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Sugawara et al.

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[54] **METHOD FOR SIEVING A SAMPLE OF PARTICULATE MATERIALS FROM A SINTERING CHARGE**

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[52] **U.S. Cl.** ..... **73/432 PS;** 209/237; 209/11

[51] **Int. Cl.** **G01n 15/02**

[58] **Field of Search** ..... 209/1, 3, 4, 11, 233, 237, 209/238; 73/432 PS

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[57] **ABSTRACT**

A sample recovered from the particulate materials of a sintering charge is dried to the extent that the water content thereof is about 0.2% to 1.2% and then sieved. Thus, the pseudo particles in said sample are not destroyed so that the accurate distribution of the particle size of charge materials at the time of sintering can be determined.

4 Claims, 5 Drawing Figures

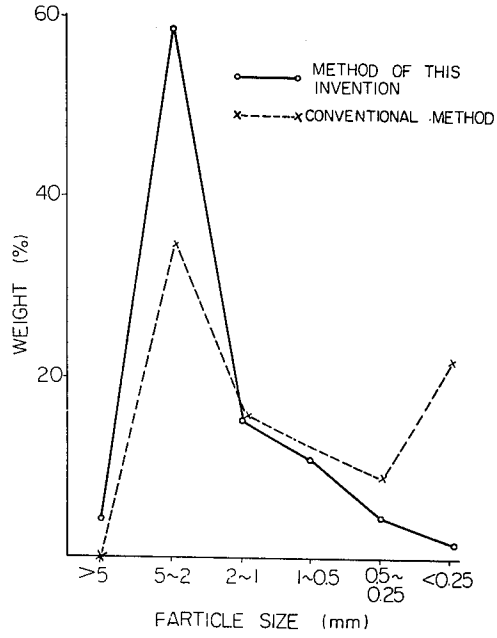


Fig. 1

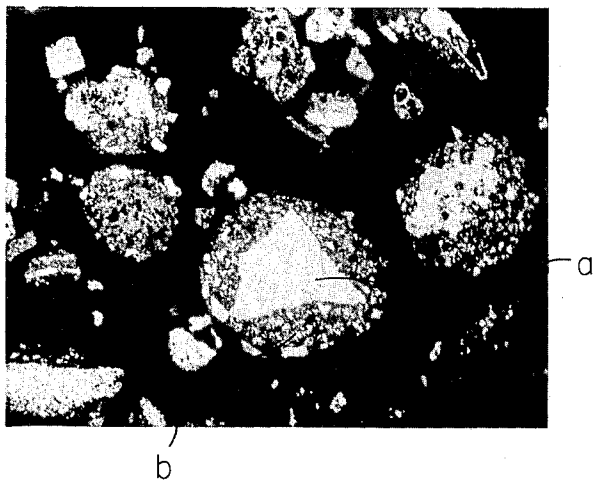


Fig. 2

SAMPLE No.	SAMPLE RECOVERED	WEIGHT AFTER DRYING	REMOVED WATER CONTENT	REMAINING WATER CONTENT	>5 mm	5 ~ 2 mm	2 ~ 1 mm	1 ~ 0.5 mm	0.5 ~ 0.25 mm	<0.25 mm	TOTAL B	LOSS A-B
1	500g	480g	4.0	1.8	20g	287g	84	57	24	6	478	2g
2	"	477	4.6	1.2	22	275	84	61	26	8	476	1
3	"	473	5.4	0.4	24	278	81	57	25	8	473	0
4	"	472	5.6	0.2	16	297	71	53	26	9	472	0

