ALLIED RESEARCH BULLETIN

Number RC 20

SUBJECT

LEAD TITANATE EXPOSURE STUDIES

Prepared by: S. F. Carlson
M. Van Loo

December 3, 1936

ALLIED RESEARCH LABORATORIES

Chicago, Illinois

N14222

LEAD TITANATE EXPOSURE STUDIES

General Statement

Lead Titanate - a high temperature furnaced pigment, cream white in color, of high opacity - first became available for practical test purposes early in 1934. Claims for great durability were made as a component of mixed paints.

Exposure Studies, 1934

The pigment combinations shown in Table I were put out for exposure in 1934 on both White and Yellow Pine, using SWP White as the guide coat on a portion of each panel to eliminate wood differences. These paints have gone through three summers' vertical exposure.

The oil used was half raw and half alkali refined Linseed. Because of the high density of Lead Titanate, the poundage of pigments required to produce ready to use paints was considerably higher than normal, resulting in gallon weights up to 20 pounds for the 100% Lead Titanate paint down to 17 pounds for the lower percentages containing inert pigments. Also, the Lead Titanate used had extremely high thixotropic properties, making it difficult to produce a satisfactory ready to use consistency paint within the customary pigment-volume relationships. These paints being between 24% to 27% pigment volume.

Table I Pigment Compositions

Panel No.	Lead Titanate	Titanox B	White Lead	Leaded Zinc 35/65	Asbestine
34 Sp 38	100%	-	-	-	-
34 Sp 39	50%	50%	-	-	-
34 Sp 56	50%	-	50%	-	-
34 Sp 41	50%	-	-	50%	-
34 Sp 59	40%	-	-	60%	-
34 Sp 40	40%	40%	-	-	20%
34 Sp 42	40%	-	-	40%	20%
34 Sp 57	40%	-	40%	-	20%
34 Sp 58	30%	-	30%	30%	10%
34 Sp 60	30%	-	15%	45%	10%
34 Sp 61	25%	-	10%	45%	20%

0007-SWP-000006808

Exposure Results

The high content Lead Titanate paints dried slower than normal paints, producing soft, tender films. This resulted in abnormal dirt collection and mildew formation; although the exposure location was such that the generally accepted types of paints exposed along with the Lead Titanate did not show mildew or abnormal dirt collection.

After three summers' (2-1/2 years) exposure the 100% Lead Titanate paint has shown no tendency to "clean up" and remains almost black. Film is intact.

The 50% Lead Titanate, 50% Titanox B at the end of the third summer has begun to chalk heavily, although traces of the earlier excessive dirt collection remain. The film presents a strongly eroded appearance.

The 40% Lead Titanate, 40% Titanox B and 20% Asbestine shows bad cracking, generally following the valleys of the brush marks. Films chalking moderately but retaining appreciable dirt collection. This formulation with White Lead replacing Lead Titanate in other exposure tests has shown good durability with minimum tendency toward cracking.

The panels similar to the two preceding Lead Titanates but with the Titanox B replaced with White Lead (BLC) both show excessive dirt collection, no chalking, film intact.

The remaining exposure panels of this series contain Zinc Oxide in percentages varying from 20% to 40%. All are chalking moderately but still show considerable dirt collection. The Zinc Oxide apparently hardened the films in the earlier drying and exposure stages so that a much milder form of dirt collection resulted. Film still intact.

Use of Lead Titanate in Tints

The performance of Lead Titanate as the component of the white base for light tints of house paints is indicated by exposure 34 Sp 61, which has the following pigment composition:

25% Lead Titanate
26% White Lead - 10% BLC, 16% BLS
29% Zinc Oxide
20% Asbestine
100%

The degree of chalking at the end of the third summer is considerably less than that of the 50 Lead, 40 Zinc, 10 inert base for tints used by S-W and several of the affiliated companies. The dirt collection is slightly greater.

In locations where the dirt collection is at a minimum, tint retention of light colored paints containing 25% Lead Titanate should be improved. In locations - particularly cities - where dirt collection is prevalent, the tint retention as judged by general appearance, would not be as good as at present. In this connection it should be noted that the low Zinc Oxide content in the following formula showed no improvement in reducing dirt collection over that of the above formula or of the formula containing 40% Zinc Oxide.

