DUH-132

OP-59 Revised

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PROJECT 9536

700
Materials - Corrosion

Those Eligible to Read the Attached

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Classification Cancelled (Change to DECLASSIFIED)

By Authority of *H F Carroll*, *DMORE 1-17-56*

By *J. Hoke 4-3-56*

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Route List

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Date 6-7-44

Subject Corrosion Inhibitors for Aluminum

To *C.P.* Kidder

From *H.* Worthington

[redacted] C. P. Kidder

[redacted]

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EXPLOSIVES DEPARTMENT - TNX

1 & 2 - C. P. Kidder
3 - W. O. Simon
4 - W. O. Simon
5 - R. M. Evans - J. N. Tilley
6 - File 1 (CHG, GDG, RW)
7 - File 2 (GDG, Technical)
8 - W. E. Kirst
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10 - H. Worthington
11 - Chronological

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C. P. Kidder, (2)
P. O. Box 100
Richland, Washington

June 7, 1944

CORROSION INHIBITORS FOR ALUMINUM

We are summarizing below the results of a discussion with Dr. G. D. Patterson on the subject of corrosion inhibitors for aluminum. This discussion took place June 6, 1944.

Patterson's first reaction to the statement of the problem was that chromate and nitrite are the only common inhibitors for the corrosion of aluminum and that our knowledge of nitrite is relatively scanty because of its newness in the field. It was his impression that the protective chromium film depends upon the presence of hexavalent chromium for its effectiveness, and that in a flowing system the chromium film has to be continuously re-formed. You will note that there appears to be a difference of opinion as to the composition of the protective chromium film, inasmuch as others have ascribed the effectiveness of chromium to its reduction to the trivalent form in the film. If Sloan should make another expedition to the University of Washington to look up the literature on corrosion inhibitors, he might make a special effort to cover the literature on the subject of the composition of this film. I will also discuss this subject with Dr. R. B. Mears.

Patterson suggested the addition of a precipitant for trivalent chromium but had no specific agent to suggest.

Work done at the Experimental Station on antifouling paints for boats with aluminum hulls gave a number of leads. In a series of tests in distilled water in the presence of mercury salts, the following agents in addition to chromates were found effective: potassium antimonate, sodium nitrite, sodium perchlorate, and, to a less extent, sodium cobaltinitrite. When the distilled water was replaced with sea water, only the chromates and potassium permanganate were found effective. Potassium permanganate was not especially effective in distilled water.

The Chemical Department prepared a search of the patent literature on protective coatings for metals a few years ago. From the U.S. patents dealing with the protection of aluminum, the following possibilities were drawn:

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C. P. Kidder #2 [redacted] 6/7/44

Sodium fluosilicate with nickel or cobalt sulfate, nitrate, or chloride, and sodium, potassium, or ammonium nitrate.

Sodium carbonate plus an alkali salt of the highest oxide of metals which can form at least 2 oxides such as V, Mo, Ti, W, U, Cb, Mn, Cr.

1.5% of an alkali salt of phosphochromic acid plus 1.5% of an alkali salt of sulphomolybdic acid plus 0.5% of sodium or potassium orthophosphate plus 1.5% sodium or potassium tartrate.

Potassium titanium double fluoride with chromium fluoride and sodium fluoride.

0.1% of a sodium salt of a fatty ester sulfate, a fatty acid sulfate, a fatty oxysulfate, or a sulfonated vegetable oil. (U.S. Patent 2113453). Patterson is skeptical about this method and calls attention to the trouble that we might encounter with foam. On the other hand, we have contemplated using such materials as inhibitors of film formation and should not utterly discount their use as inhibitors of aluminum corrosion, especially since Mears once told us that soluble oils were sometimes effective inhibitors of corrosion.

Patterson also suggested that we look into the possibility of such complex fluorine compounds as the fluophosphates and fluoborates. Pennsylvania Salt has been featuring certain fluorine compounds as new developments in the past year or so and I have asked Technical Library to find out what they can about them. We should, of course, be reluctant to introduce boron compounds in the water, although if they were effective in low enough concentrations, they might be used.

Chemical treatment of aluminum in boiling solutions of potassium dichromate and sodium carbonate without the passage of any electric current is quite successful as a method of preparing aluminum surfaces for painting, and might be a desirable way to get a protective coat laid down on the pieces before charging.

We shall keep you informed of the results of other discussions on this same subject.

TECHNICAL DIVISION

Hood Worthington

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