Fig. 3

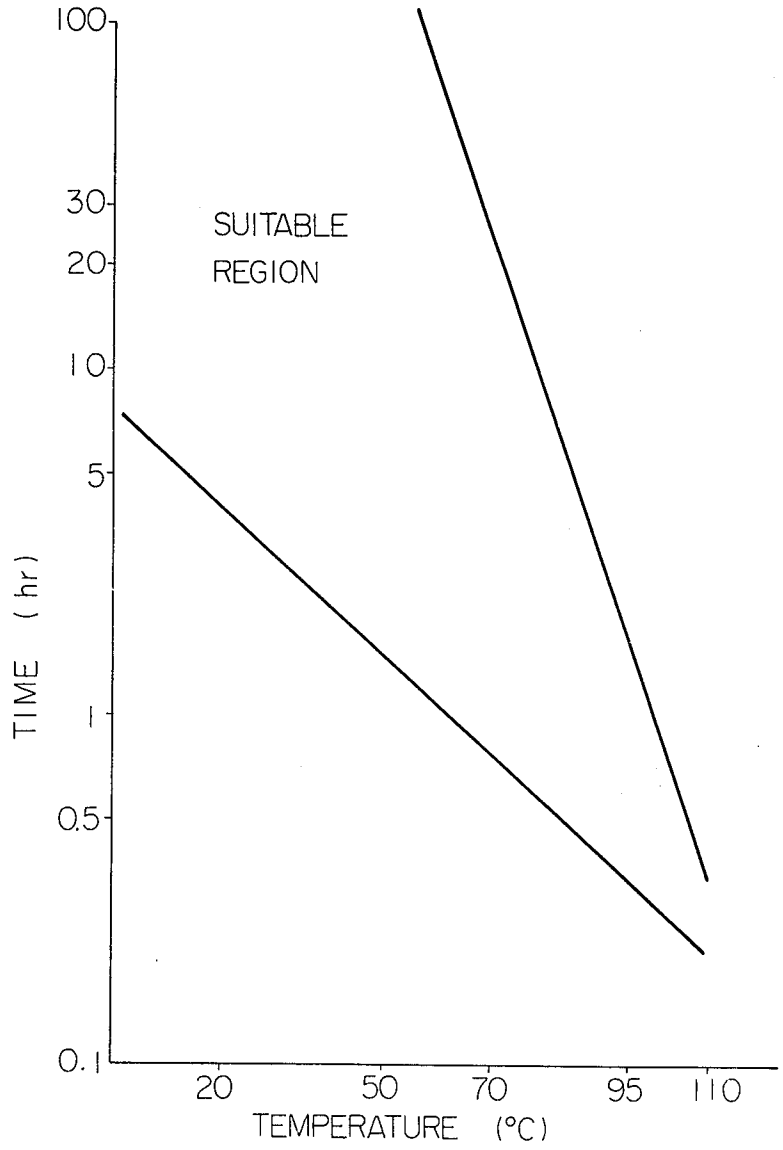

100
30
20
10
5
1
0.5
0.1
TIME (hr)
SUITABLE
REGION
20
50
70
95
110
TEMPERATURE (°C)

