Dr. J Convey

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TEST OF PEAT MOSS FROM RED MILL, P. Q. AS A FOUNDRY SAND CONDITIONER

by

A. E. MURTON

PHYSICAL METALLURGY DIVISION

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SUMMARY OF RESULTS

A sample of peat moss from Red Mill, P. Q. was tested to determine its suitability as a foundry sand conditioner. The results were essentially the same as those obtained with a sample of peat moss from England, which is in commercial use as a foundry sand conditioner.

In comparison with sea coal, peat moss gave better protection against expansion defects such as scabbing and rat-tails, but had inferior peel, and would cause more trouble from casting shrinkage. It could be substituted for sea coal in some operations, but probably best results would be obtained by using both together.

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*Senior Scientific Officer, Ferrous Metals Section, Physical Metallurgy Division, Mines Branch, Department of Mines and Technical Surveys, Ottawa, Canada.

INTRODUCTION

On September 6, 1963, a meeting was held at the Physical Metallurgy Division of the Mines Branch to determine if the facilities of the Mines Branch could be used to evaluate peat moss as a foundry sand conditioner. Present were Mr. James Bradley, Superintendent of Mines, Sherwin-Williams Co. of Canada Ltd., Red Mill, P. Q., and Messrs. Pierre Vachon and Marius Dionne of the Quebec Department of Industry and Commerce. At this meeting it was decided that it would be useful to have the Mines Branch carry out tests to determine whether the Red Mill peat moss was effective enough as a foundry sand conditioner to warrant developing a market for it.

A sample of peat was received from Red Mill, P. Q. on November 14. An additional sample of foundry grade peat was obtained from Carlyle, England, to determine whether the Red Mill peat had similar properties to the peat now used in British foundries.

METHOD OF TESTING

Scabbing Tendency

The peat samples and a sample of Ohio sea coal, were added to sand (Ottawa AFS 62) mixtures bonded with western bentonite. The test batches of sand were each used for ten heats. They were mulled one minute dry and six minutes wet before each use. The initial batch of sand was mulled with western bentonite in a weight ratio of 5 parts to 100 parts of sand. Subsequent bentonite additions were made to produce and maintain a green compressive strength of about 9 psi.

The peat moss samples were added to the new sand on a dry weight basis of 3 parts to 100 parts of sand. The sea coal was added in a ratio of 6 parts to 100 parts of sand. Subsequent additions of peat or sea coal were added to maintain the same gas evolution at 1095°C (2000°F) as

the new sand had.

A test casting developed by the Steel Founders' Society of America was used to evaluate the effectiveness of the additives in preventing the casting defect known as "scabbing". Four castings from each heat were poured. Extra sand was used in the first heat, to ensure that after ten heats there would still be enough sand to make the required four moulds. This extra sand was mixed in after each heat to keep the sand uniform.

The moulds were prepared to produce as closely as possible a mould hardness of 80. They were rammed with a combination of hand ramming and jolt squeezing.

The castings were poured at 1400°C (2552°F) in grey iron with an approximate composition of

Carbon - 3.50
Silicon - 2.45
Manganese - 0.80

Effect of Acidity

Peat is an acid material, and lowers the pH of the sand. Some authorities consider that this effect is harmful, because western bentonites work best at a pH of around 9. To test the effect of the acidity a further test was made on the sample conditioned with the Carlyle peat after it had been used for ten heats. The pH of this sand was increased from 6.3 to 9.2 by the addition of 4.25 lb of soda ash per ton of sand, and the sand used to pour an eleventh set of castings. The results are discussed below.

Prevention of Mould Wall Movement

A troublesome problem which occurs in pouring hypoeutectic iron is mould wall movement, whereby the sand will move to enlarge the mould cavity. This causes the castings to contain shrink holes, because there is not enough metal to fill the mould. Sea coal is helpful in preventing mould wall movement. A bar 2 in. in diameter by $7\frac{1}{2}$ in. long was used to test

this property. The bar was fed by a riser to supply the metal required by the enlargement of the mould wall. The mould was rammed to 88-90 mould hardness. The enlargement of the casting was estimated.

RESULTS

Sand Properties

The moulding properties of the sand mixtures, together with the amounts of bentonite and sand conditioner, are shown in Tables 1, 2 and 3.

Surface Finish

There was no significant difference in the surface finish produced by any of the sand conditioners over the surface finish produced by sand with no conditioner.

Scabbing Tendency

Representative scab block castings from the three test series are shown in Figures 1-6 inclusive. The shrinks on the cope surfaces of these castings are of no significance; the surface of the plate end is important.

It will be seen that peat moss is much more effective than sea coal in reducing scabbing tendency.

