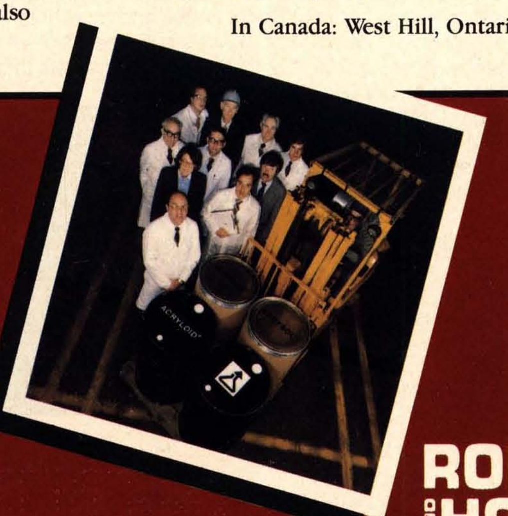
jct JOURNAL OF COATINGS TECHNOLOGY

JCTAX 53 (681) 1–100 (1981)

OCTOBER 1981

Extender Pigments in Latex Wall Paints


For Waterborne, High Performance
LOW-VOC
BAKING ENAMELS


ACRYLOID

A bright new way to make your coatings dull

R. T. Vanderbilt's new VANTALC™ 6H is a highly efficient enamel dulling agent. It allows you to control the gloss of industrial paints and coatings without altering their color or performance.

VANTALC 6H is a super fine magnesium silicate. Its extremely high purity and brightness assure your coatings of excellent clarity. Bright whites and clean tints.

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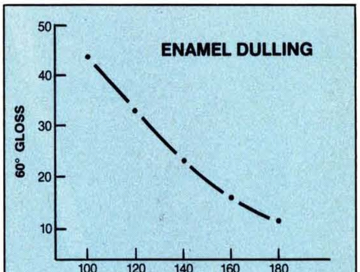

R. T. Vanderbilt Company, Inc.

INDUSTRIAL MINERALS AND CHEMICALS

OCTOBER 1981

JOURNAL OF COATINGS TECHNOLOGY

Volume 53 Number 681

Features

Federation Activities

Departments

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Comment

PRI Is Working!

For the past year, an ad hoc committee of five Federation Past-Presidents has been studying the role of the Paint Research Institute in addressing the research needs of the coatings industry. In its efforts, the committee has visited with representatives of the Constituent Societies, PRI Trustees (past and present), researchers who have worked on PRI grants, and others in the industry, to gather information on ways and means to make PRI a more effective research arm of the Federation.

The committee's preliminary report submitted at the Board of Directors meeting this past May focused on a consensus of Society members' views which reflected a lack of understanding of PRI programs and goals. The members criticized the paucity of PRI communications and the perceived "ivory tower" research being carried out. (Please read the full report on pages 37–39 of the August JCT.)

Meanwhile, PRI President Peter Robinson and his Board of Trustees have been busy revamping the administrative structure, including procedures for research project selection and management, as well as improving communications activities. These actions, along with the steps taken earlier to move to a consortium approach for specific research projects, indicate that, in fact, PRI *is working*.

There is every reason to believe that when the ad hoc committee makes its anticipated final report at the Fall Board Meeting later this month its recommendations, together with the current in-house actions being taken by the Trustees, will enable the Paint Research Institute to once more gain the confidence and support of the industry and the Federation membership.—RFZ/TAK

Second generation epoxies fo

ECN 1299 resin improves chemical and solvent resistance.
Can be formulated into coatings with very high HDT. In combination with o-cresol novolac, produces coatings with excellent resistance to aggressive solvents. Withstands over six months immersion in methylene chloride.

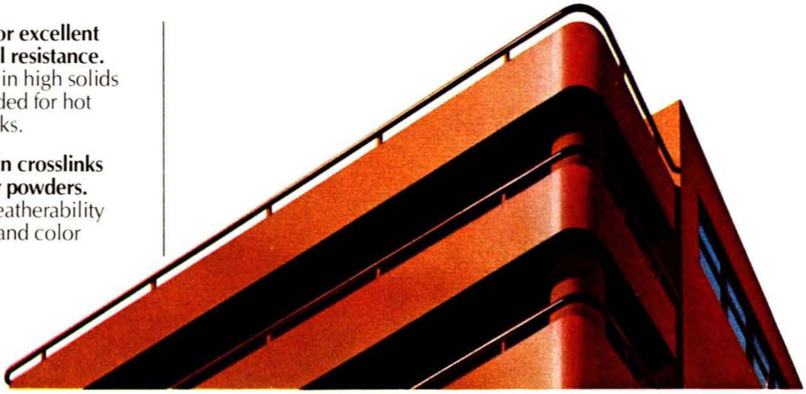
tanker linings

hardeners for vinyl plastisols

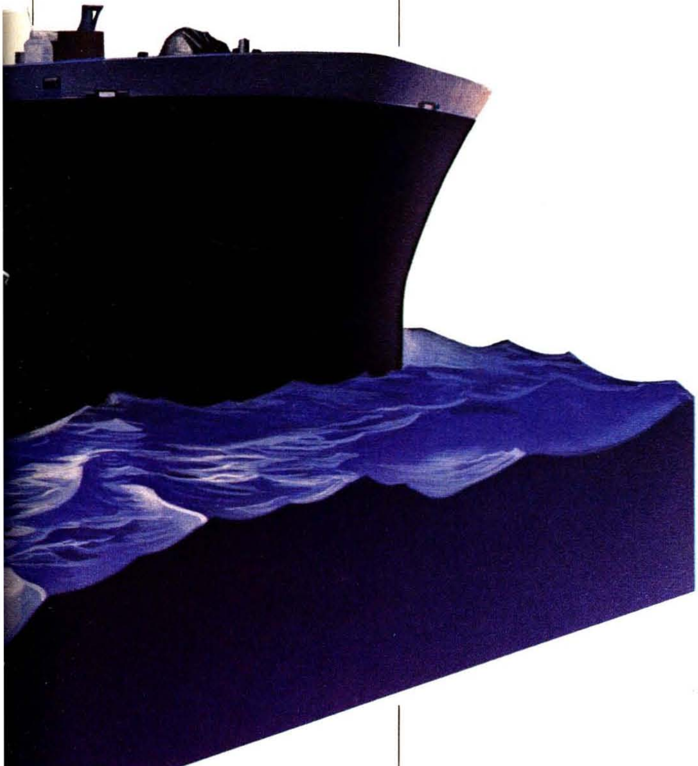
Hardeners HT 939 and HY 940 improve adhesion of epoxy modified vinyl plastisols.
Remain stable six months after formulating. High latency. Cure rapidly—five minutes at 100°C.

0500 resin increases heat tolerance.
Due to low viscosity, allows formulation of solvent-free, room temperature cured coatings with outstanding resistance to aggressive solvents (metlylene chloride, MEK, Cellosolve).

EPN 1138 resin increases high temperature stability.
Improves chemical resistance.

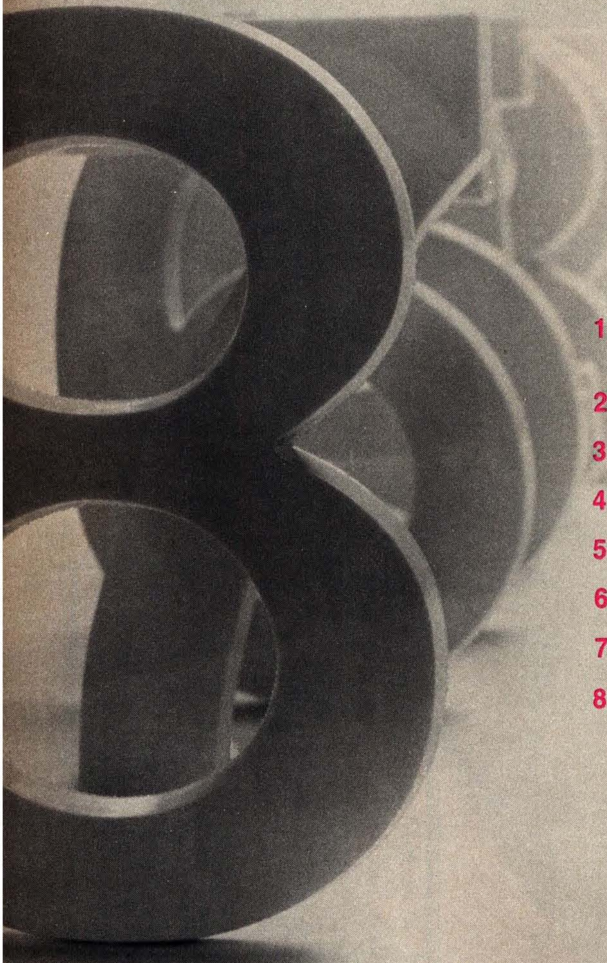


exterior coatings



TROYSAN POLYPHASE ANTI-MILDEW

Eight solid reasons to use our new liquid fungicide



Seeking a non-metallic fungicide for protecting your latex paints?

Then it's time to consider using Troysan Polyphase Anti-Mildew.

This remarkable fungicide has gained solid field acceptance since its introduction in 1976.

And if you're not using it now, here are eight good reasons why you should:

1 Consistent, reliable performance as a mold growth inhibitor in aqueous systems
2 Minimal cost, high performance
3 Easy-to-handle, pumpable liquid—no dusting problem
4 Liquid form means no dispersion problem
5 Stable—will not hydrolyze during storage
6 Superior tint retention, chalk resistant
7 Low toxicity, EPA-approved
8 Resistant to sulfide staining

Troysan Polyphase Anti-Mildew.
Solid value in a liquid fungicide.
Sample and technical data on request.