Fig. 4

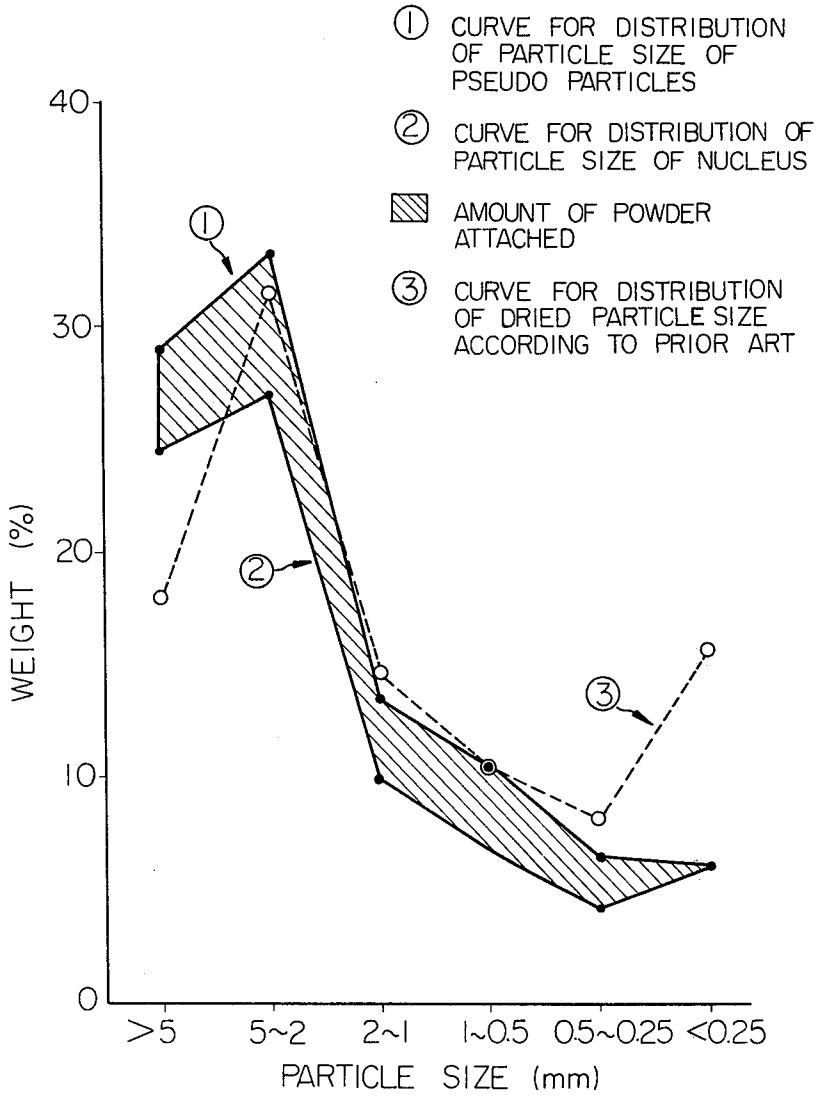
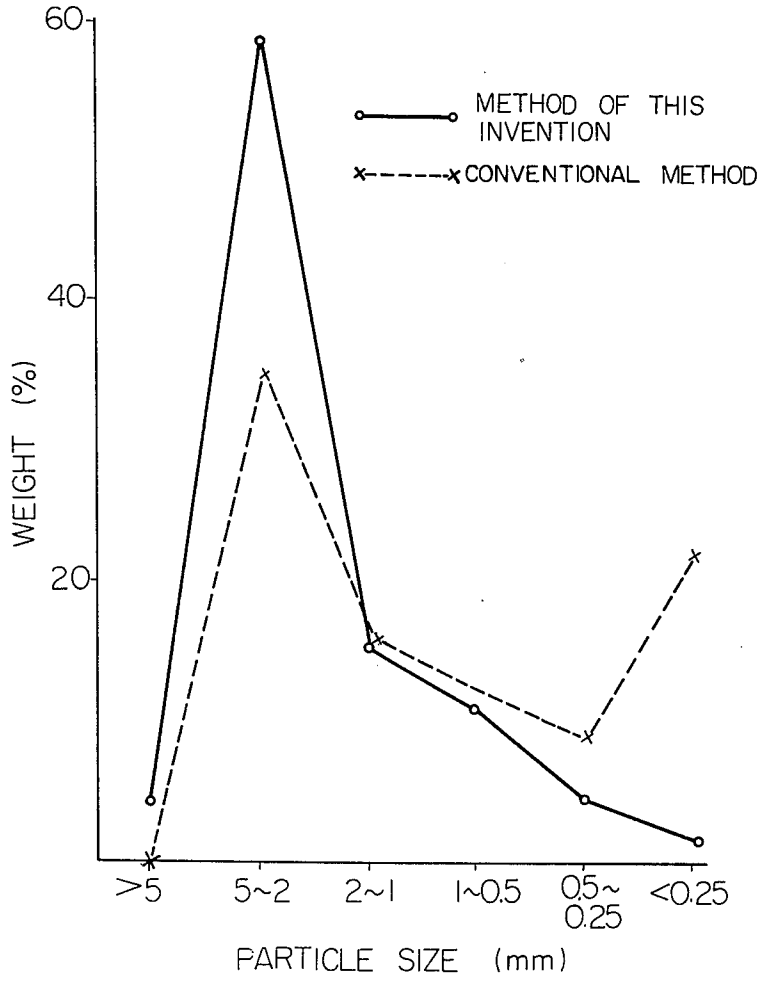

① CURVE FOR DISTRIBUTION OF PARTICLE SIZE OF PSEUDO PARTICLES
② CURVE FOR DISTRIBUTION OF PARTICLE SIZE OF NUCLEUS
AMOUNT OF POWDER ATTACHED
③ CURVE FOR DISTRIBUTION OF DRIED PARTICLE SIZE ACCORDING TO PRIOR ART
WEIGHT (%)
40
30
20
10
0
>5
5~2
2~1
1~0.5
0.5~0.25
<0.25
PARTICLE SIZE (mm)

