NAVAL AIR DEVELOPMENT CENTER

WARMINSTER, PA. 18974

REPORT NO. NADC-72159-VT 30 AUG 1972

EVALUATION OF CORROSION INHIBITING PIGMENTS FOR ALUMINUM

PHASE REPORT

AIRTASK WF51543202
Work Unit D

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S U M M A R Y

INTRODUCTION

The purpose of this investigation which was performed under AIRTASK number WF51543202, Work Unit D, was to screen various inhibitors for their corrosion protection of aluminum alloys. Some of these inhibitors were evaluated because of their alleged protection of steel. A secondary objective was to find what type of chemicals or pigments afford protection for aluminum.

SUMMARY OF RESULTS

The use of inhibitors having some solubility of hexavalent chromium in the salt solution, as evidenced by the characteristic chromate ion color, resulted in very little weight loss of the aluminum coupon, and very little visible corrosion.

Materials which are insoluble in the salt solution permitted high weight losses and severe visual corrosion.

There was excellent correlation between weight losses of the aluminum coupons and their visible corrosion.

CONCLUSIONS

Pigments or chemicals which contain water soluble chromates afford the best corrosion protection for aluminum alloy. Likewise water soluble compounds such as potassium permanganate, which is also a strong oxidizing agent and deposits insoluble manganese dioxide on the aluminum surface is also satisfactory.

In screening materials for their corrosion protection of aluminum, the weight loss of the coupon plus its visual examination for corrosion is a satisfactory technique for selecting materials which will subsequently be compounded into a paint and further evaluated.

Inhibitive pigments which may be satisfactory for steel are not necessarily good inhibitors for aluminum.

RECOMMENDATIONS

a. Zinc and strontium chromates, combining as they do low cost with adequately controlled water solubility, be the only chromate pigments used for the protection of aluminum alloys.

b. The technique of immersing an aluminum coupon into a 5% salt solution containing the inhibitor, be adopted as a standard screening test because of its good correlation with more sophisticated tests.

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EVALUATION AND DISCUSSION

BACKGROUND

The fastener areas, edges of seams, areas where the paint has flaked and other bare aluminum areas on naval aircraft are corrosion prone because they are frequently in contact with salt water as well as sulfur dioxide and particulate matter from smoke stackes. The purpose of this assignment was to screen various inhibitors, some of which are used to protect steel. If the screening test showed other commercially available pigments to be equal or superior to the presently used strontium chromate, then appropriate primers would be made and further evaluated.

DEVELOPMENT OF METHODS AND RESULTS

Coupons, 2 in. X 2 in. X .020 in. were cut from 7075T6 aluminum alloy. The coupons were cleaned with acetone, weighed and suspended with a string in a glass jar containing 5% sodium chloride solution and 0.10% of the inhibitor and capped. The coupons were suspended in the inhibitor/salt solution for 21 days. They were then removed, rinsed in distilled water, dried and weighed. The coupons were examined visually for corrosion.

Table I lists the inhibitors, weight loss and appearance of the coupons after immersion in the salt solution. Figures I to III are photographs of the suspended specimens.

TABLE I

CORROSION EVALUATION OF VARIOUS INHIBITORS
IMMERSED IN 5% SALT SOLUTION FOR 21 DAYS

INHIBITOR, 0.10% (1,000 PPM)	AVERAGE WEIGHT (Gain or Loss)	APPEARANCE
Strontium Chromate	- 2.0 Mg.	No corrosion
Strontium Molybdate	- 33.1 Mg.	Severe corrosion
Zinc Molybdate	- 4.7 Mg.	Moderate corrosion
Zinc Phosphate	- 17.9 Mg.	Severe corrosion
Aluminum Phosphate	- 37.1 Mg.	Severe corrosion
Potassium Chromate	- 1.3 Mg.	No corrosion
Potassium Permanganate	- 3.9 Mg.	Slight corrosion
Chromium Chromate	+ 2.5 Mg.	Slight corrosion
Cadmium Phosphate Chromate	+ 4.5 Mg.	Slight corrosion

Figure 1. - 7075-Aluminum Alloy Specimen Suspended in 5% Salt Solution Containing 0.1% Inhibitor