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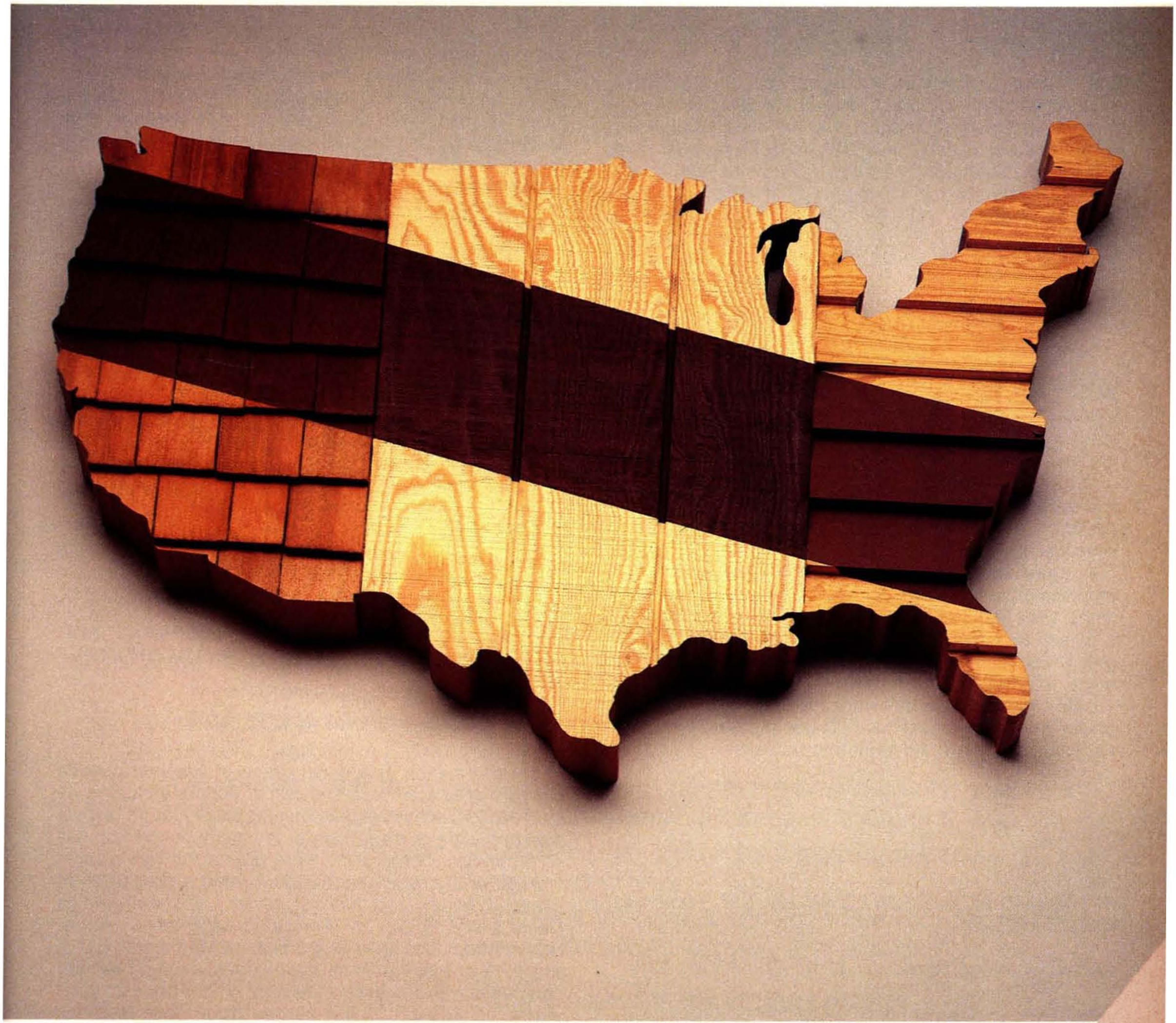

Abstracts of Papers in This Issue

MELANIN BIOSYNTHESIS IN *AUREOBASIDIUM PULLULANS*—D.J. Siehr

Journal of Coatings Technology, 53, No. 681, 23 (Oct. 1981)

The organism associated with the mildew defacement of organic coatings is *Aureobasidium pullulans.* Evidence is presented here to suggest that the melanin pigment synthesized by *A. pullulans* is formed from acetate via the intermediate 1,3,6,8-tetrahydroxynapthalene. When *A. pullulans* is grown in a medium containing tricyclazole, 2-hydroxyjuglone and flaviolin accumulate in the medium.

EXTENDER PIGMENTS IN LATEX WALL PAINTS—Louisville Society for Coatings Technology

Journal of Coatings Technology, 53, No. 681, 27 (Oct. 1981)

A study was undertaken for the purpose of characterizing the effect of extender pigments on critical properties of latex wall paints.

A review of available extenders was made and a list of representative materials compiled. These extender pigments were then evaluated in a typical flat latex wall paint at 50 and 60 PVC. Tests were run on each paint to check properties such as scrub resistance, sheen, stain resistance, and hiding power.

Data collected from this work allows correlations to be drawn about the effect of extender pigment type and particle size on specific paint film properties.

OPTIMIZING RESINS FOR LOW VOC—S.N. Belote and W.W. Blount

Journal of Coatings Technology, 53, No. 681, 33 (Oct. 1981)

Volatilization of low molecular weight resins designed for high-solids coatings can cause a significant differential between calculated solids and determined solids of coatings. The resin that is volatilized is not as effective at reducing coatings viscosity as solvents, yet has to be considered volatile under the new EPA guidelines. It was theorized that an optimum average molecular weight exists for a combination of resin raw materials at which VOC at the same viscosity cannot be reduced by lowering resin molecular weight.

Six polyester resins of the same composition but with varying molecular weights were evaluated for VOC at the same viscosity with various catalyst levels and cure temperatures. An optimum molecular weight was determined. It was further determined that the effects of catalyst level and cure temperature on VOC were significant.

ELECTROCHEMICAL TECHNIQUES TO EVALUATE CORROSION OF COATED METAL—D.V.S. Gupta

Journal of Coatings Technology, 53, No. 681, 41 (Oct. 1981)

The use of electrochemical techniques, particularly the potentiodynamic polarization technique and the linear polarization technique, for evaluating coatings as well as for formulation research is presented. Case studies on the utility of the methods are also presented.

SOLVENT-BORNE MILLBASE DEVELOPMENT FOR HIGH SPEED DISPERSION OF TITANIUM DIOXIDE—C.C. Tatman

Journal of Coatings Technology, 53, No. 681, 57 (Oct. 1981)

The performance of a given grade of titanium dioxide pigment is related to a number of factors including its chemical and physical composition as well as its dispersion and state of dispersion in the medium in which it is incorporated. The present work covers the role dispersion plays in developing the performance properties of gloss, strength, and hide. It reviews the well-known Daniel's Wet-Point/Flow Point and Guggenheim Equation methods designed to provide the formulator with a way to assure optimum millbase composition. The paper concludes with the presentation of laboratory data generated using a procedure derived from those methods that allows a short-cut approach to nonaqueous millbase formulation for those instances where the need for rapid response precludes the more thorough approach of Daniel.


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Pfizer
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HOW WE MADE FAST-DRYING ZINC-RICH PRIMERS EVEN BETTER.

Government / Industry

OSHA's Original Lead Standard Is in Effect

The U.S. Supreme Court has refused to review a lower court decision which held that the Occupational Safety and Health Administration's (OSHA) Occupational Exposure to Lead Standard was appropriate and justified as originally issued for paint and coating manufacturing operations. The standard, which lists various methods of compliance for different industries, will be phased in over a 10-year period beginning June 29, 1981, the effective date.

Paint and coatings manufacturers have one year from the effective date to comply with the standard as originally published in the November 14, 1978 *Federal Register* which allows for a permissible exposure limit (PEL) of 50 micrograms of lead per cubic meter of air averaged over an eight-hour time period. Lead pigment manufacturers must comply with the interim PEL of 100 micrograms per cubic meter of air averaged over an eight-hour time period within three years after the effective date and with the 50 microgram PEL within five years after the effective date.

Following the initial determination of employee exposure levels, employers must begin implementing engineering and work practice controls. Until this is done employees must be furnished with respirators in order to comply with the standard. As engineering controls are phased in, respirator use is to be phased out.

Employers whose initial monitoring shows exposures no greater than the *action level* (airborne concentrations of lead of 30 micrograms per cubic meter of air averaged over an eight-hour period without regard to the use of respirators) have no obligation to take further action until changes occur in the workplace which would increase worker exposure to lead.

Written compliance programs detailing the employer's plan to reduce exposure to lead are to be submitted by paint and coatings manufacturers within six months of the effective date; plans made by pigment manufacturers are to be submitted within one year of the effective date.

The standard also includes employee education and training and housekeeping provisions. For further information on this standard contact Bruce Hamill or Pat Hurd, National Paint and Coatings Association, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005.

Service Group Seeks Retired Pigment Chemist For Overseas Project

The International Executive Service Corps (IESC) is currently searching for a recently retired chemist with experience and expertise in quinacridone and cadmium pigments as a volunteer for a two month assignment with an industrial chemical company in India. The advisor would review company procedures to bring about general improvements in the pigment manufacturing process.

The IESC, a partially government-sponsored organization, selectively recruits individuals for project assignments overseas to help the people of less developed countries speed their own economic growth. Since it was organized in 1964, IESC and its volunteer advisors have completed over 7,800 projects in 69 countries of Latin America, the Middle East, Southeastern Europe, Africa, and South and East Asia.

In the current project, the chemist-advisor *and spouse* would travel to Poona, India (near Bombay), with all travel and living expenses paid for during the two-month stay. A translator would be provided and the recruit would work closely with his Indian counterpart in completing the project.

For more information concerning this unique opportunity, contact Mr. Samuel A. Moore, Executive Recruiter, IESC, 622 Third Ave., New York, NY 10017.

CARB Issues Study of Architectural Coatings

The California Air Resources Board (CARB) staff has concluded that the technology for non-flat water-based coatings, while adequate in terms of performance, does not allow for total replacement of solvent-based coatings for all applications in a recently published CARB staff report entitled, "A Study of Architectural Coating Technology in California." The CARB staff's assessment also indicated that the technology for water-based coatings is advancing, and it is expected that water-based coatings can be fully competitive with solvent-based coatings in one or two years.

The review compares available non-flat water-based and low-solvent (high-solids) coatings with conventional (high solvent) coatings in terms of performance and emissions and will be used by the Technical Review Group of the California Air Pollution Control Officers Association, the Environmental Protection Agency and CARB in the discussion of potential modification of current architectural coating rules. The conclusion of the report recommends that the standard for architectural non-flat interior coatings should be set at 350 grams/liter (less water) until September 1982 and reduced to 250 grams/liter (less water) thereafter with special consideration given to small paint manufacturers.

To obtain a copy, contact Chuck Beddow at CARB, 1102 Q Street, P.O. Box 2815, Sacramento, CA 95812.

Battelle Study to Focus on Hazardous Waste Disposal

Resolving America's hazardous waste management problems will be costly, but also can represent some attractive business opportunities, according to researchers at Battelle's Columbia Laboratories.

