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O T T A W A March 13, 1945.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1812.

Cause of Dark Streaks on Certain Types of
Magnesium Alloys after Anodizing to
Improve Corrosion Resistance.

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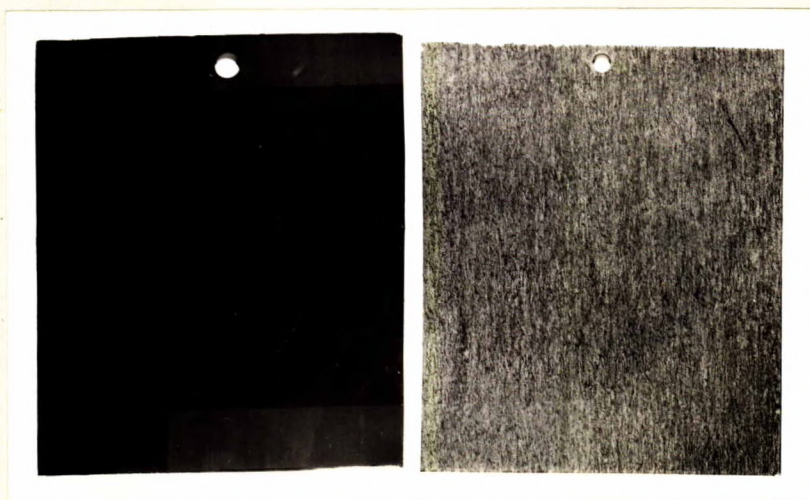
Origin and Object of Request:

In connection with the work which is being done in these Laboratories on protective coatings for magnesium and its alloys, an anodizing treatment in sodium hydroxide solution was investigated. It was found that the #8 alloy sheet of Dominion Magnesium Limited was covered with dark streaks after the anodizing treatment (see Figure 1b) whereas that from certain other sources was uniform in colour (see Figure 1a). This matter was brought to the attention of Dominion Magnesium Limited and they requested that the matter be thoroughly investigated.

(Continued on next page)

(Origin and Object of Request, cont'd) -

Figure 1.



(a)

(b)

SAMPLES OF #8 ALLOY SHEET ANODIZED AND SEALED.

- (a) Sheet produced by the Dow Chemical Company.
- (b) Sheet produced by Dominion Magnesium Limited.

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Tests Performed:

I.

Magnesium alloys from different sources and pure magnesium from Dominion Magnesium Limited were anodized and sealed and the presence or absence of the dark streaks noted.

Anodizing Procedure:

Electrolyte - 5 per cent aqueous solution of sodium hydroxide.
Temperature - 140-158° F.
Current Density - 18 amperes per square foot.
Treatment Time - 20-30 minutes.

Sealing Procedure:

Bath - 5 per cent aqueous solution of sodium chromate.
Temperature - 170-180° F.
Treatment Time - 30 minutes.

(Continued on next page)

(Series I, cont'd) -

Results:		:Streaks :	Streaks
Type of Metal		:Present :	Absent
Alcan #18 alloy.	-		X
Dominion #18 alloy.	-		X
Dow #18 alloy.	-		X
Dominion #8 alloy, Sheet #1. Rolling direction vertical in anodizing bath.	-	X	
Dominion #8 alloy, Sheet #2, Rolling direction vertical in anodizing bath.	-	X	
Dominion #8 alloy, Sheet #2, Rolling direction horizontal in anodizing bath.	-	X	
Dow #8 alloy.	-		X
Dominion #8 alloy, rolled.	-	X	
Dominion #11 alloy.	-	No streaks but surface was rough before anodizing and anodizing did not improve it.	
Pure magnesium (Dominion).	-		X

From the above table the conclusion will be drawn that the streaks were present in the Dominion Magnesium #8 alloy but not in any of the others, including Dow #8 alloy.

II.

In an attempt to determine the reason why streaks appeared in the Dominion Magnesium alloy #8 but not in the Dow alloy #8, a microscopic examination was made of the two materials. In both materials particles of manganese (either free or in combination) were found to occur in small segregations. These were scattered rather uniformly throughout the Dominion material but seemed to be more highly concentrated near the centre than near the surface in the case of the Dow material. It seemed apparent

(Series II, cont'd) -

that these segregations were the cause of the streaks which appeared in the material from Dominion Magnesium Limited after anodizing.

III.

As a confirmatory test, the following spectrographic analyses were made:

- (a) Dark streaks and a light area on the anodized Dominion Magnesium #8 sheet were analysed for manganese.

Result:

Area	:	Manganese, per cent
Light area	-	0.26
Dark streak #1	-	0.34
Dark streak #2	-	0.75
Dark streak #3	-	0.58

- (b) Dow #8 sheet was machined so that one end of the sample was in the form of a wedge.

Result:

Position of Area Tested	:	Manganese, per cent
Surface of sheet - #1 area	-	0.23
" " " - #2 "	-	0.24
" " " - #3 "	-	0.25
Near surface of sheet - #1 area	-	0.26
" " " - #2 "	-	0.20
Near centre of sheet - #1 "	-	0.17
" " " - #2 "	-	0.20
Centre of sheet - #1 area	-	0.54
" " " - #2 "	-	0.70

Conclusions:

1. The dark streaks observed on the anodized Dominion Magnesium #8 alloy sheet are due to manganese segregations, which are rather uniformly distributed throughout the sheet.

2. The dark streaks do not appear on the Dow #8 alloy sheet because the manganese is concentrated towards the centre

(Conclusions, cont'd) -

of the sheet in that material.

3. The dark streaks do not appear on the Dominion Magnesium #18 alloy or on pure magnesium. The Dominion Magnesium #11 alloy was not entirely clean before entering the anodizing bath. The anodizing treatment did not seem to make it any worse.

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