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HOT PROPERTIES OF TEST SAND MIXTURES

by

A. E. MURTON

PHYSICAL METALLURGY DIVISION

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SUMMARY OF RESULTS

The hot properties of four test sand mixtures were tested. Expansion, hot strength, and hot deformation were measured at 1500°F, 2000°F, and 2500°F. Mixtures containing Truline and wood flour had the lowest expansion and the most plastic fractures.

The test conditions do not duplicate those which occur in the mould, and no firm conclusion as to the relative merits of the mixtures should be made before they are tested under foundry conditions.

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

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(1 Table; 4 illustrations)

INTRODUCTION

On November 10, 1958, a letter was received from Mr. C. O. Gerbrandt, J. R. Short Canadian Mills Ltd., requesting tests to determine the hot properties of some test sand mixtures.

The mixtures to be tested were:

Ottawa 50-70 test sand	3600 gm
silica flour	600 gm
western bentonite	150 gm
Ceratex or Truline	60 gm
wood flour	30 gm
water	360 gm

In addition to the above two mixtures, a mixture was made containing Ceratex without wood flour, and one containing Truline without wood flour.

In this report the mixtures are numbered as follows:

1. Ceratex, no wood flour.
2. Ceratex with wood flour.
3. Truline, no wood flour.
4. Truline with wood flour.

ROOM TEMPERATURE PROPERTIES

Mixture Number	1	2	3	4
Moisture	7.2	6.8	7.0	7.2
Permeability	63	65	65	52
Green compressive strength, psi	7.9	7.7	5.4	6.6
Overhang) High jolt	no break	no break	31	58
) Low jolt	no break	no break	114	no break
Sag at 100 low jolts	0.008"	0.008"	0.018"	0.015"

ROOM TEMPERATURE PROPERTIES (Cont'd.)

	1	2	3	4
Air-set compressive strength, psi				
After 60 min.	10.3	11.2	7.8	9.8
After 90 min.	11.0	12.2	8.3	10.9
After 120 min.	14.3	14.6	9.7	13.1
Green Hardness				
After 60 min.	93	90	90	90
After 90 min.	95	93	94	94
After 120 min.	96	95	95	96
Baked tensile strength, psi				
450°F - 60 min.	116.5	61.5	118.0	-
90 min.	163.5	81.5	132.5	-
120 min.	159.5	64.0	135.5	-

HOT PROPERTIES

Expansion, in. per in.				
1500°F	0.0148	0.0132	0.0125	0.0134
2000°F	0.0170	0.0156	0.0149	0.0145
2500°F	0.0191	0.0179	0.0174	0.0161

Hot Strength and Deformation

The hot strength and deformation were measured after the specimens were given a 12 minute soak at temperature. Strength-deformation curves were drawn from data recorded on a Robot 35 mm camera. These curves are shown in Figures 1-4 inclusive.