"The cost of containing and cleaning up abandoned and active hazardous dump sites is estimated at $50 billion," says Battelle's David A. Sharp, "and 60 million tons of new hazardous wastes are generated each year. Many companies view hazardous waste disposal as their biggest future problem, and cite that this could deter expansion, slow new product development, and have a major impact on profitability and prices."

Battelle is proposing to evaluate business opportunities and technologies associated with the generation, handling, processing, and disposal of hazardous waste in the United States.

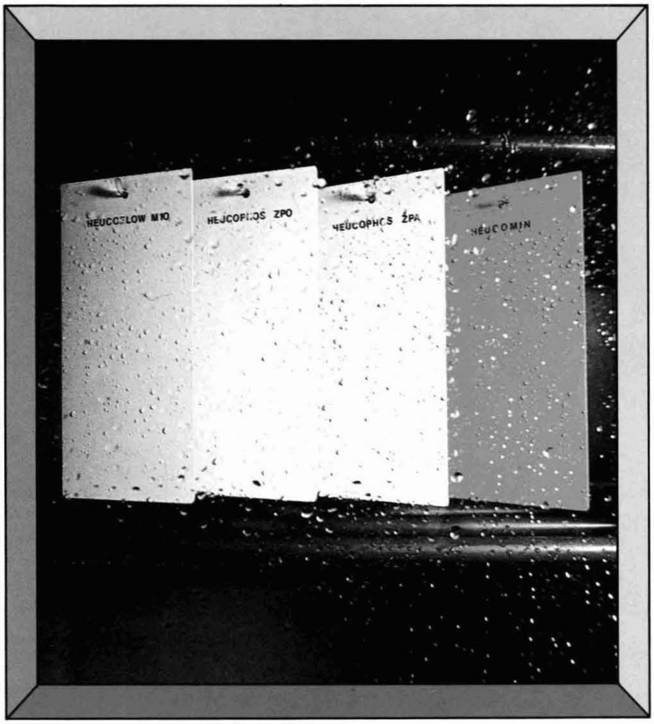
As part of a seven-month study to be sponsored by a number of companies, researchers will analyze the developing hazardous waste management industry, market opportunities, present and developing technologies, and economic constraints facing the industry.

Researchers will collect and analyze information on worldwide hazardous waste management technology and survey several hundred U.S. and foreign firms to obtain data on their present and future products and processes.

Membership in the study is available for an investment of $4,500. Additional information may be obtained from David A. Sharp, Battelle's Columbus Laboratories, 505 King Ave., Columbus, OH 43201.

Improved Health and Safety
at Work without
Loss of Efficiency

HEUCOPHOS ZPO
HEUCOPHOS ZPA
HEUCOFLOW M 10
HEUCOMIN 5



HEUCOPHOS ZPO
HEUCOPHOS ZPA

New
Pigm
Indu

New Anticorrosive Pigments on Phosphate Base

In a test the new HEUCOPHOS-Pigments have been compared with high quality zinc chromates and zinc phosphates.

Test Conditions:

Sand blasted sheet metal was coated to 50 ± 5 micron dry film thickness and then weather exposure tests were done.

Pigmentation:

40 vol. % Anticorrosive Pigment
25 vol. % Barium sulphate
25 vol. % Talcum
10 vol. % Titanium dioxide

Binding Agents:

Alkyd resin and Epoxy Esters
In order to guarantee the comparability of the pigments the free binding agent Q = PVK/KPVK has been held constant.

Results:

In the salt spray test better results were achieved in both binding agents for HEUCOPHOS ZPO and ZPA compared to zinc phosphate and same results compared to zinc chromate. In the Kesternich test ZPO and ZPA exceed zinc chromate and zinc phosphate in both cases. The good test results are based on the special analysis, the exactly defined particle size distribution as well as on the optimal pigment surface of ZPO and ZPA pigments. These facts combined with the binding agents lead to effective adhesive and inhibitory complexes on metal substrates.

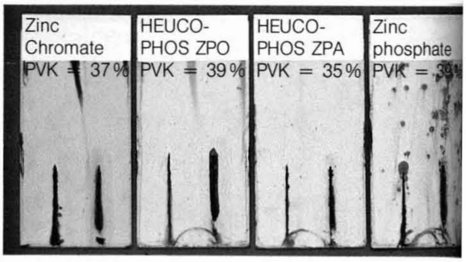
Alkyd resin	Zinc Chromate	HEUCO-PHOS ZPO	HEUCO-PHOS ZPA	Zinc Phosphate
Salt spray test	80	70	80	40
Kesternich test	20	70	70	40

▲▼ Rating Numbers: 100 = very good, 0 = bad ▲▼

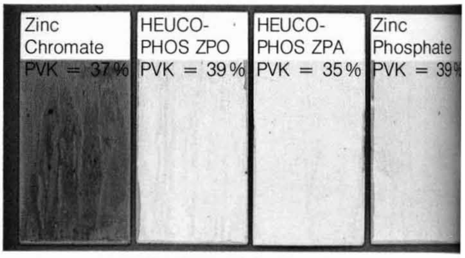
Epoxy Esters	Zinc Chromate	HEUCO-PHOS ZPO	HEUCO-PHOS ZPA	Zinc Phosphate
Salt spray test	90	90	75	35
Kesternich test	20	80	85	60

Resume of the criterions for review of protective effect according to DIN 53209, 53151, 53167

Aklyd resin, modified wood oil – tall oil – oil length 4

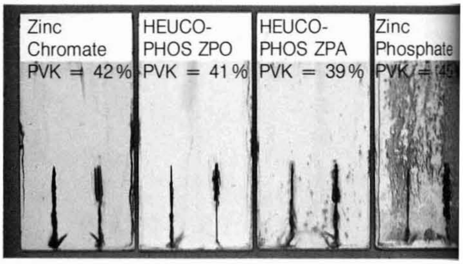


Salt spray test DIN 50021 – 300 h

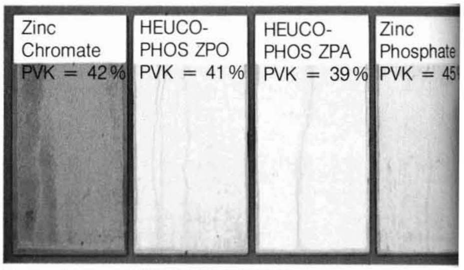


Kesternich test DIN 50018 1.0 S-10 cycles

Epoxy Esters (Q = 0,8)



Salt spray test DIN 50021 – 300 h



Kesternich test DIN 50018 1.0 S-10 cycles

rosive
Higher
ygiene

HEUCOFLOW M 10

Zinc Chromate Paste, free of binding agents

HEUCOFLOW M 10 zinc chromate paste eliminates the former industrial hygienic stress as the zinc chromate no longer exists in respirable form.

HEUCOFLOW M 10 zinc chromate paste is an alternative to zinc chromate in powder form without any risks and an immediate replacement.

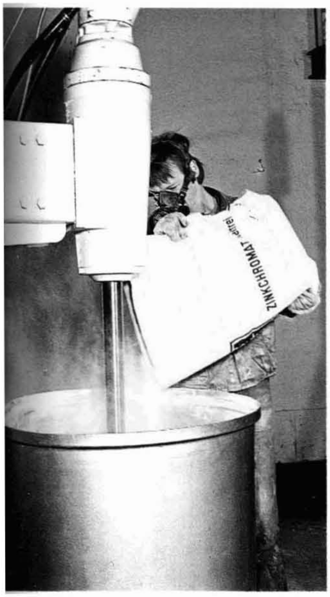
HEUCOFLOW M 10 zinc chromate paste is free of binding agents, has a 75 % pigmentation and with it's 23 % share of solvents it can fit into existing zinc chromate recipes without any problem.

HEUCOFLOW M 10 zinc chromate paste shows a Grindometer fineness of below 15 microns for dissolver handling.

Technical Data:

COMPOSITION		HEUCO-FLOW M 10
ZINC CHROMATE M 10	± 1%	75
Aromatics	%	23
Montmorillonites	%	2
Density of Paste	g/cm³	2
Grindometer Fineness	µm	15

COMPOSITION		ZINC CHRO-MATE M 10
CrO_3	%	43,5
ZnO	%	39,0
K_2O	%	10,0
Cl	%	0,02
SO_4	%	0,03
wsl. CrO_3	g/100 cm³/10 g	0,08
Conductivity	m S/cm	1,8
Density	g/cm³	3,5



Reply Card

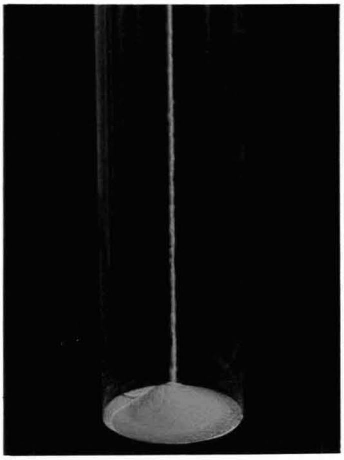
Please send me a 500-g-sample each of

☐ HEUCOPHOS ZPO
☐ HEUCOPHOS ZPA
☐ HEUCOFLOW M 10
☐ HEUCOMIN 5
☐ general information on the Heubach-Group

Remarks: ______________________________

The way to meet
OSHA's 50 µm
lead exposure limit

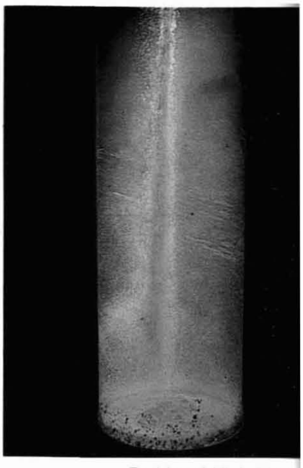
HEUCOMIN 5



HEUCOMIN 5

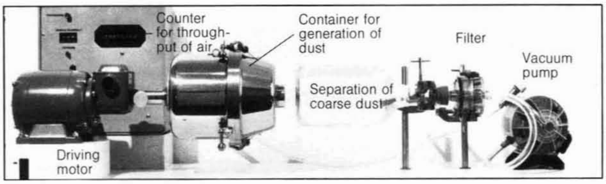
TECHNICAL DATA		Red Lead	
		HEUCOMIN	HIGH DISP.
Dusting Properties	**mg/100g**	**< 5**	**> 100**
PbO_2	%	> 33,5	> 33,5
Pb_3O_4	%	> 96,0	> 96,0
Density	g/cm³	9	9
Bulking volume	g/ml	1,4	1,4
Tamped volume	g/ml	2,6	2,6
Loss on ignition 750° C	%	0,8	–
Residue on Sieve 63 µm	%	0,1	0,1
Ø particle size (DZV)	µm	0,7	0,7
Oil Absorption	g/100 g	5,0	5,5

