

# FILE COPY

O T T A W A

January 17, 1945.

## R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1777.

Examination of Dominion Magnesium Limited  
Alloy Steel Retort No. C-995.

=====



O T T A W A

January 17, 1945.

R E P O R T  
of the  
ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1777.

Examination of Dominion Magnesium Limited  
Alloy Steel Retort No. C-995.

=====

Origin of Request and Object of Investigation:

On October 26, 1944, a sample taken from Retort No. C-995 was submitted to these Laboratories by Dominion Magnesium Limited, Haley, Ontario. Their letter of October 25, requesting an examination to determine the cause of early failure, gave the following data on this retort:

History of Retort -

<u>Retort</u> <u>No.</u>	<u>Alloy</u>	<u>Wall Thickness,</u> <u>inches</u>	<u>Blowups</u>	<u>Life, in</u> <u>days</u>
C-995	35-15	1	5	97

Shawinigan Analysis -

<u>Carbon</u>	<u>Manganese</u>	<u>Silicon</u>	<u>Nickel</u> <u>- Per Cent -</u>	<u>Chromium</u>	<u>Molybdenum</u>	<u>Copper</u>
0.13	0.64	0.29	40.09	18.23	0.23	Neg.



Visual Observation:

The outside and inside surfaces of the sample submitted are shown in Figures 1 and 2.

A cross-section was prepared and this is shown in Figure 3.

These figures are all about half size.

The retort wall, at the spot where this section was taken, was only about  $\frac{1}{8}$  inch thick.

There was a heavy scale deposited on the inside surface. The part of this scale immediately adjacent to the metal was a metallic grey in colour and was magnetic.

Chemical Analysis:

Samples of the retort metal and the scale on the inside surface were obtained for chemical analysis. The results are given in Table I.

TABLE I. - Chemical Analysis.

	<u>Metal</u>	<u>Scale</u>
	- Per Cent -	
Carbon	0.03	-
Silicon	-	2.00
Manganese	0.51	-
Nickel	38.75	9.15
Chromium	16.65	5.44
Molybdenum	0.10	-
Iron	-	11.23
Magnesium	-	31.72
Calcium	-	4.85
Copper	-	0.05

Microscopic Examination:

A cross-section adjacent to the failure was prepared for microscopic examination. Figure 4 is a photomicrograph of the structure of the metal adjacent to the inner surface of the retort. It will be noted that carbides are present in the metal immediately below this surface. The section has been decarburized through almost the entire thickness. Note, also, the unevenness of this surface.



Discussion of Results:

A comparison of the Shawinigan analysis with that for the metal, in Table I, indicates that the metal has been decarburized, which is a normal condition after service. The photomicrograph in Figure 4 indicates that none of this decarburization occurred on the inside surface of the retort but, as in the case of all previous retorts examined, proceeded from the outside surface. The presence of a magnetic scale containing chromium, iron and nickel on the inside of the retort indicates that there is some corrosive action taking place on the inside surface, apparently resulting in the formation of magnetic oxides.

Conclusions:

The examination shows that in certain localized spots the retort walls become thin and that there is a magnetic deposit, presumably an oxide, containing iron, nickel and chromium, at these areas. The attack is, therefore, not general but rather a localized one. It has been suggested that oxides present were trapped in the centrifugal casting, but non-surface oxide zones would be expected to be present if this explanation were correct. No such areas were found but at the present time no alternative explanation of the presence of the oxide can be advanced.

oooooooooooo  
ooooo  
o

HVK:GHB.



Figure 1.



PHOTOGRAPH SHOWING  
OUTSIDE SURFACE OF  
RETORT SAMPLE.

(Approximately  $\frac{1}{2}$  actual size).

Figure 2.



PHOTOGRAPH SHOWING  
INSIDE SURFACE OF  
RETORT SAMPLE.

(Approximately  $\frac{1}{2}$  actual size).

Figure 3.