Effect of Acidity

The soda ash addition increased the strength of the sand, but it did not have much effect on surface finish. It reduced the slight tendency to scab that the used sand had, but there seemed to be somewhat more erosion.

Mould Wall Movement

Two bars were cast in each test batch of sand. The weights in grams were as follows:

No addition	3005, 2988
Sea coal	2863, 2853
Red Mill peat	2939, 2939
Carlyle peat	2935, 2924

These results indicate that peat is of some benefit in preventing mould wall movement, but sea coal is over twice as effective.

Casting Peel

One purpose of sea coal additions is to promote casting peel. It was very helpful in this respect; small castings cast in sand conditioned with sea coal would not require blasting or tumbling. The sand adhered with no addition or with peat moss, and the castings would have to be cleaned.

Ramming

The sand conditioned with peat moss was much more flowable than the one with sea coal, and rammed up more easily. This should reduce mould erosion and metal penetration, and result in improved surface finish on castings difficult to ram.

Shakeout

The sand conditioned with peat moss had much lower dry strength, which made the castings easier to shake out. The lower dry strength did not cause trouble with erosion on this fairly difficult casting.

DISCUSSION

The two samples of peat moss appeared to behave identically. A comparison of sea coal and peat moss is as follows:

1. Sand conditioned with peat moss is less subject to expansion defects such as scabs and rat-tails.

2. Peat moss is less helpful in preventing mould wall movement than is sea coal. This would result in more shrinkage problems.

3. Sand peel with sea coal is much better. This would sometimes enable the castings to be finished without blasting or tumbling. Peat moss is not helpful in promoting peel.

4. Surface finish is about the same.

5. Flowability with peat moss is much better. This would enable the castings to be rammed much more uniformly, resulting in less penetration and fewer sand erosion defects.

6. The sand conditioned with peat moss requires more moisture. This has no effect on the quality of the castings.

7. Shakeout is better with the peat moss.

8. Although on the initial use the amount of sea coal used on a dry weight basis was about twice as great as for peat moss, the make-up additions were about the same. On a wet basis the initial additions were about the same for the Quebec peat moss as for the sea coal, because the peat moss was wet.

CONCLUSIONS

1. The two samples of peat moss, from England and from Quebec, were of equal value as a foundry sand conditioner.

2. As a replacement for sea coal, peat moss had advantages and disadvantages, as discussed above. Probably it could be used in conjunction with sea coal, to combine the best points of both.

