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ZINC SULPHIDE HOUSE PAINT EXPOSURE STUDIES

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ZINC SULPHIDE HOUSE PAINT EXPOSURE STUDIES

Introductory Statement:

Many attempts have been made by white pigment producers and paint manufacturers to produce Lithopone paints of equally satisfactory performance compared to Lead and Zinc Paints, and to Lead, Zinc and Titanium Paints. None of the attempts have been definitely successful.

Our exposure tests made over a period of years confirm the above conclusion. As the inherent weakness of Lithopone as an exterior usage pigment due to its high Blanc Fixe content appears to have been well established, further attempts in the direction of establishing of Lithopone as a suitable pigment in exterior quality paints have been abandoned by this department.

Whether increasing the Zinc Sulphide content of Lithopone from 28% to 55% and reducing the blanc fixe content from 72% to 45% as in the Double Strength Lithopones of which Cryptone is typical, is sufficient to produce quality paints of satisfactory durability is still open to question.

Also, the question of the maximum durability obtainable with Zinc Sulphide with the complete replacement of Blanc Fixe with other inert pigment combinations, especially those containing Mica, remains to be determined.

Further, the inherent characteristics which can be introduced into pure Zinc Sulphide by variations in the manufacturing process which work towards increased durability have not been fully established.

The following report discusses briefly the results of exposure studies on all of these three lines of endeavor and presents an outline of further exposure studies based on the encouraging results already obtained.

The exposure studies on Calcium-Zinc Sulphide pigments will be dealt with in another report as they represent a separate line of endeavor.

A. Zinc Sulphide Pigments--Effect of Partial Replacement of Blanc Fixe On Durability

The demand for increased hiding power resulted in the production of the higher strength Zinc Sulphide pigments of the type represented by Cryptone produced by New Jersey Zinc Co., and 1203-C by S-W Co., in which the Zinc Sulphide content was raised from 28% to approximately 55% and the Blanc Fixe content reduced from 72% to about 45%.

1933 Series:

Based on exposure results reported by New Jersey Zinc Co. and earlier exposures of our own, it was felt that this pigment - Cryptone - had sufficient improved durability over Lithopone to permit of its introduction into S.W.'s Family

Paint White in the spring of 1933. The pigment combination per 100 Gals. being:

300 Lbs.	Cryptone	or	38%
200 "	Leaded Zinc 35/65	"	25%
300 "	Inert Pigments	"	37% (Asb. and Silica)

This formula and variations of this formula were exposed covering -

a. Replacement of the Cryptone content with Leaded Zinc, 412 Dry.

b. Replacement of the Cryptone with Titanox B.

c. Replacement of the Cryptone with an equivalent amount of Zinc Sulphide and the Blanc Fixe replaced with Asbestine and Silica.

d. Replacement of the Cryptone with 5 experimental lots of S.W.'s production of 1208-C.

These formulations were exposed as 3 coat work on both White and Yellow Pine, S.W.P. White, Rex 471 (Titanox B formula) applied as a guide coat on a portion of each panel to detect wood differences.

The exposures have gone through four summers, equal to about 5 years on a house job or about the normal life of a white paint job.

Due to the composition and the considerably greater opacity of the S.W.P. guide coat, it might be expected that it would show a marked superiority in durability. This was not the case. On Yellow Pine, the behavior of the entire series was comparable with the S.W.P. White, and represented a fair degree of durability, except the replacement of Cryptone, with Leaded Zinc which showed considerable cracking. Otherwise, no marked superiorities or deficiencies were observed.

On White Pine marked differences were shown. As a group, the 7 Zinc Sulphide exposures showed marked durability over the 7 S.W.P. White guide paintings 3 of the latter showing pronounced flaking and scaling, this feature being substantially absent in the Zinc Sulphide paints.

Interpreted on the basis of the performance of the guide coat as eliminating wood differences, one panel with another, the New Jersey Cryptone was slightly superior to the 5 Coffeyville experimental Double Strength pigments. These showed no substantial differences one with another.