DZV = central value of volume distribution acc. to electronic microscope



Red Lead High Dispers

Equipment for Dust Measurements



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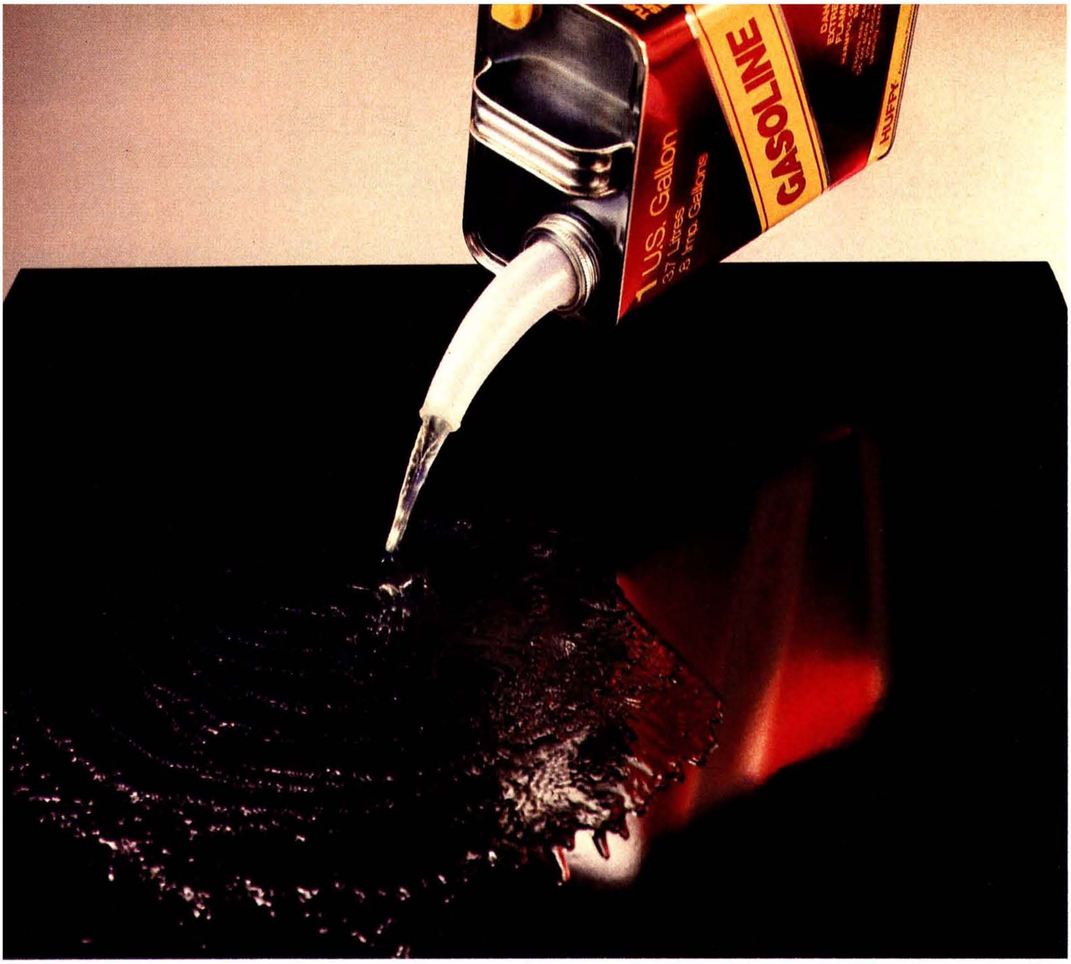

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PROCEEDINGS/NUMBER 148

Melanin Biosynthesis In *Aureobasidium Pullulans*

Donald J. Siehr
University of Missouri-Rolla*

The organism associated with the mildew defacement of organic coatings is *Aureobasidium pullulans*. Evidence is presented here to suggest that the melanin pigment synthesized by *A. Pullulans* is formed from acetate via the intermediate 1,3,6,8-tetrahydroxynapthalene. When *A. pullulans* is grown in a medium containing tricyclazole, 2-hydroxyjuglone and flaviolin accumulate in the medium.

INTRODUCTION

Aureobasidium pullulans has been pinpointed as the organism responsible for the unsightly pigmentation of organic coatings.[1] The black, polymeric, pigment produced by this organism is referred to as a melanin. Other fungi also produce black pigments and over the years researchers suspected that the melanin produced by many fungi differs from that produced by animals. The animal pigment differs from the fungal melanin[2] in that it contains about 8% nitrogen and indoles are found in the products obtained from alkali fusion of the pigment. Fungal melanins have been found to contain much less nitrogen and catechol is liberated from them during alkali fusion.

Studies on *Verticillium dahliea*[3] done by a group at the National Cotton Pathology Research Laboratories (NCPRL) SEA, USDA have uncovered a biological pathway to fungal melanin that may be common amongst the fungi. These workers have isolated a compound, scytalone (III, Figure 2), from a brown mutant, brm-1, of *V. dahliea*. When scytalone is fed to an albino mutant (alm-1) of *V. dahliea* the albino produces a black pigment. Besides scytalone several other compounds were isolated from the brm-1 mutant. Two of these compounds were napthoquinones, 2-hydroxy juglone (VI, Figure 2) and flaviolin (VII, Figure 2).[3]

A systemic fungicide, tricyclazole (I, *Figure* 1), is effective in controlling blast disease in rice. Tokousbalides and Sisler[4] found that tricyclazole prevented melanin formation in *V. dahliea* wild type and caused the accumulation of 2-hydroxy juglone, flaviolin, and small quantities of scytalone in the growth medium.

When *A. pullulans* is grown on an agar medium to which tricyclazole has been added a red brown pigment is excreted into the medium. The identity of this pigment is the subject of this paper.

EXPERIMENTAL

Source of Chemicals

A strain of *A. pullulans*, NRRL-Y-2567, was obtained from Dr. Kurtzman at the Northern Regional Research Laboratory (NRRL), Peoria, IL. *V. dahliea* strains alm-1 and brm-1 were supplied by Dr. Bell, NCPRL. Tricyclazole was a gift from Eli Lilly Company. Scytalone was isolated from cultures of *V. dahliea* brm-1. Flaviolin and 2-hydroxyl juglone were prepared from scytalone by procedures described in the literature.[3] An authentic sample of flaviolin was supplied by Dr. Michael Wheeler, NCPRL.

Culture of Organism

A. pullulans was grown on a nitrate medium.[5] For the inhibition of melanin and production of red-brown pigment, tricyclazole was dissolved in 95% ethanol and

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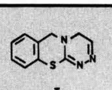

I

Figure 1—Tricyclazole

added to the medium. The volume of alcohol used to dissolve the tricyclazole was less than 1% of the volume of the medium. One hundred milligrams of tricyclazole was added to one liter of hot medium to give a concentration of tricyclazole of 100 parts per million. The medium was then dispersed into sterile petri dishes.

Recovery of Pigments

The agar containing the excreted pigment was cut into small squares (ca. 1 cm) and extracted with acetone. Acetone was used to cover the agar pieces and allowed to remain in contact for one hour. The acetone was decanted and fresh acetone added. Again the acetone was decanted. The extraction was repeated one more time but for four hours this time. The combined acetone extract was evaporated under vacuum to remove the acetone. The residual aqueous solution was adjusted to pH3 with 85% H_3PO_4 and saturated with NaCl. This solution was then extracted three times with equal volumes of ethyl acetate. The ethyl acetate extract was dried over Na_2SO_4 overnight, filtered through glass wool and concentrated under vacuum to an oil. This residue was taken up in ethanol to give a dark brown solution.

Chromatography

Analytical chromatograms were run on E. Merck (Brinkman) prepared silica gel plates containing activated ZnS. The solvent systems used were (A) diethylether, hexanes, formic acid (60:40:1) and (B) chloroform, methanol (9:1). Preparative chromatograms were run on 2 mm prepared silica gel plates obtained from Analabs. Visible and ultraviolet spectra were obtained on a Perkin Elmer Model 552 spectrophotometer. Mass spectra were obtained on a Jelco DMS-100 mass spectrometer with a dedicated minicomputer.

RESULTS

The amount of tricyclazole used to inhibit melanin synthesis in *A. pullulans* (100 ppm) was considerably higher than that used with other fungi.[4] Even at the concentration used, the melanin biosynthesis was not completely repressed since the culture still appeared dark in color.

Thin layer chromatography (TLC) of the ethonalic solution of the agar extract separated the mixture into two yellow colored spots. When the TLC plate was viewed under ultraviolet light the two colored spots absorbed at 254 nm and a third absorbing spot was observed. This later spot when viewed at 356 nm fluoresced yellow. This behavior is characteristic of scytalone and other tetralones.

Half of the ethanolic solution was streaked onto two 20 × 20 preparative plates and developed with solvent A. After development, the portions of the TLC plates containing the yellow colored compounds and the UV absorbing material were scraped off. The recovered silica gel from individual bands was then placed in small chromatographic columns made by stuffing glass wool into Pasteur pipettes.

The pigments were eluted from the silica gel with a mixture of diethylether, ethyl acetate, and ethanol (12:12:1). On evaporation of the solvent, crystalline solids separated.

The material which had the greater R_f on a silica gel TLC plate with either solvent A or B, had the same mobility as 2-hydroxyjuglone prepared by the oxidation of scytalone.[3] A solution of the unknown in ethanol had the same adsorption in the visible and ultraviolet as 2-hydroxyjuglone. Further, the fragmentation pattern of the unknown in a mass spectrometer corresponded to that of 2-hydroxyjuglone.

Likewise, the slower moving colored material had a mobility identical to that of an authentic sample of flaviolin on a silica gel TLC plate developed with solvent A. The fragmentation patterns of the unknown and authentic flaviolin were the same. Visible and ultraviolet adsorption spectra of the unknown matched that of flaviolin.