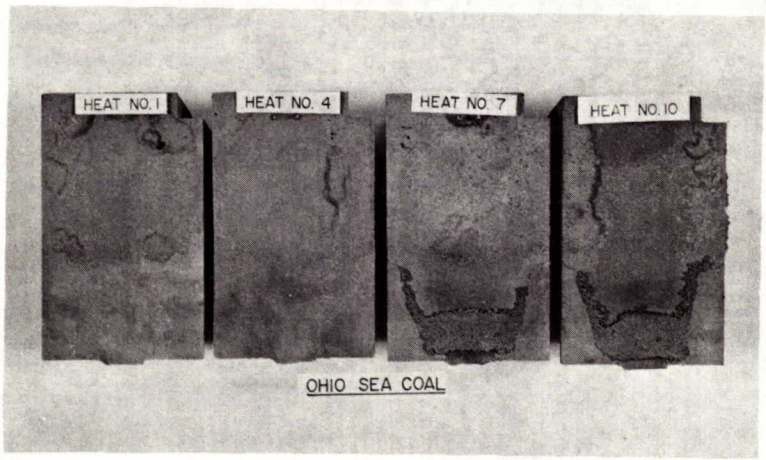

Figure 1 - Sea Coal, Cope Surface

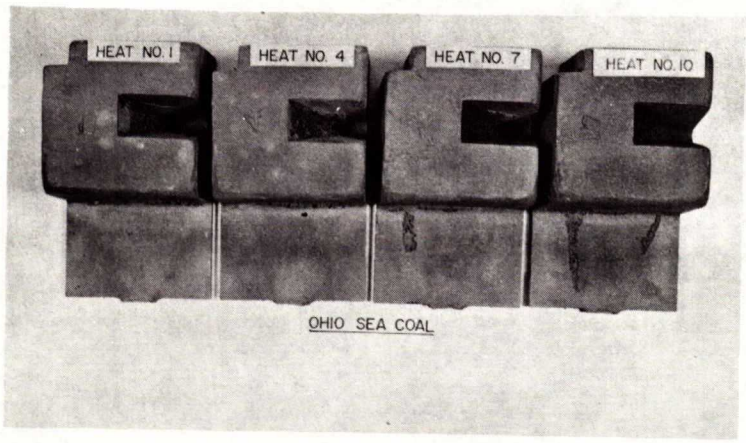

Figure 2 - Sea Coal, Drag Surface

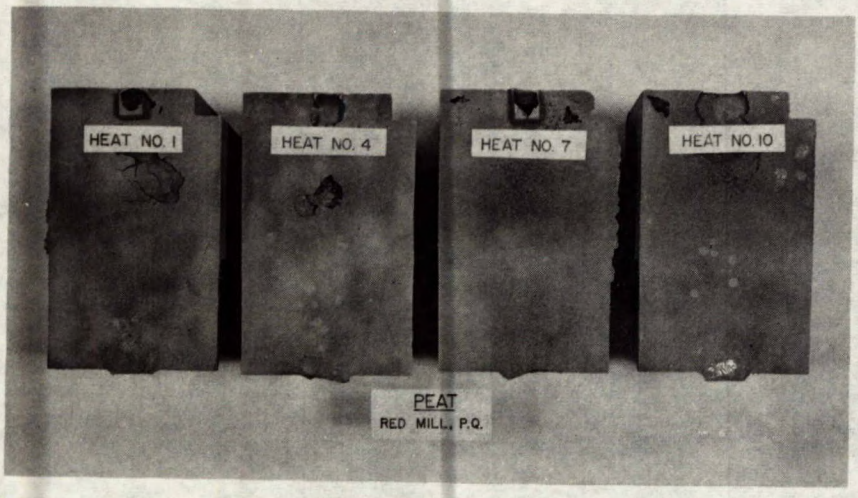

Figure 3 - Quebec Peat Moss, Cope Surface

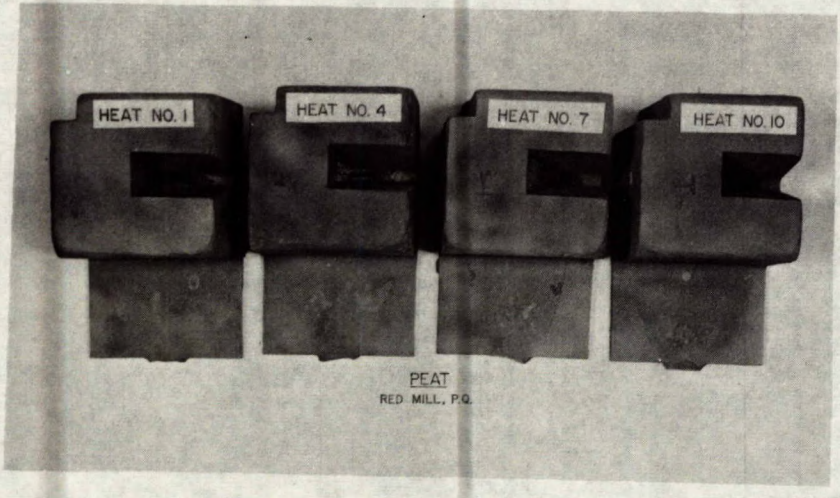

Figure 4 - Quebec Peat Moss, Drag Surface

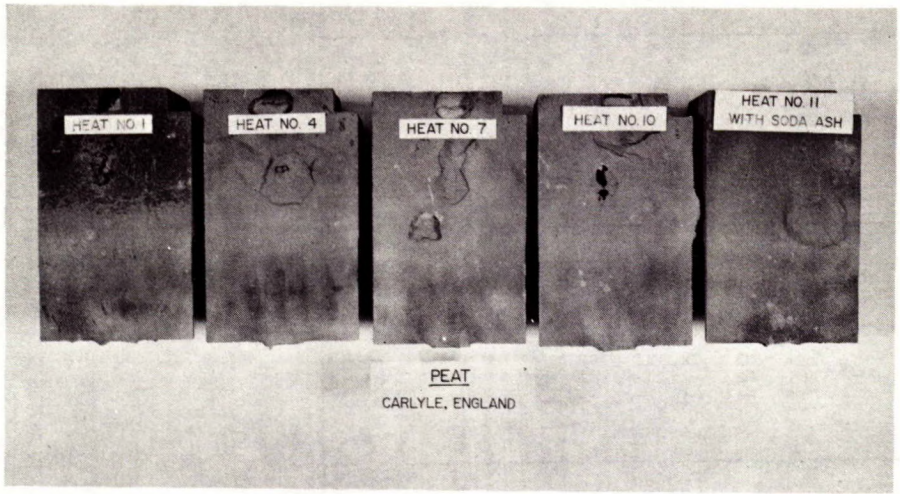

Figure 5 - English Peat Moss, Cope Surface

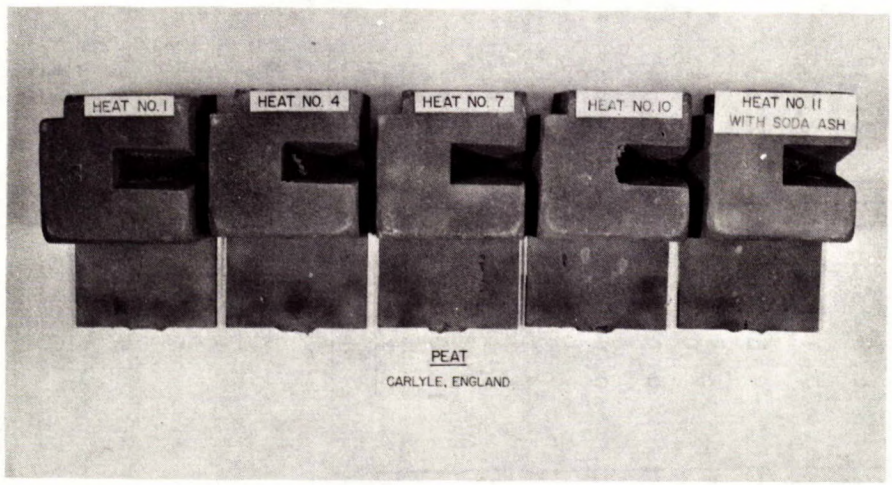

Figure 6 - English Peat Moss, Drag Surface

TABLE 1

Properties of Sand Conditioned with Sea Coal

Heat No.	Moisture, Per Cent	Permeability	Green Compressive Strength, psi	Green Deformation, Per Cent	Green Shear Strength, psi	Dry Compressive Strength, psi	Addition, Pounds (900 pound batch) Bentonite	Sea Coal
1	2.8	119	6.6	2.61	1.8	91	45	54
2	3.2	105	7.3	2.66	2.0	131	5	2.5
3	3.2	111	9.1	2.69	2.0	106	5	-
4	3.3	105	9.0	2.74	2.2	110	-	3.75
5	3.5	105	9.1	2.79	2.5	110	5	3.75
6	3.5	115	9.1	2.57	2.5	101	-	3.75
7	3.5	117	10.3	2.71	2.4	89	5	3.75
8	3.6	102	8.8	2.82	2.5	81	-	5
9	3.3	114	10.0	2.77	2.8	70	5	5
10	3.6	102	9.9	2.75	2.4	80	2.5	5

TABLE 2

Properties of Sand Conditioned with Red Mill Peat Moss