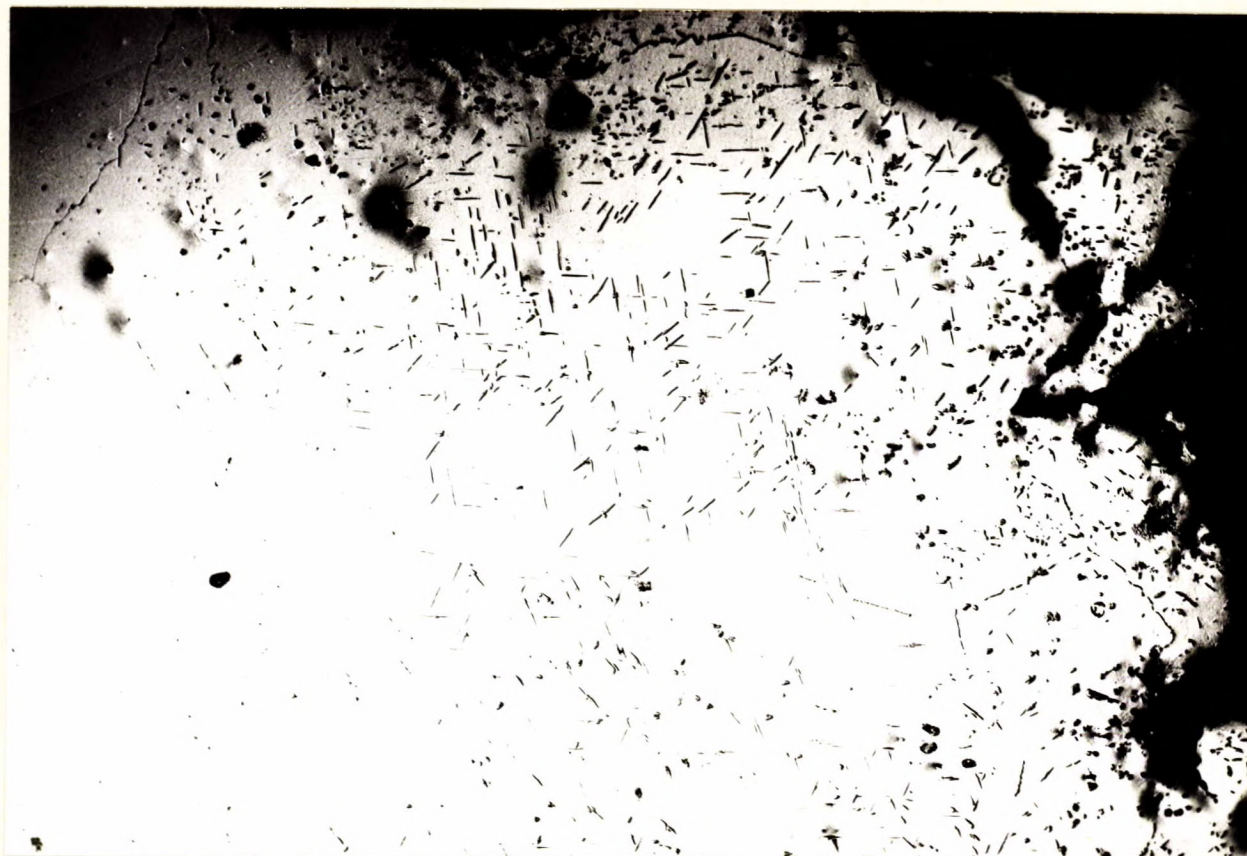


PHOTOGRAPH SHOWING CROSS-SECTION  
OF RETORT SAMPLE.

(Approximately  $\frac{1}{2}$  actual size).



Figure 4.



X100.

PHOTOMICROGRAPH SHOWING STRUCTURE AT  
INSIDE SURFACE OF RETORT SAMPLE.

Note distribution of carbide.

—

HVK:GHB.