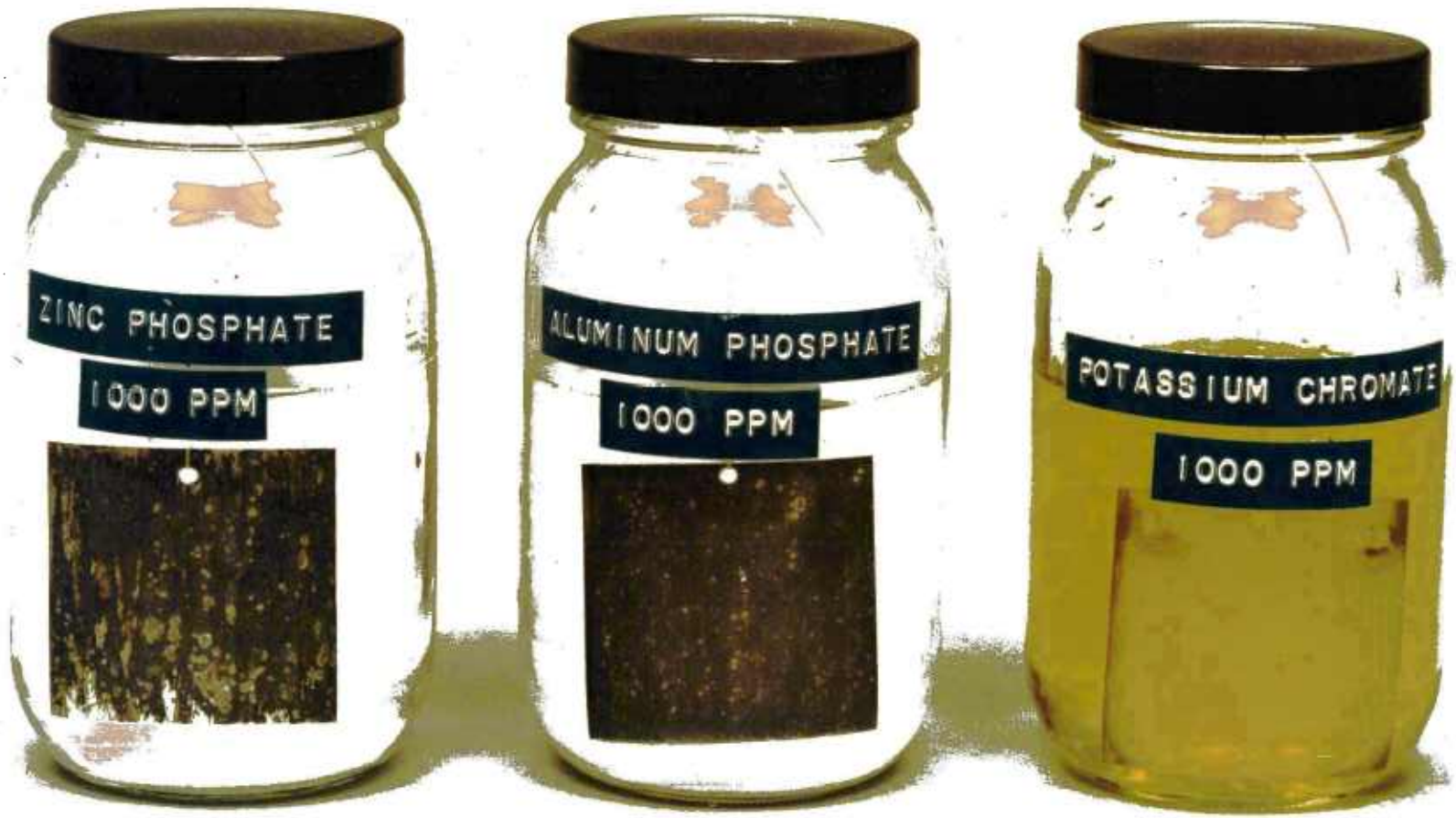

Figure 2. - 7075-Aluminum Alloy Specimen Suspended in 5% Salt Solution Containing 0.1% Inhibitor

Figure 3. - 7075-Aluminum Alloy Specimen Suspended in 5% Salt Solution Containing 0.1% Inhibitor

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
Naval Air Development Center
Air Vehicle Technology Department
Warminster, Pennsylvania 18974

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b. GROUP

3. REPORT TITLE

EVALUATION OF CORROSION INHIBITING PIGMENTS FOR ALUMINUM

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
PHASE

5. AUTHOR(S) (First name, middle initial, last name)
WILLIAM C. MARSHALL

6. REPORT DATE
30 AUGUST 1972

7a. TOTAL NO. OF PAGES
9

7b. NO. OF REFS
0

8a. CONTRACT OR GRANT NO.
AIRTASK WF51543202

b. PROJECT NO. Work Unit D

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
NADC-72159-VT

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES

12. SPONSORING MILITARY ACTIVITY
Naval Air Systems Command
Washington, D.C. 20360

13. ABSTRACT

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Corrosion						
Inhibitor						
Hexavalent Chromium						
Corrosion Protection						
Aluminum Alloy						

D I S T R I B U T I O N L I S T

REPORT NO. NADC-72159-VT

AIRTASK WF51543202
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