Heat No.	Moisture, Per Cent	Permeability	Green Compressive Strength, psi	Green Deformation, Per Cent	Green Shear Strength, psi	Dry Compressive Strength, psi	Addition, Pounds (900 pound batch) Bentonite	Peat Moss
1	4.5	102	6.1	3.05	1.8	41	45	2.7
2	4.5	93	11.2	2.80	2.9	36	5	2.45
3	4.4	96	9.9	2.89	2.5	50	-	3.15
4	4.4	102	10.5	2.64	2.7	65	5	3.15
5	4.7	90	8.2	3.45	2.5	74	-	2.45
6	4.6	100	9.3	3.00	2.5	49	5	3.15
7	4.8	102	10.4	3.25	2.5	56	2.5	3.15
8	4.9	94	7.8	3.00	2.1	70	-	3.15
9	5.2	97	9.3	3.35	2.6	88	5	3.15
10	5.2	104	10.8	3.11	3.0	70	2.5	3.15

TABLE 3

Properties of Sand Conditioned with Carlyle Peat Moss

Heat No.	Moisture, Per Cent	Permeability	Green Compressive Strength, psi	Green Deformation, Per Cent	Green Shear Strength, psi	Dry Compressive Strength, psi	Addition, Pounds (900 pound batch) Bentonite	Peat Moss
1	4.3	91	6.5	3.60	1.6	25	45	2.7
2	4.5	97	8.1	3.30	2.1	35	5	4.5
3	4.4	101	9.2	3.30	2.2	39	5	3.5
4	4.4	100	9.1	3.19	2.2	41	-	2.5
5	4.2	102	10.5	2.65	2.5	39	5	3.15
6	4.3	102	9.7	2.82	2.4	42	-	3.15
7	4.4	109	7.3	3.25	1.9	38	-	2.35
8	4.4	102	9.6	2.76	2.3	48	5	3.15
9	4.6	102	10.5	2.83	2.6	53	5	3.15
10	4.6	92	9.2	3.05	2.3	51	-	2.35
11	4.6	102	12.7	2.85	3.4	43	5	3.15