpentine and has much more content of MgO to compare with Dolomite and Serpentine. Magnesite is, like Brucite, has lower content of CaO to compare with Dolomite and lower content of SiO_2 to compare with Serpentine, and has more MgO than Dolomite and Serpentine.

In this invention it is recommended Bucite and/or Magnesite are used as the MgO contain auxiliary material. Because high contents of MgO content exerts the effect of this invention apparently and both have much lower content of SiO_2 than Serpentine.

The following data can be achieved by the test operation according to this invention.

In the example test case 1, the sized coarse material was made with Dolomite, without using Limestone powder, productivity increased 32 % and by using Brucite, which contains lower CaO than dolomite, productivity increased 42 %. Namely if the auxiliary material, which has much MgO content, is used for the product of seized coarse raw material, the productivity rises steeply. This situation is supposed that when the MgO contain auxiliary material is added to the raw materials for the sized coarse material, its physical strength can be improved, and the cohesion-reaction to melting material is limited and the form of the coarse materials are kept in long time during the sintering. As the result porous spaces around the coarse material is kept stable and air permeability in the raw materials can be improved.

As the result to keep a highly stable condition about the air permeability in the raw sinter layer, it is indispensable to add a coarse material which contains MgO contain auxiliary material.

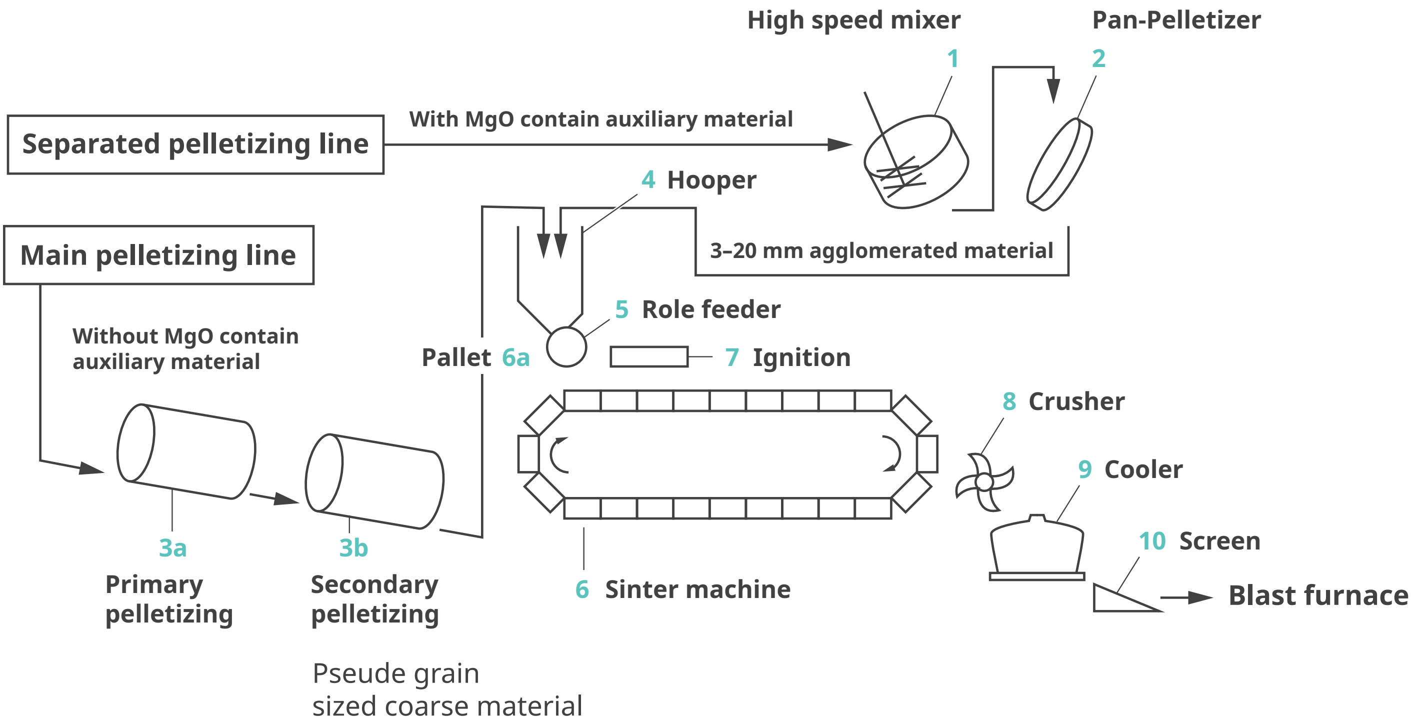
Appendix

Table 1

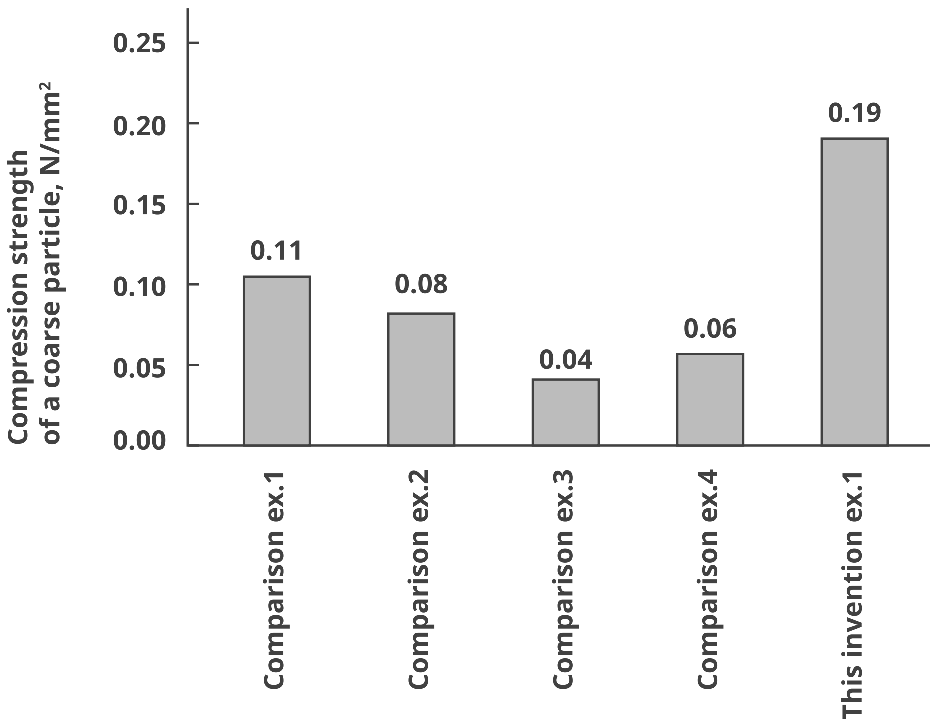
Brand	Chemical components, mass %						
	T.Fe	SiO_2	CaO	Al_2O_3	MgO	F.C	L.O.I.
Marra Mamba (Australia)	60.7	3.9	0.0	2.6	0.1	–	7.0
Hematite A	62.7	3.6	0.1	2.4	0.1	–	3.6
Hematite B	67.0	0.5	0.0	1.2	0.0	–	2.0
Pisolite C	55.7	5.1	0.7	2.6	0.3	–	11.6
Pisolite D	56.9	4.3	0.1	1.3	0.1	–	13.0
Brucite	0.7	8.2	4.1	0.5	54.5	–	29.3
Magnesite	1.0	0.6	0.2	0.1	47.1	–	51.0
Serpentine	5.3	38.3	2.0	1.0	37.8	–	15.6
Dolomite	0.5	1.1	29.4	0.1	21.3	–	47.5
Limestone powder	0.1	0.0	55.2	0.0	1.0	–	43.7
Returned Ore	58.3	4.3	8.9	1.7	1.3	–	0.0
Blast furnace dust	30.4	5.8	3.6	2.6	0.6	33.6	39.1
Powder coke	0.4	6.4	0.3	3.3	0.1	86.7	86.7

