

PAINT RESEARCH DEPARTMENT
Report of Investigations
For the Month of July, 1966

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Project #12 - Exterior Primers

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Exposure series 32347-63 at 70 months shows good performance for emulsion primers with modifiers on pine and on weathered chalky and glossy surfaces. Similar primers with no modifier show loss of adhesion, particularly on chalky surfaces. No choice between tung, safflower oil or alkyd as modifiers. Monsanto experimental primer based on 630-RJ 100 vehicle satisfactory; Dow experimental 2647 primer develops some checking and cissing.

Project #206 - Exterior Emulsion Paints

Page 2

Alkyd modification increases Brushometer reading of latex paints. One coat exterior latex paints based on Rohm and Haas E-398 and E-425 latices show considerable promise.

Project #177 - Pigment Studies

Page 3

Nineteen pigments, including whites, extenders and colors were studied for UV absorption and reflection properties. The results show that at equal concentrations carbon black is more opaque than black iron oxide. Of the extenders studied aluminum silicate has the lowest transmission of ultraviolet. Exposure series 36442-36449 F, examined after three years' Florida south exposure, shows that Virflux PR-5, a buff colored natural TiO_2 , when used in an A-100 tint improves the tint retention of buffs and tans but reduces tint appearance in other tints.

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Project #177 - Cont.

Exposure series 41547-41559 examined after a year's exposure in Chicago showed that barium carbonate used as the extender in house paint developed a severe chalk face. Exposure series 44193-44229 was prepared for exposure to study various titanium oxides (including du Pont's R-960, Cabot's RF-30 and American Potash's CR-800) in both oil type and alkyd type house paints. Exposure series 44468-44491 was prepared for exposure to evaluate titanium oxides from various suppliers in an acrylic house paint; also includes du Pont's potassium titanate PKT.

Project #97 - SWP

Page 7

Exposure series 44513-44535 was prepared to study various coatings over woods of varying paintability. The woods include Lauan, Ponderosa Pine and cedar. The paint systems include two coats self-primed and one coat of topcoat over the recommended primer. Previous series of similar nature had shown that Lauan (formerly called Philippine Mahogany) fell in the lower Group 3 or upper Group 4 of species of woods classified for paintability.

Project #86 - Leaded Zinc Pigments

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Exposure series 44184-44192 was prepared to study the effect of leaded zinc oxide on the exterior performance of house paints. Of specific interest is the effect on film erosion and bulk film properties. 30 pounds of Vancide PA per 100 gallons of paint is included to inhibit mold growth as zinc oxide concentration goes down.

Project #77 - Preservatives

Page 9

Dow NC-1013 mildewcide tends to show reactivity with some types of latex. Package stability can be improved considerably by the use of Strodex PK-90.

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Project #201 - Exterior Clear Finishes and Pigmented Stains Page 10

Seven organic UV absorbers were analyzed with Cyasorb UV-24 proving to be the most efficient followed closely by Tinuvin 327. The other UV absorbers included Cyasorb UV-9, Uvinul N-539, Uvinul #410, Tinuvin P and Bayer 318. Instron tests of Arcflint 505 indicate that the 55:45 blend of epoxidized oil and polyester is the best compromise between elongation and tint retention when formulating an exterior coating. Some improvement in the bulk film properties of linseed oil may be observed as the degree of polymerization is increased. In a study of linseed oils with increasing degree of polymerization the differences observed were not so marked as to predict great differences in relative changes of bulk film properties on exposure.

Project #221 - Production Finishing of Forest Products Page 12

Panels 36095-36110 L and 36095-36126 C show good mold resistance for medium oil alkyd primed cedar after 37 months in Louisiana and 44 months in Chicago. Busan 11-M1 and 18-M leaded zinc oxide improve the mold inhibition but low PVC emulsion Chek-Gard type primers are best for mold resistance. Panels 37261-92 C show that immediate painting of wood substrates improved the performance over painting after the substrate has weathered. Cedar and Douglas Fir siding and Douglas Fir and medium density paper overlaid plywood all show poorer performance after as little as one month's weathering before painting, after 36 months' Chicago exposure. Panels 42051-86 C and F show good performance for Check Retarders using either E-172 or a blend of AC-34 and AC-201 after 9 months' exposure in Chicago and Florida. A-100 and production emulsion topcoats show better crack resistance than an alkyd topcoat.

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Project #225 - Electrochemical Investigations

Page 15

Work continued on the electrodeposition of polyolefins such as polypropylene, especially to improve flow and to eliminate craters and pinholes. Changes in cure schedule were not very helpful; a schedule of five minutes at 400° F. was selected as optimum. The effects of "pack density" of the films were studied, using a considerably smaller particle size non-commercial polypropylene. Smooth, continuous films were obtained on aluminum and steel. While TiO₂ particles are small compared with the polyolefins, pigmentation with TiO₂ offered no improvement. Attempts were made to reduce the particle size of polypropylene by dry grinding at very low temperatures, e.g. -70° C., without much success. Deposition in a cell in which the particles had to pass through a 25 micron mesh screen gave smoother films. Microthene FN-500 polyethylene with particles said to be below 20 microns gave no improvement. Work with alkali solubilized resin systems for electrodeposition looks promising at this time. A portable resistance bridge was designed and built for use in electrodeposition studies.