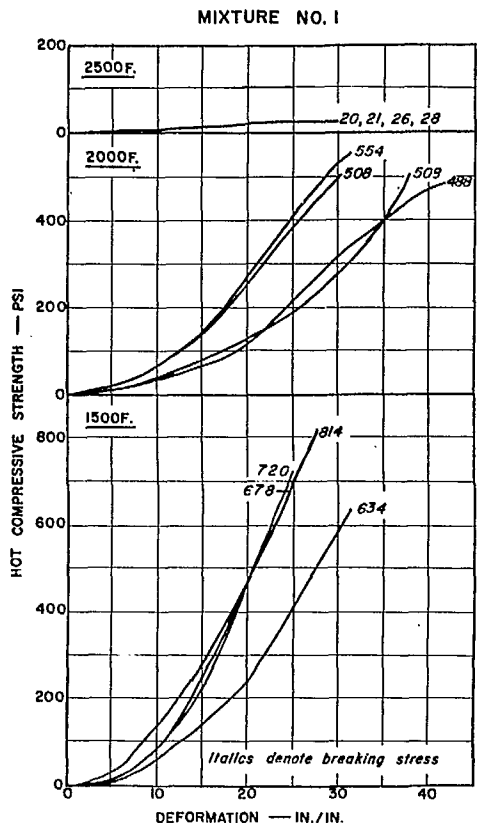

Figure 1. - Stress-Strain Curves - Mixture No. 1

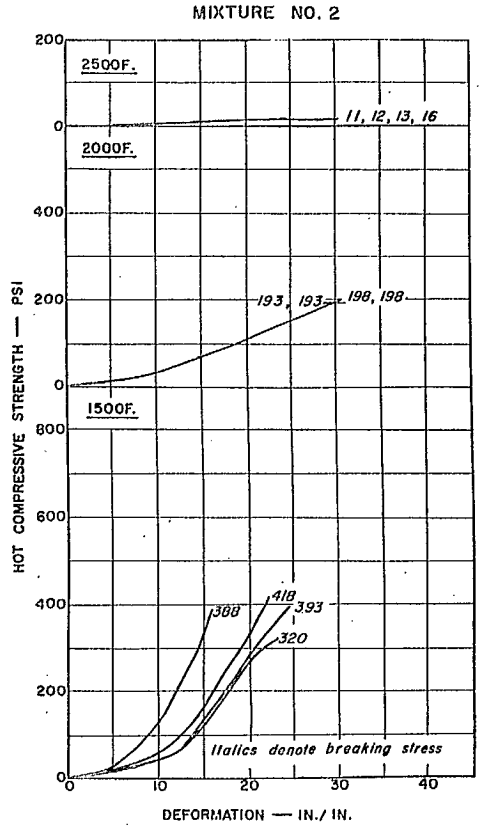

Figure 2. - Stress-Strain Curves - Mixture No. 2

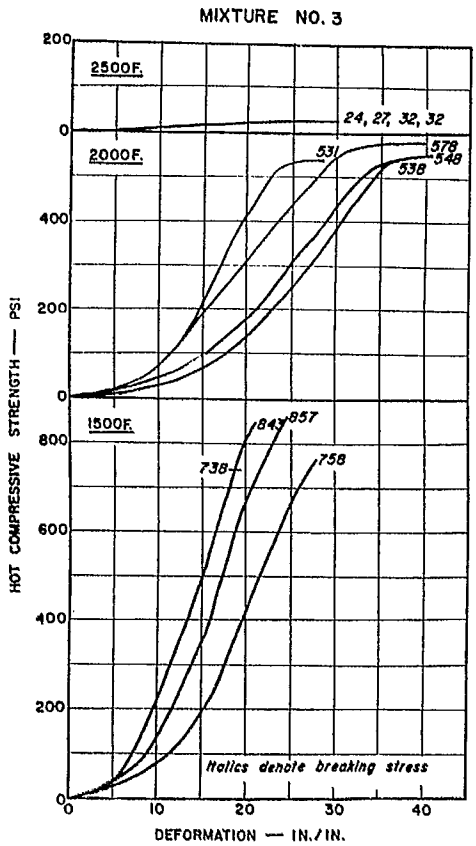

Figure 3. - Stress-Strain Curves - Mixture No. 3

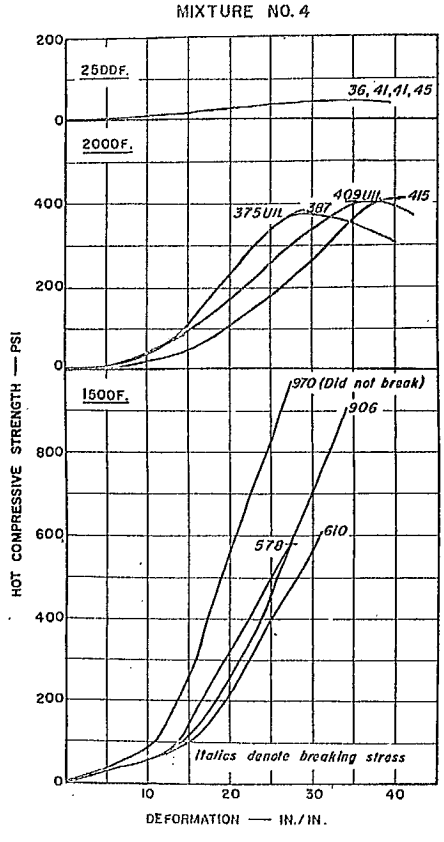

Figure 4. - Stress-Strain Curves - Mixture No. 4

DISCUSSION

The results of the expansion tests showed that the mixture containing both Truline and wood flour had the least expansion. Truline alone, Ceretex and wood flour, and Ceretex alone followed in that order.

The results of the hot strength tests are more difficult to interpret. There is little difference in the performance of the four mixtures at 2500°F. At 1500°F they all seem to be brittle, and the chief difference appears to be in the lower strength of the sample containing wood flour and Ceretex.

The main differences in the mixtures were seen in the strength-deformation tests at 2000°F. Observations at 2000°F were:

1. Mixtures containing Ceretex alone and Ceretex and wood flour had the most brittle fracture.
2. The mixture containing Ceretex and wood flour gave the most consistent results.
3. The mixture containing Truline and wood flour had the most plastic fracture.
4. The mixture containing Truline alone had a somewhat plastic fracture.

It should be remembered that the test conditions (12 minute soak at temperature) do not at all resemble those which occur in the mould. As pointed out by J. L. Evans and J. White - "Effect of Heat on Moulding Materials", British Foundryman, Vol. 51, No. 12, 615, (Dec. 1958), the peak strengths which occur in sands containing bentonite

on slow heating may be of little practical significance. W. B. Parkes and R. G. Godding - "Behaviour of Moulding Sands at High Temperatures", Proc. Inst. of Brit. Foundryman, 1955, Vol. 48, p.A187, in tests in which they heated sands rapidly with dielectric heating found no indication of a peak temperature for hot strength. The peak strengths which occur on slow heating appear to be associated with the formation of a liquid phase in the sand-bentonite mixture.

CONCLUSION

On the basis of these tests the mixtures containing both Truline and wood flour have the best hot strength properties. However, no firm conclusion should be drawn without actual foundry tests of sand mixtures.

AEM/KW