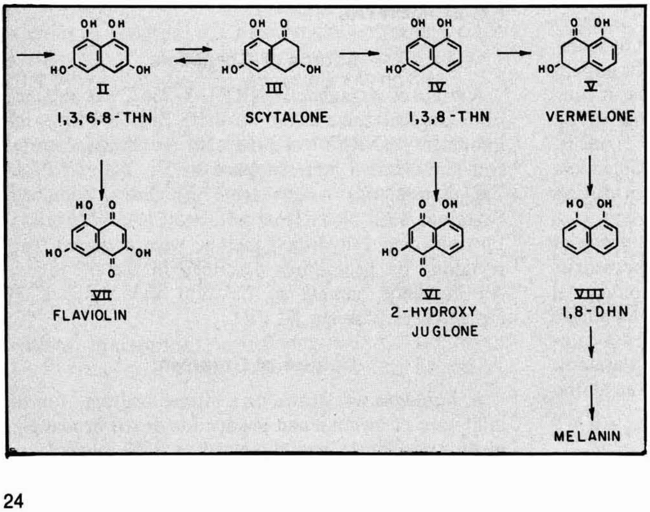

Figure 2—Portion of biosynthetic pathway for melanin production in *Verticillium dahliea*. Tricyclazole blocks the conversion of scytalone (III) to 1,3,8-trihydroxynapthalene (IV) and Vermelone (V) to 1,8-dihydroxynapthalene. This causes the accumulation of flaviolin (VIII) and 2-hydroxyjuglone (VI)

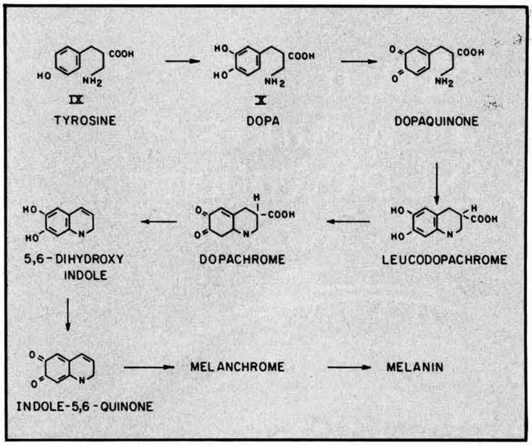

Figure 3—Pathway for melanin biosynthesis from tyrosine. The formation of DOPA (X) and Dopaquinone are enzymic catalyzed reactions. The other steps may be either enzymic or nonenzymic

On this basis, it is concluded that *Aureobasidium pullulans* grown in the presence of tricyclazole excretes 2-hydroxyjuglone and flaviolin.

Evidence for the presence of scytalone in the products excreted by tricyclazole poisoned *A. pullulans* was also obtained. A substance with the R_f of scytalone was observed on TLC plates when the mixture was chromatographed. This spot absorbed 254 nm UV light and fluoresced yellow in 365 nm light. Further characterization was not attempted since only a small amount of this substance was present.

DISCUSSION

Tokoushalides and Sisler[4] have concluded from their studies on the effect of tricyclazole on melanin synthesis in *Verticillium dahliea* that the antibiotic blocks the conversion of 1,3,8 trihydroxy napthalene (IV, 1,3,8-THN, *Figure* 2) to vermelone (V, *Figure* 2) and interferes with the production of scytalone from 1,3,6,8 tetrahydroxy napthalene (II, 1,3,6,8-THN; *Figure* 2). The first site of inhibition causes 1,3,8 trihydroxynapthalene to be converted to 2-hydroxyjuglone while the second brings about the formation of flaviolin from 1,3,6,8 tetrahydroxynapthalene. In *V. dahliea* it is proposed that vermelone gives rise to 1,8-dihydroxynapthalene (VIII, 1,8-DHN) which is in turn polymerized to melanin (*Figure* 2).

Since 2-hydroxyjuglone and flaviolin are both produced when *A. pullulans* is grown in the presence of tricyclazole, it can be assumed that the pathway to melanin in *A. pullulans* resembles that in *V. dahliea.*

This pathway to melanin production is not the only one present in fungi. The mushroom, *Agaricus bisporus*, is the source of the enzyme, tyrosinase, which catalyzes the conversion of tyrosine (IX) to melanin (*Figure* 3). Dihydroxyphenylalanine (X) (DOPA) is also a substrate for this enzyme and is often used as a substrate in the assay of tyrosinase activity. Our attempts to demonstrate tyrosinase activity using either tyrosine or DOPA with cell free preparations of *A. pullulans* were unsuccessful. It may be that *A. pullulans* does not form melanin from tyrosine but only from 1,3,8 trihydroxynapthalene.

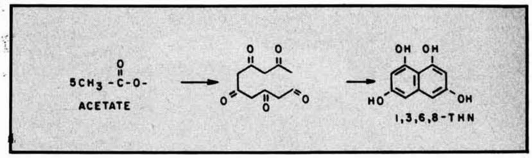

Figure 4—Polyketide synthesis from the head-to-tail condensation of acetate. The product 1,3,6,8-tetrahydroxynapthalene is compound II in *Figure* 2

Melanin formation in *A. pullulans* appears to be correlated with suboptimum growing conditions. Thus, on a medium rich in amino nitrogen *A. pullulans* produces melanin only slowly if at all. On a painted surface access to nutrients is limited for *A. pullulans* and it rapidly produces melanin.

The pathway to melanin via scytalone involves a polyketide precursor. Polyketides are derived from the head to tail condensation of acetate residues in a fashion similar to that in fatty acid biosynthesis (*Figure* 4). In the polyketide, however, the carbonyl functions are either not reduced or are reduced only after cyclization. *A. pullulans* growing on a painted surface probably has greater access to acetate than amino acids and the formation of melanin pigment by way of the polyketide pathway seems logical. Acetate as such might not be present in the paint film but could be a metabolic product produced by *A. pullulans* from carbon sources in its environment.

ACKNOWLEDGMENTS

The research described in this paper was supported in part by a Paint Research Institute, Mildew Defacement Grant.

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Extender Pigments in Latex Wall Paints

Louisville Society for Coatings Technology
Technical Committee

A study was undertaken for the purpose of characterizing the effect of extender pigments on critical properties of latex wall paints.

A review of available extenders was made and a list of representative materials compiled. These extender pigments were then evaluated in a typical flat latex wall paint at 50 and 60 PVC. Tests were run on each paint to check properties such as scrub resistance, sheen, stain resistance, and hiding power.

Data collected from this work allows correlations to be drawn about the effect of extender pigment type and particle size on specific paint film properties.

INTRODUCTION

The proper selection of extender pigments is vital to successful paint formulation. While representing a relatively small percentage of total raw material cost, extender pigments can have profound positive and negative effects on many paint properties. For this reason the Louisville Society undertook the project of characterizing the effect of a number of common extender pigments on important properties of flat latex wall paints.

EXPERIMENTAL PROCEDURE

A review of currently available extender pigments was made and 17 pigments selected for the study. These extenders represented various pigment types and particle sizes.

Test Formula

Evaluations were made in typical latex wall paint formulas at 50 and 60 PVC. Formulas using calcium carbonate as the sole extender were used as controls (see *Table* 1). Each extender pigment was substituted for a portion of the calcium carbonate on an equal volume basis, thus maintaining the same PVC in all paints. It should be recognized that the effective PVC will vary from paint to paint due to differences in the binder demand of each pigment. Levels of use for each pigment were determined after consulting the manufacturers' recommendations which would generally take into consideration the specific pigments' binder demand (See *Table* 2).

Formulas, evaluation procedures, and raw material samples were distributed to eight companies within the Louisville Society. Each was also provided with a reference standard to insure consistency in the results of each laboratory.

Evaluations

Stormer viscosity, weight per gallon, and fineness of grind were checked on all paint samples to insure that each was, in fact, a reasonable paint formula and had been manufactured correctly. It would have been

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Presented by Donald Collier at the 58th Annual Meeting of the Federation of Societies for Coatings Technology, October 30, 1980, in Atlanta, GA.

Table 1—Formulations of Standards A and B

	Standard A (50 PVC)		Standard B (60 PVC)	
	lb	gal	lb	gal
Water	300.0	36.01	300.0	36.01
Ethylene Glycol	25.0	2.69	25.0	2.69
Natrosol® 250MBR	6.5	0.58	7.5	0.67
Tamol® 731	6.0	0.65	6.0	0.65
Igepal® CO-630	4.0	0.45	4.0	0.45
PMA 100	0.1	0.01	0.1	0.01
Colloid 677	2.0	0.27	2.0	0.27
Ti-Pure® R-931	200.0	6.41	175.0	5.61
Atomite®	237.9	10.54	280.0	12.39
Texanol®	12.0	1.52	12.0	1.52
Amsco-Res® 661	275.0	30.39	186.0	20.55
Water	83.9	10.07	156.4	18.77
Colloid 677	3.0	0.41	3.0	0.41
	1155.4	100.00	1157.0	100.00

Table 2—Extender Pigments

Pigment	Level in 50 PVC Formula (lb/100 gal)	Level in 60 PVC Formula (lb/100 gal)
Hydrous aluminum silicate (0.55μ)	125.0	176.0
Delaminated aluminum silicate (1.0μ)	125.0	178.0
Hydrous aluminum silicate (0.7μ)	125.0	176.0
Hydrous aluminum silicate (4.0μ)	125.0	176.0
Diatomaceous silica	50.0	50.0
Calcium carbonate (10.0μ)	130.0	185.0
Precipitated calcium carbonate (1.1μ)	130.0	185.0
325 mesh water ground mica	135.5	192.5
Precipitated amorphous silica (0.12μ)	50.0	50.0
Amorphous silica (94% less than 40μ)	127.5	181.0
Anhydrous sodium potassium aluminum silicate (7.5μ)	125.0	177.5
Anhydrous sodium potassium aluminum silicate (4.5μ)	125.0	177.5
Calcined aluminum silicate (0.9μ)	126.5	179.5
Thermo optic aluminum silicate (1.4μ)	106.0	150.0
Calcined aluminum silicate (2.0μ)	126.5	179.5
Talc (2.0μ)	134.5	191.0
Talc (7.0μ)	137.0	194.5

unreasonable to evaluate each formula variation for all paint properties. Several tests were therefore chosen to evaluate properties felt to be most critically influenced by extender pigments. These were scrub resistance, hiding (contrast ratio), film porosity, sheen, and burnish resistance.