Project #112 - Fire Retardant Paints

Page 20

Ammelide, a product of the hydrolysis of melamine is suspected as the cause of poor color acceptance of Phos-Chek P/30 based emulsion fire retardant paints. Evaluation of substitutes for melamine is in progress.

Project #103 - Metal Protective Paints

Page 22

Panels 44416-35 C and F have been prepared for exposure in Chicago and Florida to test several emulsion primers for metal.

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Project #12 - Exterior Primers

Series 32347-63 was examined after 70 months' exposure at Chicago. Emulsion primers were applied to pine siding, weathered chalky panels and to weathered glossy panels. Primers were based on Rhoplex AC-33, Flexbond 800 and Lytron 680 with alkyd, tung oil and safflower oil modifiers. One coat of A-100 A6 G 66 Seaway Green was used as the topcoat. Performance on all substrates has been quite satisfactory. Adhesion to both the weathered chalky and glossy surfaces has been good. Similar primers with no modifier show loss of adhesion, particularly on the chalky surface. There is no choice between the three modifiers used in this series; all were instrumental in promoting good adhesion with no undesirable side effects.

A Monsanto experimental primer, 301408-4 DD, based on a 680-RJ-100 vehicle, gave satisfactory performance. A Dow experimental primer, P-688-42-2, based on their 2647 latex, shows some checking and has the appearance of cissing. A competitive alkyd emulsion primer, Fuller's 7079, gave satisfactory adhesion. Mildew has never presented a problem in this series. The results in general indicate satisfactory performance for emulsion primers, even on the pine panels which are normally considered a difficult surface to paint.

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Project #206 - Exterior Emulsion Paints

Work has continued on self-priming and one coat exterior latex paints. With paints based on eight different latices, a comparison is being made to determine the effect of modifier on the performance of these paints. Straight latex paints are compared with related paints containing a linseed alkyd modifier to the extent of 15% and 25% of the vehicle solids by volume. All paints are in the 81 - 86 KU range. Brushometer readings were determined.

In general, alkyd modification tends to increase the Brushometer reading. A portion of our data is listed below to illustrate the magnitude of this change. Brushometer readings are given in poises.

<u>Paint</u>	<u>No Alkyd</u>	<u>15% Alkyd</u>	<u>25% Alkyd</u>
E-173	0.38	0.43	0.59
E-388	1.46	1.64	1.72
E-425	1.76	1.90	2.05

The Brushometer readings indicate that alkyd modification exerts a small but definite influence on the application properties of the paint. The E-388 and E-425 latices are the new Rohm and Haas experimentals which exhibit improved flow and have considerable brush drag, particularly the E-425 type. Readings indicate that E-425 paints can be formulated with brush drag equal to that of an oil base house paint. Actual application properties of the two types will differ due to the rapid drying rate of the latex paint and difference in surface wetting characteristics.

Brushometer readings for the E-173 paint are typical of the average latex paint with very little brush drag and illustrate why it is so easy to apply such paints at an excessive spreading rate. It is possible that the E-425 paint may have too much brush drag for easy application to a chalky surface. E-388 paints may prove more adaptable to a greater variety of surfaces and more exposure experience is available with this latex. In general, it appears that the E-388 and E-425 latices represent a considerable step in the direction of a practical one coat latex paint.

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Project #177 - Pigment Studies

We have recently completed a study of various pigments with regard to their ability to absorb and reflect ultraviolet radiation. The study includes white and colored pigments as well as extender pigments. Each pigment was dispersed in an alkyd varnish at a concentration of 10 pounds per 100 gallons. A low concentration was chosen to allow some transmission by such pigments as rutile titanium dioxide. All data are reported for dry films having a corrected thickness of 2 mils. Also reported is the wave length at which transmission by the film becomes 0%. The results of this study are shown in Table I.

The data are reported as percent transmission, the remainder of the light being absorbed or reflected by the film. It should be pointed out that the alkyd resin will absorb some of the radiation and therefore it cannot be assumed that all absorption is by the pigment only. However, the alkyd resin is constant throughout all samples and the transmission of one pigmented film relative to another should be quite meaningful.

It is interesting to note that calcium carbonate transmits more ultraviolet radiation than magnesium silicate. We repeatedly observe that calcium carbonate extended paints exhibit better tint retention than magnesium silicate. This suggested that perhaps it absorbed and/or reflected more UV energy than magnesium silicate, thereby protecting the binder. However, the results are contrary to this thought. It therefore appears that the oil demand of each pigment is of more importance. Calcium carbonate having less oil demand leaves more free vehicle to function as pigment binder. It can also be assumed that because there is more total free vehicle the percentage of degraded binder would be less in a calcium carbonate extended paint at any point in the exposure history, leaving more vehicle to bind the pigment particles together into a continuous film.