Table 2

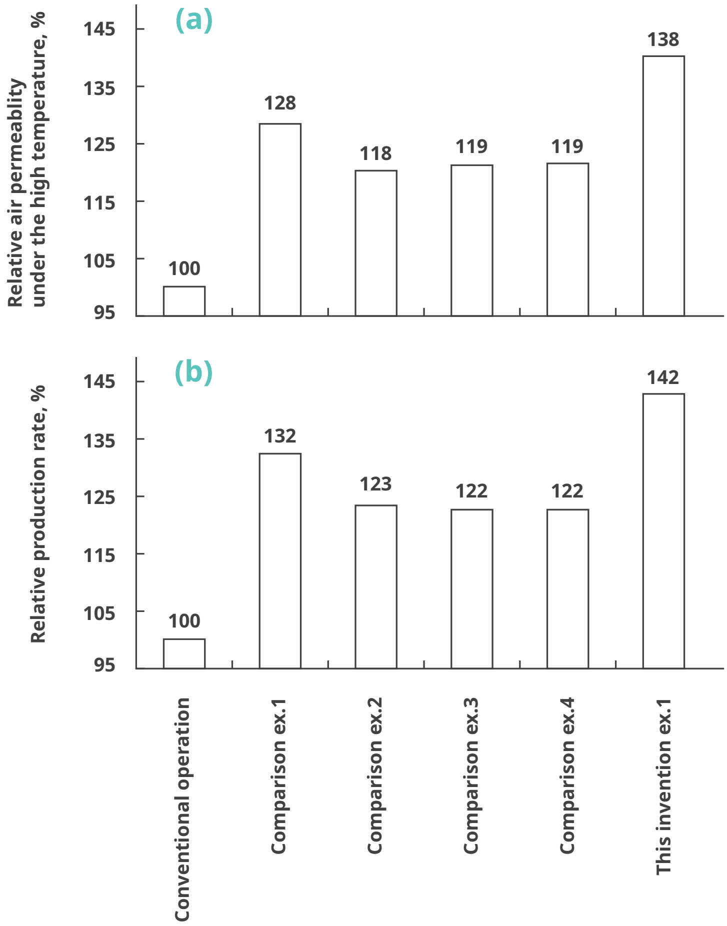
	Known operation	Reference operation ex.1	Reference operation ex.2	Reference operation ex.3	Reference operation ex.4	This invention
Mixed powder raw material, mass %						
Marra Mamba (Australia)	20	0	0	0	0	0
Hematite	16	16	16	16	16	16.1
Pisolite	38.5	38.5	38.5	38.5	38.5	38.5
Returned ore	10	10	10	10	10	10
Powder serpentine	1.4	1.4	1.4	1.4	1.4	1.4
Dolomite	1.2	0	0	0	0	0
Blast furnace dust	1.3	0	0	0	0	0
Limestone powder	11.6	11.6	10.8	10	9.2	12.2
Sub total	100	77.5	76.7	75.9	75.1	78.2
Ave. size, mm	2.9	2.9	2.9	2.9	2.9	2.9
Coarse size raw material, mass %						
Marra Mamba (Australia)	0	20	20	20	20	20
Dolomite	0	1.2	1.2	1.2	1.2	0
Brucite (-1 mm)	0	0	0	0	0	0.5
Blast furnace dust (-5 mm)	0	1.3	1.3	1.3	1.3	1.3
Limestone (-1 mm)	0	0	0.8	1.6	2.4	0
Sub total	0	22.5	23.3	24.1	24.9	21.8
Ave. size, mm	–	8.2	8.5	8.7	8	7.3
Total	100	100	100	100	100	100
Powder coke, mass %	4.6	4.6	4.6	4.6	4.6	4.6
Relative heat transfer, %	100	128	118	119	119	138
Relative productivity, %	100	132	123	122	122	142