SCRUB RESISTANCE: Scrub resistance was tested following ASTM D 2486-74a. This test method involved using a Gardner Scrub Machine to wash a paint film until a specified amount of erosion occurred. A scrub index was calculated for each test paint by dividing the number of cycles at failure by the number of cycles causing failure of the standard. Thus, a test formula having a 0.75 index withstood only 75% of the number of cycles required for failure of the standard (See *Tables* 3 and 4).

HIDING: Hiding was measured by determining the contrast ratio of each test paint. Again, an index was calculated by dividing the contrast ratio of the test paint by that of the standard. Thus, test paints having indexes greater than 1.00 gave a higher contrast ratio than the standard (see *Tables* 3 and 4).

POROSITY: Film Porosity was included in the evaluation as an indication of how resistant the film is to staining. Less stain penetration indicated the surface can be washed more easily, removing dirt and stains without damage to the film.

The procedure used was ASTM D 3258-73, which involved measuring the reflectance of a film before and after applying a penetrating medium. Again an index was calculated vs the standard to simplify the results. Numbers greater than 1.00 indicated a greater change in reflectance than the standard and, therefore, greater film porosity (see *Tables* 3 and 4).

SHEEN: Sheen of each test film was determined by ASTM D 523-67 using an 85° angle of measurement (see *Tables* 3 and 4).

BURNISHING: Burnish resistance was determined by washing the films on a Gardner Scrub Machine for 300 cycles. The sheen of each panel before and after washing is reported in *Tables* 3 and 4. Large changes in sheen would result in poor appearance due to poor uniformity.

RESULTS

By examining *Tables* 3 and 4, the formulator can determine what positive and negative effects each extender will have. Listed below are some general conclusions which can be drawn from this data.

Scrub Resistance

Only the sodium potassium aluminum silicates and the large particle size amorphous silica gave better scrub resistance than the calcium carbonate controls. The hydrous and delaminated aluminum silicates gave poorer scrub resistance than the calcined clays. The negative effect of the aluminum silicates on scrub resistance was more pronounced at the higher PVC level.

Table 3—50% P.V.C.

Pigment	Scrub	Hiding	Porosity[a]	Sheen	Burnishing[b]	Cost per gallon vs standard
Standard Calcium carbonate (2.5μ)	1.00	1.00	1.00	2	2.5/5.0	—
Hydrous aluminum silicate (0.55μ)	0.46	1.03	1.85	9	6.0/10.0	+6.4¢
Delaminated aluminum silicate (1.0μ)	0.46	1.02	1.60	6	9.0/21.0	+4.3¢
Hydrous aluminum silicate (0.7μ)	0.52	1.01	1.49	8	12.5/22.0	+3.1¢
Hydrous aluminum silicate (4.0μ)	0.74	0.998	0.98	2	1.0/4.0	+1.4¢
Diatomaceous silica	0.80	1.01	1.15	1	1.0/3.5	+4.2¢
Calcium carbonate (10.0μ)	0.96	1.00	1.10	2	2.5/6.0	−1.7¢
Precipitated calcium carbonate (1.1μ)	0.66	1.05	1.64	5	4.0/16.0	+3.8¢
325 mesh water ground mica	0.43	1.04[c]	0.99	1	1.0/4.0	+14.5¢
Precipitated amorphous silica (0.12μ)	0.60	1.03	3.11	5	5.0/14.0	+10.3¢
Amorphous silica (94% less than 40μ)	1.11	0.997[d]	1.27	<1	1.0/1.5	−2.0¢
Anhydrous sodium potassium aluminum silicate (7.5μ)	1.26	0.989	0.90	1	1.0/3.0	+2.0¢
Anhydrous sodium potassium aluminum silicate (4.5μ)	1.18	0.990	1.10	1	2.0/4.0	+2.5¢
Calcined aluminum silicate (0.9μ)	0.71	1.03	1.96	13	12.5/20.0	+15.3¢
Thermo optic aluminum silicate (1.4μ)	0.77	1.02	1.96	4	4.0/7.0	+9.0¢
Calcined aluminum silicate (2.0μ)	0.76	1.02	1.84	6	5.0/8.0	+6.8¢
Talc (2.0μ)	0.44	1.01	1.50	5	4.0/7.5	+3.5¢
Talc (7.0μ)	0.98	0.996	0.95	2	1.0/2.0	−0.8¢

(a) Higher numbers indicate greater change in reflectance, hence greater porosity.
(b) Initial sheen/sheen after wash.
(c) Gray color.
(d) Slightly gray color.

Table 4—60% P.V.C.

Pigment	Scrub	Hiding	Porosity[a]	Sheen	Burnishing[b]	Cost per gallon vs standard
Standard Calcium carbonate (2.5μ)	1.00	1.00	1.00	2	2.0/7.0	—
Hydrous aluminum silicate (0.55μ)	0.20	1.03	1.21	15	7.0/9.5	+8.9¢
Delaminated aluminum silicate (1.0μ)	0.15	1.04	1.35	9	7.0/16.0	+6.2¢
Hydrous aluminum silicate (0.7μ)	0.22	1.03	1.39	12	16.0/35.0	+4.4¢
Hydrous aluminum silicate (4.0μ)	0.49	1.02	1.02	1.5	1.0/5.0	+1.9¢
Diatomaceous silica	0.65	1.01	1.36	1	1.0/5.0	+4.2¢
Calcium carbonate (10.0μ)	0.86	0.994	1.12	2	2.0/5.5	−6.7¢
Precipitated calcium carbonate (1.1μ)	0.42	1.02	1.75	5	6.0/26.0	+5.5¢
325 mesh water ground mica	0.21	1.04[c]	1.46	1	1.0/4.5	+20.6¢
Precipitated amorphous silica (0.12μ)	0.54	1.02	1.39	4	5.0/15.0	+10.3¢
Amorphous silica (94% less than 40μ)	1.29	0.996[d]	0.75	<1	1.0/1.5	−2.8¢
Anhydrous sodium potassium aluminum silicate (7.5μ)	1.14	0.989	0.75	1	1.0/3.0	+2.8¢
Anhydrous sodium potassium aluminum silicate (4.5μ)	1.21	0.993	0.76	1	1.2/4.0	+3.5¢
Calcined aluminum silicate (0.9μ)	0.30	1.04	1.42	12	20.0/45.0	+21.7¢
Thermo optic aluminum silicate (1.4μ)	0.33	1.04	1.51	5	6.0/17.0	+12.7¢
Calcined aluminum silicate (2.0μ)	0.30	1.05	1.50	6	10.0/26.0	+9.7¢
Talc (2.0μ)	0.20	1.04	1.62	6	7.0/28.0	+5.1¢
Talc (7.0μ)	0.90	1.02	1.16	1	2.0/5.5	−1.1¢

(a) Higher numbers indicate greater change in reflectance, hence greater porosity.
(b) Initial sheen/sheen after wash.
(c) Gray color.
(d) Slightly gray color.

Hiding

The smaller particle size extenders gave the greatest improvement in hiding. The positive effect of the aluminum silicates was more pronounced at the higher PVC level. All extenders gave equal or better hiding than the controls with the exception of the large particle silica and the sodium potassium aluminum silicates.

Film Porosity

The calcium carbonates and sodium potassium aluminum silicates generally had the least stain penetration. The amount of variation in porosity was greater at the lower PVC level indicating that at higher PVC's the effect of the individual pigments on porosity is minimal due to the inherently high degree of film porosity of any high PVC latex wall paint.

Burnishing

The large particle size silica and the clays, particularly the calcined clays, showed the best burnish resistance.

SUMMARY

As is generally the case in paint formulations, extenders must be selected to achieve the best balance of properties. The information from this study can be used in choosing the extender pigments to obtain the paint properties required of a specific formulation. It should be noted that these results should be used only as a general guide since no attempt was made to optimize the effect of any of the extenders involved.

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Trademark References

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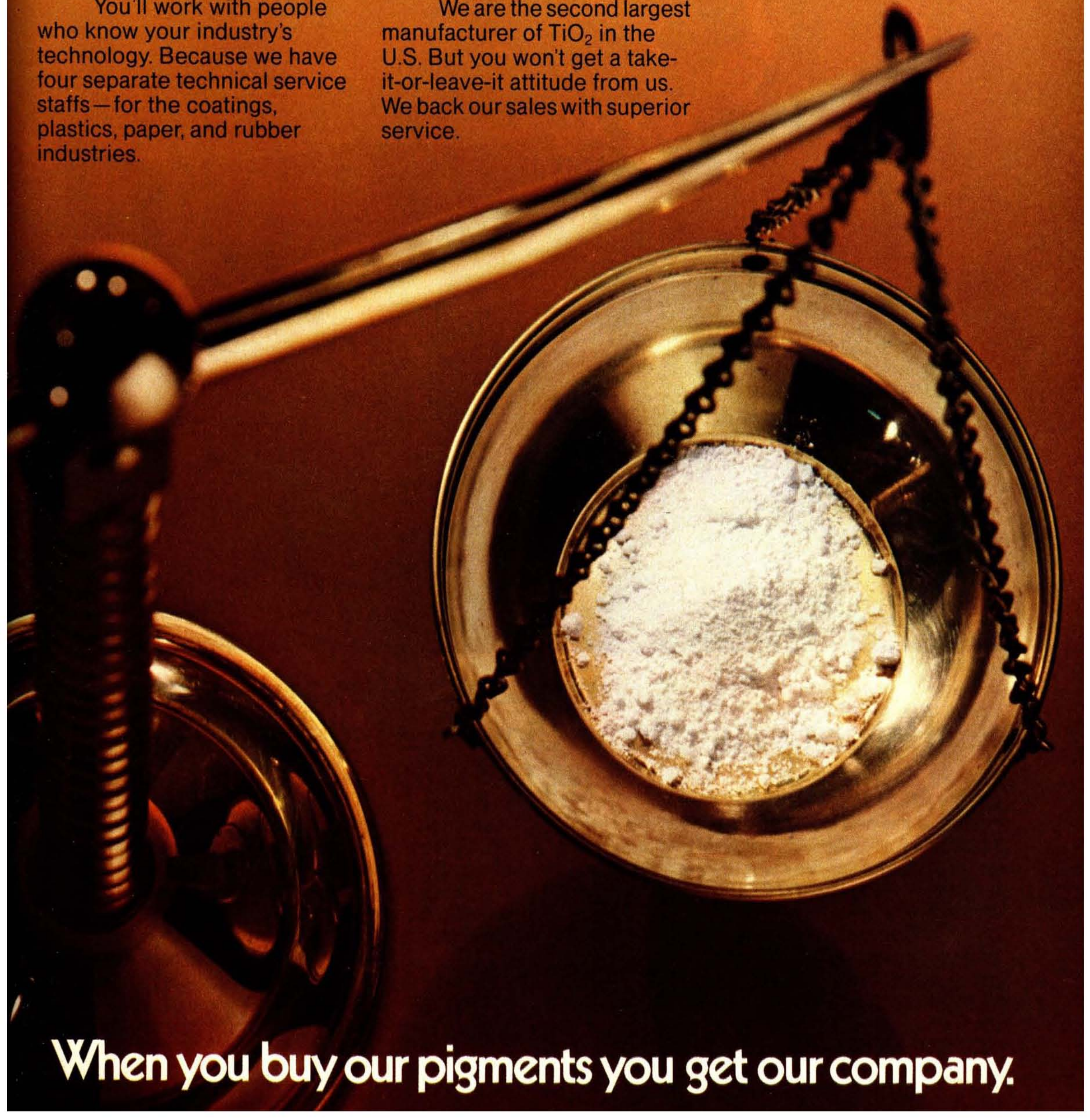
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Optimizing Resins for Low VOC

