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3,687,740

HEAT RESISTANT CHROMATE
CONVERSION COATINGS

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No Drawing. Continuation of abandoned application Ser. No. 799,973, Feb. 17, 1969. This application Jan. 22, 1971, Ser. No. 109,055

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4 Claims

ABSTRACT OF THE DISCLOSURE

Methods are described for preventing adverse effect of heat on the salt spray corrosion resistance of chemical chromate conversion coated zinc or aluminum specimens by simply immersing the specimens for a period of about 1 to 3 minutes in a solution of sodium silicate, barium nitrate, or glycerine. The silicates and nitrates are rinsed off after the immersion step and then drain dried whereas the specimens immersed in the glycerine solution are merely drain dried after the immersion step.

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aluminum specimens to temperatures as low as 50° C. may have adverse effects, whereas temperatures approaching 150° C. or higher can result in virtually complete loss of the ability of the specimens to resist salt spray corrosion.

Chromated zinc or aluminum components of military equipment are often necessarily subjected to heat during fabrication, storage, shipment or use. It is of vital importance, therefore, that such equipment used by the military be made resistant to the damaging effects of heat and salt spray.

Accordingly, a broad object of this invention is to provide methods for fabricating improved protective coatings.

Another object of the invention is to provide chemical chromate conversion coated zinc or aluminum having superior elevated temperature corrosion resistance.

A further object of the invention is to provide such a coating on zinc or aluminum which is characterized by ease and economy of fabrication.

Other objects of the invention will in part be obvious and in part appear hereinafter in the following detailed description.

In accordance with the objects aforementioned, chromated zinc and aluminum were first prepared as shown in Table I below:

TABLE I.—PREPARATION OF CHROMATE ZINC AND ALUMINUM SPECIMENS

Metal	Cleaning	Chromating	Draining and rinsing
Zinc electroplated from cyanide bath on mild steel panels (10×15 cm.).	None. Used directly after rinsing.	Immersed 20 sec. in solution of sodium dichromate, 200 g./l., sulfuric acid (sp. gr. 1.84), 6 ml./l., 25° C., pH 0.8.	Drained for 5 sec.; rinsed in flowing water at 25° C. for 50 sec.
Aluminum 2024-T3 panels (10×15 cm.).	Degreased; caustic etched 30 sec. at 70° C.; rinsed; desmutted in 50% by vol. HNO ₃ (sp. gr. 1.42); rinsed.	Immersed 5 min. in solution of chromic anhydride, 5 g./l., potassium ferri-cyanide, 1 g./l., barium nitrate, 1.9 g./l., sodium fluosilicate, 1.35 g./l., 25° C., pH 1.5.	

Reference is hereby made to patent application Ser. No. 799,973, of Fred Pearlstein et al., for "Heat Resistant Chromate Conversion Coatings," filed Feb. 17, 1969, abandoned in favor of streamlined continuation application of Fred Pearlstein et al., Ser. No. 109,055, filed Jan. 22, 1971, for "Heat Resistant Chromate Conversion Coatings," and assigned to the same assignee of this patent application.

The invention described herein may be manufactured, used and licensed by or for the Government for governmental purposes without the payment to us of any royalties thereon.

This invention relates to protective coating compositions and more particularly concerns chemical chromate conversion coatings of zinc or aluminum which have superior corrosion resistance at elevated temperatures.

Exposure to heat of either zinc or aluminum, which have been chemically chromate conversion coated, can result in a decrease in their ability to resist corrosion. It has been observed that heating these coated zinc or

While still wet from the water rinse, the chromated metals were immersed into one of the following solutions:

(1) 5 ml./l. sodium silicate solution

(Sp. gr. 1.38; SiO₂:Na₂O=3.22)

for three min.; thoroughly water rinsed; drain dried; aged 66 hr. Effective range of sodium silicate is about 1 to 10 ml./l. The sodium silicate is not limited to one having physical properties above-described.

(2) 50 g./l. barium nitrate for three min.; thoroughly water rinsed; drain dried; aged 66 hr. Effective range of barium nitrate is about 25 to 60 g./l.

(3) 100 ml./l. glycerin for one min.; no rinse; drain dried; aged 66 hr. Effective range of glycerin is about 20 to 500 ml./l.

The treated specimens, in triplicate, were heated 2 hours at 100 or 200° C. (see Table II), and along with unheated specimens, were exposed to five percent neutral salt spray (Federal Test Method Standard, No. 151B, dated Nov. 24, 1967). The results of the salt spray corrosion tests after 96 hours exposure are shown in Table II.

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The silicate and nitrate solutions should be rinsed from the chromated metals to prevent adverse reaction therebetween. On the other hand, the glycerine must not be rinsed and is needed to impart corrosion resistance to the chromated metals at elevated temperatures.

TABLE II.—CORROSION RESISTANCE OF CHROMATED ZINC AND ALUMINUM MODIFIED BY SOLUTION IMMERSION POST-TREATMENT

Post treatment	Immersion time, min.	Corrosion rating ¹ after 96 hr. salt spray exposure (avg. of 3), white salts					
		Unheated		2 hr. at 100° C.		2 hr. at 200° C.	
		Zn	Al	Zn	Al	Zn	Al
None		5	5	3½	3½	0	1
5 ml./l. sodium silicate	3	4	5	3	5	2½	2
50 g./l. barium nitrate	3	4½	5	4	5	3	3½
100 ml./l. glycerin	1	5	5	5	5	3	5

¹ Corrosion ratings: 5, no corrosion, 4, traces of corrosion, 3, slight corrosion, 2, marked corrosion, 1, considerable corrosion, 0, severe corrosion.

As can be seen from the above table, the immersion treatment of freshly chromated zinc in any of the solutions tested generally improved the corrosion resistance of specimens subjected to heat. However, there was slight reduction of the corrosion resistance of unheated specimens as the result of the modifying post treatment with either sodium silicate or barium nitrate solutions.

Chromated aluminum, modified by the immersion treatments, and subjected to heating was also superior to unmodified chromated panels. The silicate treatment appeared beneficial to specimens heated at only 100° C. but provided little improvement as a result of heating at 200° C. The treatment of chromated aluminum in barium nitrate or glycerin solutions largely prevented the adverse effect of heat on corrosion resistance. The chromate films which were glycerin treated but not rinsed were especially effective, providing complete retention of corrosion resistance although having been heated at 200° C.

We claim:

1. A process for preventing adverse effect of elevated temperatures on salt spray corrosion resistance to chemical chromate conversion coated zinc or aluminum specimens comprising

rinsing said chemical chromate conversion coated specimens in water,

immersing said rinsed specimens while still wet from

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said water rinse in a solution of barium nitrate, and thoroughly rinsing said immersed specimens, said barium nitrate having a concentration ranging between about 25 to 60 g./l.

2. The process as described in claim 1 wherein said

elevated temperatures range between about 50° C. to 200° C.

3. The process as described in claim 1 further characterized by the steps of drain drying the immersed rinsed specimens, and aging the dried specimens for a period of about three days.

4. The process as described in claim 1 wherein said specimens are immersed in said barium nitrate solution for about 3 minutes.

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