Picture 1



Picture 2



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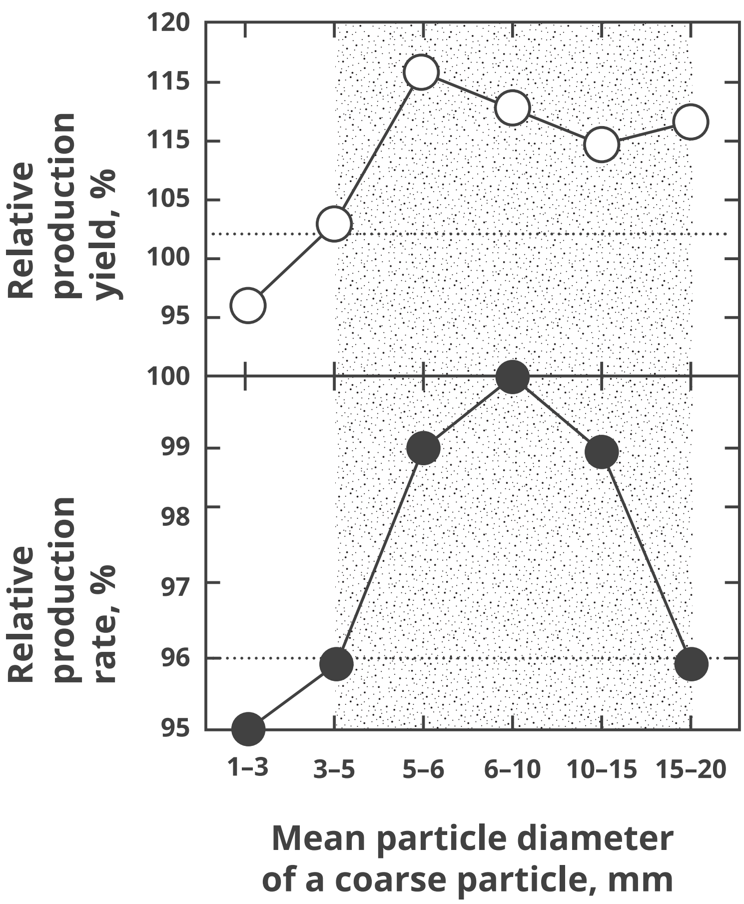

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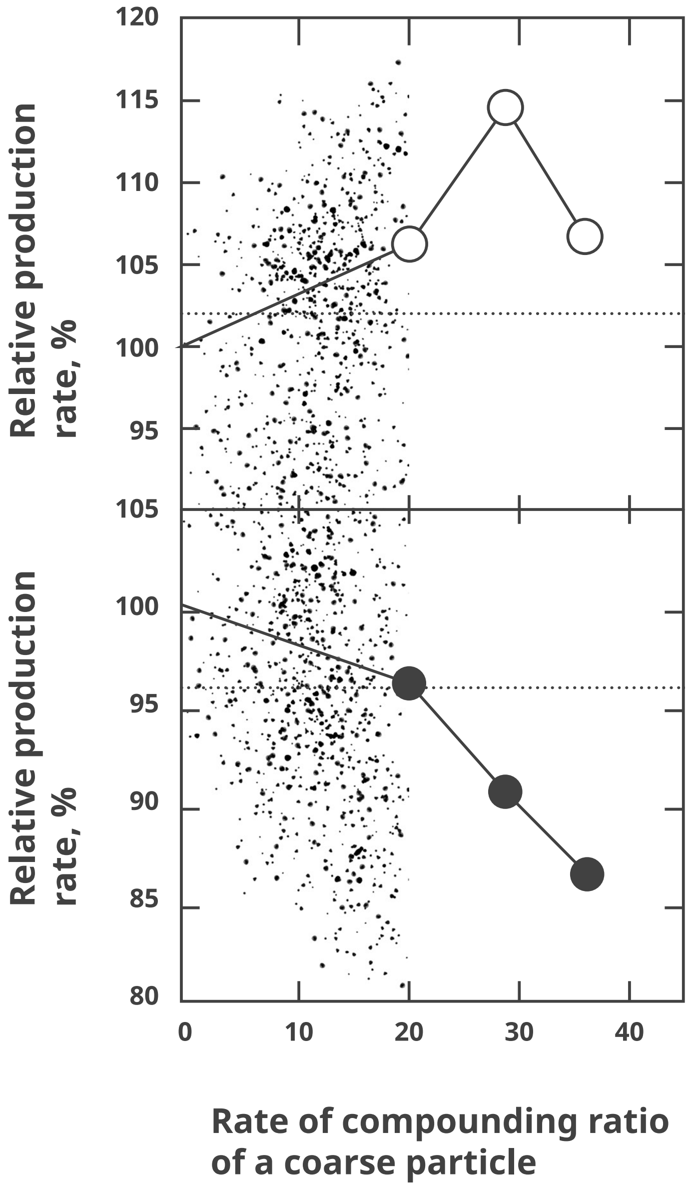

Picture 5

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