Stephen N. Belote and William W. Blount
Eastman Chemical Products, Inc.*

Volatilization of low molecular weight resins designed for high-solids coatings can cause a significant differential between calculated solids and determined solids of coatings. The resin that is volatilized is not as effective at reducing coatings viscosity as solvents, yet has to be considered volatile under the new EPA guidelines. It was theorized that an optimum average molecular weight exists for a combination of resin raw materials at which VOC at the same viscosity cannot be reduced by lowering resin molecular weight.

Six polyester resins of the same composition but with varying molecular weights were evaluated for VOC at the same viscosity with various catalyst levels and cure temperatures. An optimum molecular weight was determined. It was further determined that the effects of catalyst level and cure temperature on VOC were significant.

INTRODUCTION

The coatings industry has and is continuing to develop high-solids coatings to comply with evolving federal, state, and local air pollution control regulations. For purposes of this work, high-solids coatings are defined as having a nonvolatiles level approaching 75–80 wt% solids or volatile organic compounds (VOC) approaching 2.8 lb/gal of coating. The high-molecular-weight resins used in the binders of conventional low-solids (20–50 wt% solids), solvent-reduced coatings generally cannot be used in the new high-solids coatings. Removing solvent from the conventional coatings formulation achieves high solids or low VOC but results in coatings with extremely high viscosities. For conventional application equipment, a low viscosity is essential for proper application, leveling, and flow of the coatings.

To achieve high-solids coatings at a usable application viscosity, resins had to be developed that do not require as much solvent to reach the desired application viscosity. The obvious method of achieving this goal is to lower the molecular weight or degree of polymerization of the binder resins. A low-molecular-weight resin with lower viscosity should not require as much solvent as a similar high-molecular-weight resin to achieve a sufficiently low viscosity for application of coatings.

Some commercial high-solids resins have been found to partially volatilize during baking at temperatures required for curing amino crosslinking resins.[1] The significant difference in solids is most likely due to the volatilization of the low-molecular-weight fractions of resin or unreacted monomers that have previously been considered as nonvolatile material. This volatilization of fractions reduces the projected higher solids content that was the objective of lowering the resin molecular weight. The EPA Control Technique Guidelines[2] require that the nonvolatiles actually be determined and not simply calculated from the amount of solvent added. Therefore, the resin volatile fractions will be considered the same as organic solvents in the VOC regulations. The organic solvents added to high solids coatings are more effective at reducing solution viscosities than are the volatile resin fractions.

It was theorized that a point of diminishing returns might exist at which lowering the molecular weight of a resin formulation to achieve higher solids does not increase the solids or lower the determined VOC at viscosities required for proper application. Furthermore, the highest possible molecular weight for any given resin is usually optimum for achieving the best overall properties of the cured enamel. The objective of this work was to determine the optimum molecular weight for achieving the lowest VOC independent of coatings

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*Kingsport, TN 37662.

Presented at the Water-Borne & Higher Solids Coatings Symposium, February 25-27, 1981 in New Orleans, LA.

Table 1—Properties of High-Solids Polyester Resins for VOC vs Number Average Molecular Weight

Resin Number	1	2	3	4	5	6
% Excess hydroxyl	15	20	30	52	70	100
Theoretical Mn @ 10 acid number	1255	1005	756	500	401	315
Determined Mn (VPO)[a]	1382	1158	978	728	643	601
Determined Mn (SEC)[b]	1171	949	913	632	585	521
Determined Mw (SEC)	2268	1793	1500	950	800	688
Determined acid number	7	9	7	11	10	4

(a) Vapor Pressure Osmometry.
(b) Size Exclusion Chromatography.
Constants: Composition—NPG® Glycol/Phthalic Anhydride/Adipic Acid Molar Ratio of Phthalic Anhydride/Adipic Acid—3/1
Variables: Excess NPG Glycol Varied to Achieve Range of Molecular Weights

properties of a polyester resin based on NPG® glycol (2,2-dimethyl-1,3-propanediol).

EXPERIMENT

Resin

Six linear polyester resins with the basic composition of NPG glycol, phthalic anhydride, and adipic acid were synthesized in the laboratory, keeping the ratio of phthalic anhydride to adipic acid constant, and varying the excess hydroxyl level to achieve a range of molecular weights (see *Table* 1). The theoretical number average molecular weights (Mn) ranged from 315 to 1255, corresponding to excess hydroxyl levels of 100% to 15%. The Mn values, as determined by the vapor pressure method (VPO), ranged from 600 to about 1400. Mn by size-exclusion chromatography (SEC) ranged from 500 to 1200 and weight-average molecular weight (Mw) from 700 to 2300. All further references to Mn values in this paper are those determined by the VPO method.

A portion of each of the experimental resins was dissolved in xylene to achieve a resin to xylene ratio of 80:20 weight percent. Gardner-Holdt viscosities of the resin solutions were determined. *Figure* 1 shows the effect on viscosity of lowering the Mn of a resin from 1400 to 600 at constant theoretical solids level. As expected, lowering the Mn of the resin resulted in lower viscosities.

The nonvolatiles of the resin/xylene solutions were determined without a crosslinking resin present. The

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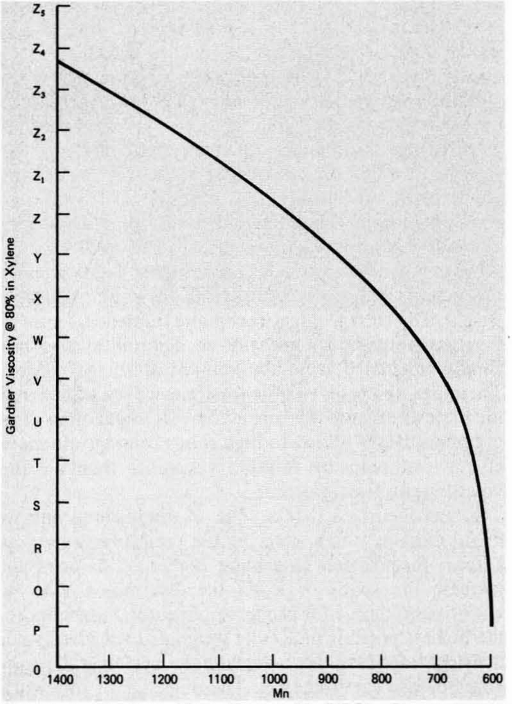

Figure 1—Gardner Viscosity vs Mn (VPO). Resin: NPG® Glycol/PA/AD. Theoretically 80.0 wt.% Solids

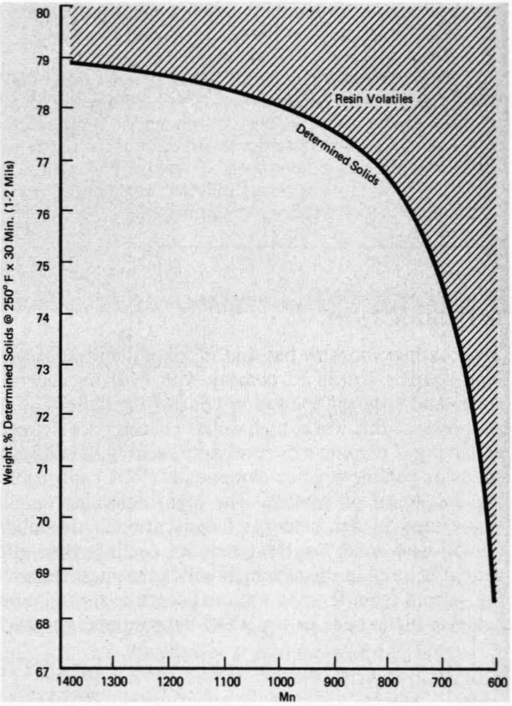

Figure 2—Determined solids vs Mn (VPO). Resin: NPG® Glycol/PA/AD. Theoretically 80% Solids

method used was a modified version of ASTM D 2369. The nonvolatiles were determined at 121°C (250°F) for 30 minutes with a volume of resin solution sufficient to obtain a dry film thickness of 1-2 mils (25-50 μm). This test is thought to be representative of the actual cure conditions used in a typical amino-resin, crosslinked polyester enamel and representative of the actual VOC emitted from the enamel on a typical surface finishing production line. To achieve a dry 1-2 mil film on the bottom of a 2.75 in. diameter (7 cm) dish, it was calculated that 0.25 cm^3 (mL) of solution in the 70% to 80% nonvolatiles range would be required.

Figure 2 shows the effect of lowering the Mn of the resin on the *determined* solids. Reducing the Mn of the resin from 1400 to 600 increased the differential between the determined solids level and the 80% theoretical solids level. The lowest molecular weight resin evaluated (Mn = 600) was determined to be nearly 15% lower in solids than calculated.

The viscosity vs Mn relationship indicated lowest viscosity was achievable with the 600 Mn resin, and the determined solids vs Mn relationship indicated highest solids was achievable with the 1400 Mn resin. To meet new compliance guidelines on nonvolatile content and viscosity requirements for application, both maximum solids and minimum viscosity coatings are desirable. To evaluate the resins while varying only one of these properties, enough xylene solvent was added to each of the original 80/20 resin/solvent solutions so that all were at the same *determined* nonvolatiles; i.e., the same nonvolatile value obtained for the lowest molecular weight resin, or 68.4 wt% (refer to *Figure* 3). With the percent determined nonvolatiles of each resin held constant, the resins could then be evaluated for their effectiveness in high-solids coatings by measuring the viscosity of the resin solutions. Therefore, the resin which gives the lowest viscosity should be the optimum resin for high-solids coatings based on Mn.