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Project #177 - Cont.

Table I

Transmission of Ultraviolet by Pigments

<u>Pigment</u>	<u>S-W Code</u>	<u>% Transmission</u> <u>280 - 400 mμ</u>	<u>Wavelength of</u> <u>Zero Transmission</u>
Rutile titanium dioxide	66 53 00	3.62%	300 m μ
Anatase titanium dioxide	66 00 22	2.88%	353
Magnesium silicate	62 32 00	24.3%	300
Calcium carbonate	63 01 00	29.2%	304
Aluminum silicate	62 02 27	22.6%	303
Barium sulfate	63 70 00	25.0%	305
Nepheline syenite	Minex-4	26.0%	313
Potassium titanate	PKT	6.0%	335
Zinc oxide	67 21 00	21.2%	310
Leaded zinc oxide	68 22 00	10.8%	320
Basic lead silicate	68 01 00	24.1%	310
Basic lead sulfate	68 10 00	19.0%	310
Basic lead carbonate	68 05 00	18.2%	310
Black iron oxide	71 50 00	9.25%	315
Carbon black (10#)	70 50 00	0%	400
Carbon black (1#)	70 50 00	17.8%	310
Phthalocyanine Green	Monastral Green B	0%	400
-	Dolamar Yellow	0%	487
Quinacridone Red	Monastral Red B	.39%	357

Exposure series 36442-49 was examined after 36 months of Florida south exposure. The series was prepared initially to study Virflux PR-5, a natural and lower cost TiO_2 in A-100. Virflux is an off-color pigment with a buff color. Therefore it was thought that in certain colors, such as tans and buffs, it would be practical to use Virflux and realize a saving on TiO_2 cost. The tint appearance of paints containing Virflux is very good in tans and buffs because the chalk is a buff color. In a green tint the tint appearance is much poorer because the chalk color is much different than the original color of the paint.

As reported earlier (Paint Research Monthly Report, December, 1965, page 7) Virflux is very low in light scattering efficiency. On the basis of hiding power per dollar pigment cost, the standard grades of TiO_2 are a better buy. However, in some specification formulations where only TiO_2 content is specified and the color can be tolerated Virflux could be used at a saving.

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Project #177 - Cont.

Exposure series 41547-41559 was examined after 12 months' exposure at Chicago south. The series was prepared to study barium carbonate as an extender in house paint. The formulations studied are A2 W 4 SWP Gloss White, A2 W 8 SWP Trim and Tinting White and A2 W 8 tinted blue. In the test paints in which all the extender was replaced by BaCO_3 , the general appearance was poor relative to the standard formula. In A2 W 4 type the standard was rated 7 for general appearance while the test paint was rated 4. The poor general appearance results from an accumulation of chalk which cannot be removed easily. The chalk in turn collects air borne dirt, resulting in a very dirty looking panel.

Exposure series 44193-44229 was prepared to study various titanium dioxide pigments in A2 W 8 SWP Trim and Tinting White, B46 W A16 P/C One Coat House Paint modified to contain only rutile TiO_2 , and in A2 W 4 SWP Gloss White. The anatase pigments are studied in A2 W 4 and rutile pigments in A2 W 8 and B46 W A16 modified. The latter two rexes are in white and a blue tint. The pigments studied are as follows:

<u>Pigment</u>	<u>Supplier</u>
Ti-Pure R-900	du Pont
Ti-Pure R-960	du Pont
Ti-Pure LW	du Pont
Titanox AWD	Titanium Pigments
Titanox ACG	Titanium Pigments
Unitane OR-600	American Cyanamid
Unitane O-110	American Cyanamid
Troncx CR-800	American Potash
RF-30	Cabot

The paints are applied as two coat systems over A2 W 2 SWP Undercoater on cedar siding and exposed in Chicago and Florida south vertical.

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Project #177 - Cont.

Series 44468-91 was prepared for exposure at Chicago and Miami to evaluate several of the newer grades of titanium oxide. Exposures were made in white and blue in an acrylic latex paint. The test includes du Pont titanium oxides R-610, R-900, R-902 and R-960, also the du Pont potassium titanate, "PKT." Due to the very high water demand of the PKT it is combined with R-610 in this initial exposure. Other titanium pigments appearing in this series are Titanium Pigment Corporation's RA-50 and RA-51, American Cyanamid's OR-600 and OR-640-A, and American Potash's CR-800. Two experimental grades identified as PRC-6 and PRC-7 are included.

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Project #97 - SWP

Exposure series 44513-44535 was prepared to study most of our current exterior coatings when exposed over wood substrates of varying paintability. The woods include Lauan, Ponderosa Pine and cedar. The paints were applied as two coat systems over their recommended undercoater on the left half of each board and two coats self-primed on the right half of the board. The panels are exposed at Chicago south.

Previous series similar in nature to 44513-44535 had shown that Lauan (formerly called Philippine Mahogany) fell into either the lower levels of Group 3 of species of wood classified by the Forest Products Laboratory for paintability, or into the upper levels of Group 4.

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