The Cryptone Family Paint exposure showed a moderate number of barely visible cracks limited to one portion of the panel. The S.W.P. White guide showed considerable cracking with incipient scaling.

The Cryptone replaced by Leaded Zinc showed extensive fine checking and cracking.

The Cryptone replaced by Titanox B showed extensive checking and cracking similar to the S.W.P. White guide paint. The cracks being of the long type. During the earlier part of the exposure cycle, this paint presented the whitest and best appearance. After four summers, it shows no superiority as to whiteness, hiding power and appearance over the Zinc Sulphide paints.

Cryptone replaced by a mechanical admixture of Zinc Sulphide, Asbestine and Silica showed no improvement to date.

While the hiding power of this series by reason of the 37% of added inert pigments was less than that required of a first grade paint, none of the films have become excessively thin and transparent.

The wearing value of this Family Paint White based on New Jersey Cryptone is considered exceptionally good for a second grade or utility paint. Attention is called to the high total inert pigment content of approximately 55%. That this type of formulation is meeting with excellent consumer acceptance is evidenced by a production of 87,000 gallons for 1935-1936.

First 1934 Series:

A similar pigmentation to the 1933 series was selected as one of the formulas to determine the durability of various semi-drying oils. The pigment combination in 100 gallons being:

300	Lbs.	Cryptone
300	"	Leaded Zinc 35/65
150	"	Asbestine
150	"	Silica

This formula made with Linseed Oil was applied as the guide paint (3 coats) on 12 White Pine and 12 Yellow Pine panels. After three summers' exposure, no checking or cracking of the film has taken place. Appearance good.

The same formula with various replacements of Linseed Oil with Soybean, Sunflower, and Walnut Oils on 9 White Pine and 9 Yellow Pine panels exposed at the same time gave the same results as above.

The above panels show a similar degree of whiteness compared with the other panels containing Titanox B and Titanium Oxide.

Again, we are confronted with a series of paints containing 50% of inert pigments which are exhibiting the type of durability performance commonly associated with a first quality paint.

Second 1934 Series:

Another series of exposures were put out later in 1934 which have now had full two years' exposure which throw further light on the durability factors of Cryptone compared with Lithopone. The formulation selected was that of Zincite White of Montgomery Ward, a house paint having a wide sales in the medium price range. The pigment composition for 100 gallons being:

515	Lbs.	Lithopone	or 55%
330	"	Leaded Zinc 35/65	" 45%
95	"	Asbestine	" 10%

On White Pine this paint has shown bad checking (of the small pattern type).

Replacement of Lithopone with Cryptone shows marked improvement, very slight checking confined to a very small part of the panel.

A 1/3 replacement of the Lithopone with Cryptone showed very moderate checking over entire panel, appreciably better than that of the straight Lithopone.

This series also contained several exposures based on a somewhat different pigment combination as follows:

295	Lbs.	Cryptone
295	"	Leaded Zinc 35/65
148	"	Asbestine
148	"	Silica

This paint after two years' exposure on White Pine used as a guide paint on several showed on one panel considerable checking and cracking on the other panels slight checking only.

Replacement of the Asbestine and Silica with a Talc possessing a definite "plate" particle structure, showed no checking.

Replacement with Mica showed no checking and the appearance of some residual gloss, possibly because of the mica effect.

An additional exposure series is now under way which is designed to extend our knowledge of the effect of varying percentages of Mica on durability.

Summarized Results:

The replacement of normal Lithopone in exterior paints with a high Zinc Sulphide content pigment similar to Cryptone, in which the Blanc Fixe content has been reduced from 72% to 45% greatly increases durability.

The durability has been increased sufficiently to justify the usage of such a pigment in conjunction with Leaded Zinc in general utility or second grade paints where good hiding power and fair durability are required.