30% Lead Titanate
30% White Lead
20% Zinc Oxide
10% Asbestine
100%

Use of Lead Titanate in Exterior Primers

At the same time the above exposures were put out, a primer containing 77% Lead Titanate and 23% micaceous inert was applied over both White and Yellow Pine under SWP White. To date the films remain intact, with no evidence of checking or cracking of the top coats.

Exposure Studies, 1935

The 1935 series were devoted largely to a study of Lead Titanate as a major component in the pigmentation of exterior house paint primers. 29 such formulations were placed on exposure in two and three coat work on White Pine and Yellow Pine siding at Sarnia, Ontario. SWP Gloss White (TiO_2 type) was used as the top coats.

The formulations included Lead Titanate, approximately 75%, with inerts such as Asbestine, Mica, and Sericite, with treated oil vehicles, in some instances with resins. The pigment-volume-concentrations varied from 31% to 35%. Lead Titanate was also used in proportions from 32% to 64% with other opaque pigments, including basic lead carbonate, and leaded zinc, some with inerts. In these formulations the pigment-volume-concentrations were held at 35%. For details see "Outline of Exterior House Paint Primer Studies."

These exposures have now been out slightly over one year and have not as yet reached a stage where they may be differentiated as to their merits as primer formulations.

Studies which were initiated on the influence of Lead Titanate in Zinc Sulfide - Calcium Sulfate exterior paints will be dealt with in a separate report.

Exposure Studies, 1936.

The 1936 series includes a study of Lead Titanate as a component in the pigmentation of an oil paint for metal surfaces. The formulation is basically a primer of vehicle construction such as was used for the wood primer tests of 1935. The finish coat is similar to SWP #363 Slate with a pigmentation of 20% Lead Titanate, 53% Leaded Zinc 40/60, 14% Basic Lead Carbonate, and 13% Asbestine.

As a control we used two coats of regular #363 Slate which has as its pigmentation 70% Leaded Zinc 40/60, 19% Basic Lead Carbonate, and 11% Asbestine.

At present, after 46 weeks of exposure at Chicago both panels have a fair general appearance with no film failures. The formula carrying 20% Lead Titanate shows less chalking than the regular, but contrary to our expectations, shows a greater degree of fading.

In the 1936 series, we have also extended the study of Lead Titanate to improve tint retention in exterior house paints. Our tint base carried a pigmentation of 10% Lead Titanate, 66% Leaded Zinc 50/50, 12% Basic Lead Carbonate, and 12% Asbestine. The paint weighed 17 pounds per gallon, and had a pigment-volume-concentration of 26.9%.

This base was tinted to match SWP #496 Ivory, #462 Cream, and #353 Light Lead, respectively, and exposed against the regular SWP tint as a control in each instance. The painting was done in three coat work on White Pine, and also as two coat repaint work on previously painted and exposed White Pine panels. Since these exposures have only been out for a few months there is no distinct difference as yet in the tint retention of the Lead Titanate tints compared with the regulars. However, where any differences do appear, they favor the Lead Titanate.

There are 15 panels in the above series. This work will be further extended to study formulations carrying a higher percentage of Lead Titanate. Three basic pigmentations will be used: (a) 70% Leaded Zinc, 15% Lead Titanate, 15% Asbestine; (b) 65% Leaded Zinc, 17-1/2% Lead Titanate, 17-1/2% Asbestine; and (c) 60% Leaded Zinc, 20% Lead Titanate, 20% Asbestine.

Conclusions to Date

1. In white paints, Lead Titanate in percentages sufficient to produce definite results, produces a yellowish white sufficiently pronounced to be objectionable.

2. Films containing substantial percentages of Lead Titanate are subject to excessive dirt collection and mildew formation.

3. Lead Titanate, Titanox B films - White Lead absent - tend to crack.

4. Improvement in tint retention of light colored paints is indicated but at the expense of heavier dirt collection.

5. While the primer tests over the resinous woods show excellent results to date - the slow, soft drying characteristics of Lead Titanate present definite difficulties as to fool-proof exterior primer formulations.

MVL SFC/AR