Fig. 5


60
40
20
WEIGHT (%)
METHOD OF THIS INVENTION
CONVENTIONAL METHOD
>5
5~2
2~1
1~0.5
0.5~0.25
<0.25
PARTICLE SIZE (mm)

METHOD FOR SIEVING A SAMPLE OF PARTICULATE MATERIALS FROM A SINTERING CHARGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of methods for sintering particulate charges such as iron, lime stone, coke and the like. More specifically, this invention relates to methods of sampling particulate charges prior to the sintering thereof in order to precisely determine the particle size distribution of the charges, and so regulate the sintering operation to provide an end-product having optimum characteristics.

2. Description of the Prior Art

It is known that the particulate materials of a sintering charge such as iron ore, lime stone, coke, etc. are mixed in a drum mixer or the like where they are adjusted so as to have a charge moisture content of about 5.0% to 7.0%, and are then passed with said moisture content to, for example, a movable fire grate, where they are sintered under such conditions as shown in FIG. **1**. From FIG. **1**, it will be noted that the powder layer (b) adheres to the particle nucleus (a) by virtue of remaining water as the binder. In other words, the particulate materials are sintered under the condition of pseudo or apparent particle size (a) and (b).

In order to determine the distribution of the particle size of said particulate materials for sintering, it has been a common practice to recover a sample just before the sintering charge is put on the movable fire grate, completely dry the sample, for example, at about 120°C for two hours and then conduct the sieving. As a result, the water which has acted as the binder is removed from the sample whereby the powder layer (b) is stripped from the particle nucleus (a) in FIG. **1**. In other words, the conventional sieving step is conducted under a condition such that the pseudo particles are destroyed, and the value thus measured does not reflect the actual charge distribution.

It is an object of the present invention to overcome the disadvantages which have been encountered in prior art sampling procedures.

It is another object of the present invention to provide a method for measuring accurately the distribution of the particle size of the particulate materials of a sintering charge by conducting sieving of a sample taken from the charge with the particle size identical to that at sintering.

These and other objects of this invention will become more apparent from a consideration of the following description accompanying drawings in which:

FIG. **1** is a photograph showing the condition of the pseudo particles.

FIG. **2** is a table showing the relation between the remaining water content and the distribution of the particle size.

FIG. **3** is a graph showing the relation between the temperature and the time required for the accurate drying of the particles to the water content of about 0.2% and 1.2% in accordance with the present invention.

FIG. **4** is a graph comparing the analysis of the particle size and the amount of the powder attached as determined according to the present invention and the prior art.

FIG. **5** is a graph comparing the measuring of the particle size according to the present invention with the prior art.

DESCRIPTION OF THE INVENTION

The present invention relates to a method for sieving a sample of particulate materials of a sintering charge which is adapted for determining the true state of the particle size of the material at the time of sintering.

According to the invention, there is provided a method for sieving a sample of a material for sintering which comprises sieving said sample under such condition that the pseudo particles are not destroyed. Also provided is a method for sieving a sample which comprises sieving said sample under the condition that the water content remaining in said sample is about 0.2% to 1.2%.

Still further provided is a method for sieving a sample of the materials for sintering which comprises recovering a sample from the materials for sintering, drying the same to the extent that the water content thereof is 0.2% to 1.2% and thereafter sieving the same.

In accordance with the present invention, various tests have been made concerning the relation between the remaining water content and the particle size so as to determine the condition under which the pseudo particles have been destroyed. The data shown in FIG. **2** depicts the test results that were obtained.

The present invention is based upon these test findings. In FIG. **2**, the sample No. 1 with a remaining water content of about 1.8% can not be fully sieved since the fine powder sticks to the mesh wires of the sieve, which may be demonstrated by the loss of 2g. Similarly, sample No. 2 having the remaining water content of 1.2% shows a loss of 1g., which can be considered as the upper limit for sieving.

As to sample No. 4 with a water content of 0.2% the column ">5mm" is indicated as 16g., the value drastically lowered from that of the 24g. of the sample No. 3. Moreover, it can be seen that the amount thus decreased has begun to be compensated by the increased amount of the columns "5-2mm" and "<0.25mm." This fact should be considered as denoting that the pseudo particle size has begun to be destroyed and separated into the nucleus (a) and the powder (b).