The high total inert pigment content of 40%-50% permitted by this type of formulation and with the maintenance of excellent hiding power, does not appear to affect the durability adversely-a factor of importance in obtaining the low costs required with the competitive type paints.

B. Zinc Sulphide Pigments-Effect of Complete Blanc Fixe Replacement on Durability

Exposure studies made with the complete replacement of Blanc Fixe with other inert pigments, such as Asbestine, Talc, Amorphous Silica, Mica, etc. may be considered under two phases. One in which the inert pigments are brought into contact with the pure Zinc Sulphide as a wet slurry and second, when introduced dry in the paint mixer with the pure Zinc Sulphide, most of the exposures being of the latter type.

1929 Series:

The initial exposure tests were begun in 1929 and were based on admixtures of Zinc Sulphide, Leaded Zinc 35/65 and Asbestine. The White panels checked considerably within three years, the Cream tints showed much greater durability. One of which is still on exposure, showing excellent tint retention, good adhesion and good general appearance, but with extensive fine pattern checking. This composition was represented by:

60% Leaded Zinc
20% Zinc Sulphide
20% Asbestine
100%

1930 - 1933 Series:

The subsequent exposure series put out yearly up to 1934 were based on the inclusion of varying percentages of White Lead, both Carbonate and Sulphate, in addition to the percentage derived from the Leaded Zinc. This under the belief that a substantial percentage of White Lead was necessary for durability.

These exposure tests showed considerable checking with the Whites in two years, and the tints in three years, when considerable percentages of White Lead (B.C.) were present. Increases in durability were observed corresponding with decreases in White Lead content and moderate increases in the Silica - Asbestine content. It was concluded from these tests that White Lead in amounts beyond that introduced through the Leaded Zinc lowered the durability of Zinc Sulphide formulations.

First 1934 Series:

In 1934 two series of exposures were put out on White Pine, one based on the Zincite formulation (see caption A, page 3, for composition) in which the 55% of Lithopone was replaced by mechanical admixtures of Zinc Sulphide and inert pigments.

The outstanding member of this series as to performance is composed of:

45% Leaded Zinc 35/65
55% Cryptone MS-130 (Zinc Sulphide - 55%
(Asbestine - 35%
(Mica - 10%
10% Asbestine
100%

After three summers' exposure the film is in perfect condition with no evidence of checking, while the guide paint containing 55% Lithopone is badly checked with flaking between coats.

The use of either Asbestine or Talc alone in place of the above combination of Mica and Asbestine introduced as a mechanical mixture in the paint mill, showed evidences of failure through very moderate checking, some preference being given to the Talc.

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Second 1934 Series:

The second 1934 series, exposed in September on White Pine, was represented by the following pigment combination:

30% Zinc Sulphide (New Jersey Zinc Co.)
46% Leaded Zinc
19% Asbestine
5% Mica
100%

The other variations being substitutions of different Zinc Sulphides.

After two years' exposure there is no evidence of checking or other signs of failure in this series. Appearance uniformly good.

1935 Cooperative Exposure Tests:

In the spring of 1935 a cooperative exposure test was arranged between Krebs, The Titanium Pigments Company and this department to study the influence of climate and personal equation factors on six typical formulations including a Lithopone and a Zinc Sulphide formulation. The paints were applied at the same time with identical reductions on Cedar and Douglas Fir. Exposed by the Titanium Pigments Company, at Sayville, Long Island, Krebs, at Wilmington, Delaware, and by this department near Detroit. White Lead in Oil was used as the comparison of guide paint on each panel.

This exposure series had as its basic aim a comparison of the durability of the following type formulas over new wood and ultimately their behavior on repainting. This latter feature being regarded as of particular importance.

