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ORE DRESSING & METALLURGICAL LABORATORIES

386

## Sintering Tests on Siderite Ore from the Helen Mine.

T. W. Hardy

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Ottawa, January 12, 1931.

# REPORT

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Report No. 386

## Sintering Tests on Siderite Ore from the Helen Mine.

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Shipment: A shipment of 1000 pounds of siderite ore from the Helen Mine was received from the Algoma Steel Corporation, Sault Ste Marie, Ontario.

Nature of Sample and Object of Tests: The material supplied consisted of the raw ore, as mined, without any preliminary treatment. Sintering tests were made in order to learn the quality of sinter obtainable, the extent to which the sulphur could be eliminated, and the best practice to obtain the desired results.

Chemical Analysis of Shipment: The shipment was crushed to pass a 3 mesh screen and carefully sampled. The head sample obtained gave the following results on chemical analysis,-

Iron (Fe) - 36.86%
Sulphur (S)- 1.34%

Sintering Tests: Various proportions of ore, coke and water were used and various suctions and bed depths were tried with a view to obtaining a combination which would give the best result as regards both the quality of the sintered product and the degree of desulphurization. Tests were conducted on material crushed to pass a 3 mesh screen and on the same material crushed to pass a 10 mesh screen in order to obtain some information on the effect of particle size.

The tests were carried out on a 12 x 18 inch laboratory type down draught sintering pan. Bed depths varied from 3 to 4.3 inches.

Table #1 shows the results obtained on sintering raw ore crushed to pass a 3 mesh screen. Excellent sinters were obtained, as evidenced by the low percentages of fines, but the outstanding characteristic of the material was its great fusibility. In all tests there was a strong tendency for the sinter to stick to the grates and in the early tests even to plug the holes in the grates. To minimize that trouble a layer of returned fine sinter was laid on the grates before the charge, which helped materially. Possibly due to the highly fusible nature of the ore, desulphurization was not as complete as we had hoped. About 0.40% appeared to be the lowest figure consistently obtainable. In these and following tests, it was found necessary to decrease the suction during the run from an initial value of about 20 inches of water to a final figure of about 5 inches owing to the excessive heat generated causing the sides of the pan to become red hot. It was also found that the thicker bed depths, i.e., over 4 inches gave better results than the thinner ones. A charge containing as low as 3% of coke was found to yield very good results, but about 4 per cent gave the greatest amount of sinter and the least fines.

Table 2 shows the results obtained on material crushed to pass a 10 mesh screen. The product obtained on this material

was also very good, and there was less tendency for the sinter to stick to the grates. However more coke was required in order to avoid excessive quantities of fines, and no improvement over the 3 mesh material was obtained in desulphurization.

Tables 3 and 4 show the results obtained on precalcined ore crushed to pass 3 and 10 mesh screens respectively. These results are comparable with those obtained on the raw ore and indicate that no significant improvement is obtained by precalcining this material.

Summary: The following are the significant features revealed by the above investigation.

(1) The siderite ore which was subjected to these tests possesses excellent sintering qualities but owing to its very fusible nature precautions must be observed to prevent the sinter from sticking to the pan and clogging the grates.

(2) Desulphurization is very incomplete, about 0.40% being the lowest value practicably obtainable in these tests.

(3) Precalcining the ore does not assist in sulphur reduction nor improve the quality of the sinter.

(4) Material crushed to pass a 10 mesh screen has no advantage over material crushed to pass a 3 mesh screen.

## Sinter Tests

### Raw Ore Crushed to 3 Mesh.

| Mix No. | Charge-Pounds: Ore | Coke Breeze | Water | Returned Fine Sinter | Thickness of Bed | Time Mins. | Weight of Sinter in Pounds | Weight of Fines in Pounds | Analysis Sinter: Fe % | S % | Character of Sinter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 40 | 3.2 | 4.3 | 3 | 3" | 35' | 13.5 | 15.5 | 54.33 | 0.43 | All sinters hard and |
| 2 | 50 | 3.0 | 2.7 | 3 | 4" | 35' | 25.5 | 9.5 | 54.12 | 0.67 | strong - Material is |
| 3 | 60 | 2.4 | 3.1 | 11 | 4.3" | 35' | 40.0 | 10.0 | 53.91 | 0.40 | very fusible and tends |
| 7 | 52 | 1.8 | 3.1 | 15 | 4.3" | 40' | 34.5 | 14.0 | 53.91 | 0.42 | to clinker and stick |
| 8 | 42 | 1.8 | 3.1 | 25 | 4.3" | 50' | 36.5 | 15.5 | 53.99 | 0.40 | to grates. |

### Sinter Tests on Raw Ore Crushed to 10 Mesh.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 42 | 2 | 2.6 | 15 | 4" | 35' | 21.5 | 20.5 | 52.86 | 0.29 | All sinters hard and |
| 5 | 50 | 4 | 2.7 | 12 | 4" | 35' | 35.0 | 9.5 | 53.49 | 0.57 | strdng. Tendency to |
| 6 | 40 | 3.2 | 2.2 | 8 | 3.5" | 25' | 23.5 | 10.0 | 52.86 | 0.46 | stick to grates not so |
| | | | | | | | | | | | great as with 3 mesh. |

## Calcination Test on Raw Ore Crushed to 3 Mesh.

| Charge | | | Product | | |
|---|---|---|---|---|---|
| Weight | Iron % | Sulphur % | Weight | Iron % | Sulphur % |
| 124.0 | 36.86 | 1.34 | 81.5 | 54.12 | 1.88 |
| 115.0 | 36.86 | 1.34 | 75.5 | 54.12 | 1.92 |

## Sintering Tests on Calcined 3 Mesh Siderite.

| Mix No. | Charge-Pounds | | | | Thickness of Bed | Time Mins. | Weight of Sinter in Pounds | Weight of Fines in Pounds | Analysis Sinter | | Character of Sinter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Cal. | Coke Breeze | Water | Returned Fine Sinter | | | | | Fe % | S % | |
| 9 | 50 | 2 | 5.2 | - | 4" | 30' | 33 | 16 | 54.12 | 0.29 | Good hard sinter. |
| 10 | 50 | 3 | 5.3 | - | 4" | 30' | 38 | 11.5 | 54.12 | 0.47 | |
| 12 | 65 | 2.6 | 6.8 | 3 | 4.25" | 40' | 49 | 19.0 | - | 0.35 | Sticks to grate. |

## Sintering Tests on Calcined 10 Mesh Siderite.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | 43 | 3.4 | 3.7 | 3.5 | 4" | 38' | 30.0 | 15.5 | 53.32 | 0.54 | Good hard sinter. |