Based upon these tests, it is postulated that the sieving of a sample of materials should be conducted under the condition that the pseudo particles should not be destroyed, and that in order to maintain the pseudo particle size, the water content remaining in the sample should be about 0.2% to 1.2%.

The water content in the particulate materials at the time of sintering is as indicated earlier about 5% to 7%. However, it also has been ascertained that when the water content in the sample is in the range between about 0.2% and 1.2% as in the present invention, the structure of the particle size or the condition of the pseudo particle size does not change at all. Moreover, in order to allow the water content to remain in the sample, the graph of FIG. **3** provided by the present invention showing the relation between the temperature and the time should be considered.

One of the most advantageous effects of the present invention is that not only accurate distribution of particle size can be determined, but also the amount of powders attached per each particle size can be measured. That is, the material is dried within the range of water

content between about 0.2% and 1.2% and then sieved. After complete drying per each particle size, the dry weight (A) is measured. Then the material is put on a sieve, the opening of which is finer by one step than said particle size, and washed with water. Thereafter the attached powder of the pseudo particles is washed away, and the nucleus of the remaining pseudo particles dried whereby the weight (B) is measured. The amount of the powder which has been attached to the particle size can be obtained by the difference between (A) and (B). As a result, it is possible to analyze the variation of various materials in the course of mixing and adjustment of moisture thereof.

As set forth earlier, this invention makes it possible to determine accurately the distribution of the particle size of the materials at the time of sintering charge, which greatly contributes to the enhancement of the quality of the sintered ore as well as the production thereof.

Samples of particulate materials for sintering were sieved according to the method of this invention and by the conventional method.

As appears from FIG. **5**, the range of <0.25mm particle size considerably increased in the conventional method while it is decreased for the method in the present invention. The structure of the particle size resulting from the method in the present invention consists mainly of the range of 5-2mm, which demonstrates that the pseudo particle size has not been destroyed.

What is claimed is:

1. A method for analyzing a sample of particulate material suitable for sintering to accurately determine the particle size distribution thereof, individual particles of said material characterized by possessing a relatively large nucleus to which is bonded by water as the bonding medium, pulverulent material or powder of relatively small size, which comprises:

a. drying the particulate material to adjust the water content thereof, the upper level of water content being the maximum amount of water tolerated for substantially complete sieving of the material and the lower level of water content being the maximum amount of water required to maintain substantially complete bonding of pulverulent material or powder to each individual particle nucleus;

b. sieving the particulate material through a plurality of sieving means of different orifice size to provide a plurality of portions of the particulate material individual paticles of which possess substantially all of the pulverulent material or powder originally adhering thereto, each portion constituting a different particle size range; and

c. weighing each portion of particulate material constituting a different particle size range based on the total weight of the sample of particulate material to determine the percentage by weight thereof thus providing an accurate determination of the particle size distribution of the sample of particulate material.

2. The method of claim **1** wherein step

a. further comprises adjusting the water content of the particulate material to within the range of from about 0.2% to 1.2% by weight thereof.

3. The method of claim **1** wherein sieving is carried out upon sieving means of progressively decreasing orifice size, said orifice sizes being (i) greater than 5 mm, (ii) from 5 to 2 mm, (iii) from 1 to 0.5 mm, (iv) from 0.5 to 2.25 mm and (v) less than 0.25 mm.

4. The method of claim **1** which further comprises the steps of

d. removing substantially all of the water from each portion of particulate material resulting from step (b);

e. weighing each portion of particulate material;

f. placing each portion of particulate material in a sieving means having an orifice size less than the particle range size of the portion of particulate material but greater than the size of the pulverulent material or powder adhering to the individual particles thereof;

g. washing each portion of particulate material thus causing the pulverulent material or powder adhering to individual particles to be dislodged therefrom and carried through the orifices of the sieving means;

h. removing substantially all of the water from each portion of particulate material resulting from step (g); and

i. weighing each portion of particulate material resulting from step (h) thus providing an accurate determination of the weight quantity of pulverulent material or powder adhering to the individual particles constituting each portion of particulate material.

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