1. 60% White Lead (B.L.C.) — (Old conventional type (White Lead and Zinc Oxide))
   30% Zinc Oxide
   10% Asbestine

2. 35% Titanox B — (Similar to former SWP)
   45% Leaded Zinc 35/65
   20% White Lead

3. 37% White Lead — (Similar to present Lowe Bros.)
   38% Leaded Zinc 35/65
   12-1/2% Titanium Oxide
   12-1/2% Asbestine

4. 40% White Lead — (National Lead Co's recommendation for a zinc-free paint)
   40% Titanox B
   20% Asbestine

5. 55% Lithopone — (Krebs' recommendation for Lithopone paint)
   35% Leaded Zinc 35/65
   20% Asbestine

6. 30% Zinc Sulphide — (Selected on basis of previous good performance)
   35% Leaded Zinc
   35% Talc

These paints were put out in June, 1935 and have had one winter and two summers' exposure. A recent check-up at all three locations shows the following:

1. The White Lead guide coat shows the typical checking or "fissuring" of White Lead.

2. Moderate checking and cracking of the 60 Lead 30 Zinc 10 Inert pigment combination.

3. Slight to moderate checking of the 55% Lithopone formulation.

4. Moderate chalking, no checking and general good appearance of other 4 paints.

Consumer Usage:

The initial Zinc Sulphide exposure tests begun in the spring of 1929 having shown definite promise, it was decided to offer for sale through one of the affiliated companies, a paint based on pure Zinc Sulphide. This paint was introduced to the trade in semi-paste form in 1931 and sold only to the painter trade and not to the general public.

The following yearly increases in production indicate a high percentage of repeat sales. One gallon of the semi-paste when reduced equals two gallons of ready mixed paint.

Year	Gals. Semi-Paste	Converted to Ready to Use Basis
1931 - 1932	7,456	14,912
1932 - 1933	11,739	23,478
1933 - 1934	15,756	31,512
1934 - 1935	27,640	55,280
1935 - 1936	36,405	72,810

The pigment formula is approximately:

30% Zinc Sulphide
45% Leaded Zinc
20% Asbestine
5% Mica (Introduced in 1934)

No complaints have been received as to lack of durability or poor appearance on continued exposure. Various inspections made by this department indicate a performance comparable with that of a first quality paint.

Summarized Results:

The complete elimination of Blanc Fixe through replacement with the silicate type of inert pigments-Asbestine, Talc and siliceous Silicates further increases the durability of Zinc Sulphide paints.

Greatest increase in durability obtained with an Asbestine and Mica admixture.

The durability characteristics attained in this manner compare favorably with and perhaps exceed those of the widely used conventional formula of 60 Lead, 30 Zinc and 10 Inert of a few years ago for first quality house paints.

Exposure results not yet sufficiently complete to make definite comparisons with the best Lead, Zinc and Titanium Oxide formulations.

C. Durability Characteristics of Different Zinc Sulphides

It has been recognized that the durability characteristics of various white pigments vary according to differences in the physical structure of the pigment particle. It is therefore conceivable that the inherent durability of Zinc Sulphide can be increased by exposure studies based on differences as to physical structure.

An initial series of six experimental Zinc Sulphides were exposed in Florida in the spring of 1934 based on the following pigment formula:

330	Lbs.	Zinc Sulphide
420	"	Leaded Zinc 35/65
70	"	Basic Lead Sulphate
120	"	Asbestine
115	"	Silica

At the end of two years' Florida exposure varying degrees of checking had taken place, clearly indicating that differences in the Zinc Sulphides used, produced appreciable differences in durability. The Zinc Sulphides having a physical structure resulting in considerably lower oil absorptions showed increased durabilities.

A further exposure program is being outlined which will expose this field more thoroughly.

Concluding Statement:

The exposure results obtained by this department and confirmed by the findings of other technical organizations, present the broad picture that the high strength Zinc Sulphide pigments are now usable in first quality exterior house paints.

That it will be a matter of personal preference, rather than of fundamental superiority, as to whether exterior paints, will in the near future be formulated with Titanium or Zinc Sulphide.