Figure 4 shows the viscosity vs the Mn of the resins at the same determined solids. Lowering the Mn from 1400 to 800 significantly lowered the viscosity. Reducing the Mn from 800 to 600 showed an increase in viscosity at the same determined solids.

These responses indicate the validity of the concept of reaching a point of no further reduction in viscosity when lowering the resin Mn at the same determined solids level. A Mn of about 800 appears optimum for a resin based on NPG glycol, phthalic anhydride, and adipic acid for lowest viscosity at the same determined solids level. The 800 Mn resin would be chosen over a lower molecular weight resin because, normally, the higher Mn resins give improved cured enamel performance properties.

Enamel

Fractions of the resins volatilized from the resin solutions described above are probably unreacted glycol or lower-molecular-weight, hydroxyl-containing, polyester oligomers that may be reacted with a melamine crosslinking resin. Thus, some of the volatile resin may

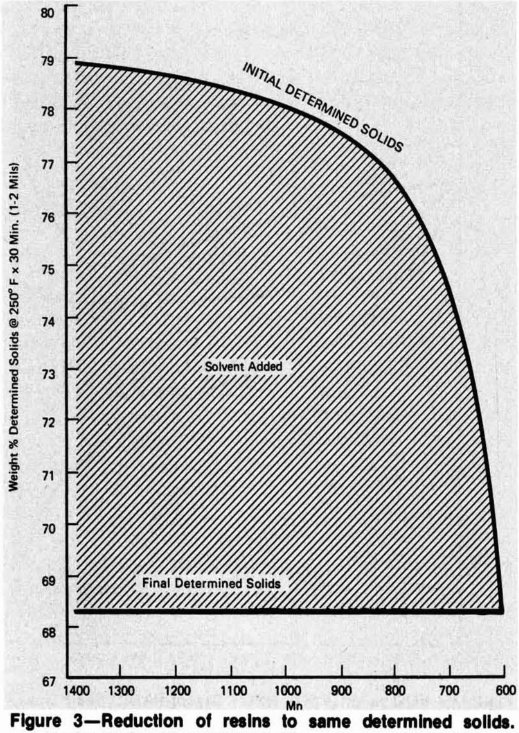

Figure 3—Reduction of resins to same determined solids. Resin: NPG® Glycol/PA/AD. Theoretically 80% Solids

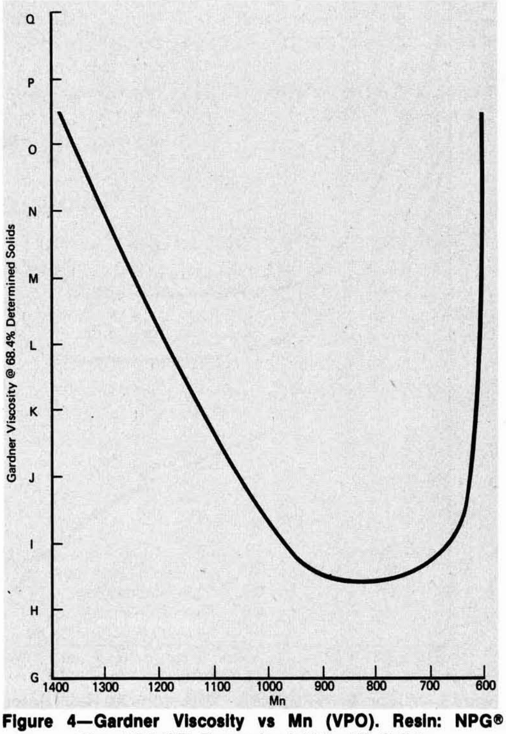

Figure 4—Gardner Viscosity vs Mn (VPO). Resin: NPG® Glycol/PA/AD. Determined 68.4 wt.% Solids

Table 2—Properties of High-Solids Polyester Resins for VOC vs Mn Evaluation

Resin Number	1	2	3	4	5	6
Determined hydroxyl number	72	98	127	151	242	316
Wt % resin solids volatilized	0.99	1.56	2.37	6.94	8.16	14.51
Calculated effective hydroxyl number	62	82	104	82	168	187
% HMMM × binder based on effective hydroxyl number	11	14	17	14	25	27

not be lost when fully formulated enamels are stoved. Therefore, in determining the optimum molecular weight, it is also important to determine the nonvolatiles of the polyester enamels in the presence of the crosslinking resin.

Since cure temperature variations affect the volatility of the low-molecular-weight fractions of resin, both a high-bake (163°C, 325°F) enamel and a low-bake (121°C, 250°F) enamel were investigated. For the high-bake enamels, 0.3% p-toluenesulfonic acid based on binder was adequate to achieve complete cure of these resins with the hexamethoxymethylmelamine (HMMM) crosslinking resin. Cure of the enamels was considered complete when the films resisted softening in contact with acetone. To achieve cure of the low-bake enamels, 1.0% of a pyridine blocked catalyst was necessary to ensure acceptable viscosity stability of the enamels.[3]

Because the ratio of polyester to HMMM is important in evaluating resin volatility, two enamel experiments were done. In the first experiment, an attempt was made to formulate the hydroxyl bearing polyester and HMMM crosslinker on a stoichiometric basis. This meant a different HMMM level for each resin. In the second enamel experiment designed as a control for the first, a constant polyester/HMMM ratio was used.

In the first enamel experiment, several assumptions were made. Perhaps the most difficult assumption made was the equivalent weight or functionality of the HMMM resin. This subject has been explored by several researchers.[1,4] The functionality of HMMM is not constant. Santer and Anderson reported that the functionality of HMMM which theoretically approaches six, depends on temperature of cure, level, and type of functionality of the vehicle, ratio of vehicle to HMMM, and catalysis.[4] As a practical matter, the functionality is thought to be between three and four for conditions encountered in this experiment. An equivalent weight of 111 was used in calculating stoichiometric vehicle ratios. The second assumption needed for the first enamel experiment was the method for calculating each polyester resin's equivalent weight per *available* reactive hydroxyl group. Since the loss of a portion of the lower molecular

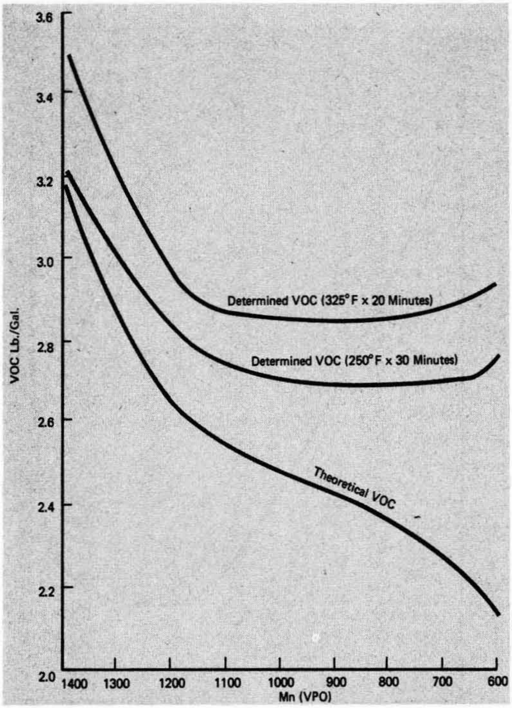

Figure 5—VOC vs Mn (VPO). NPG® Glycol/PA/AD Resin Based Enamels at Eff. Melamine Level. Viscosity—45-49 Sec. No. 3 Zahn

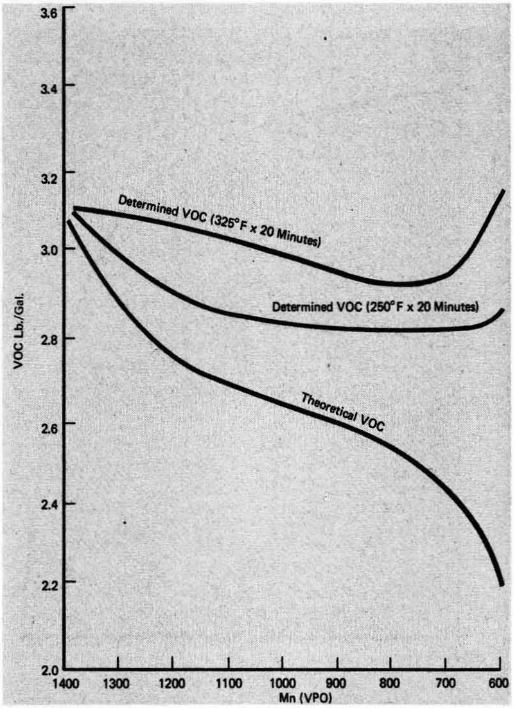

Figure 6—VOC vs Mn (VPO). NPG® Glycol/PA/AD Resin Based Enamels at 20% Melamine Level. Viscosity—34-38 Sec. No. 3 Zahn

weight resins during baking of the enamels changes the effective hydroxyl number of the resin, adjustment of the resin determined hydroxyl number was required.

As discussed previously, this lost material may or may not be volatilized during cure in the presence of a crosslinking resin. Only for purposes of determining each resin's effective equivalent weight, the weight of resin lost in the nonvolatiles determination was assumed to be lost in the enamels and also assumed to be unreacted glycol. With these assumptions and data, the effective hydroxyl number was calculated (see *Table* 2).

Using the calculated effective hydroxyl number for the polyester resin resulted in a polyester/HMMM weight ratio range of 73/27 to 89/11 to be used in the first enamel nonvolatile determination experiment. The second experiment was designed using a constant 80/20 weight ratio of polyester/HMMM to help ensure that any conclusions drawn would be the result of differences in the polyester resins and not differences in melamine crosslinker levels.

The enamels prepared from each resin using the calculated effective HMMM level were formulated to a No. 3 Zahn viscosity of 47 ± 2 seconds (approximately 400 cP). Enamel nonvolatiles or fraction volatiles were determined by the test method discussed earlier. The density of each enamel was determined using ASTM D 1475. The data was used in equation (1) to arrive at the determined VOC of each enamel.

$$\text{VOC (lb/gal)} = \text{enamel density (lb/gal)} \times \text{fraction volatiles of enamel} \qquad (1)$$

In addition, the theoretical VOC was calculated from each enamel formulation using the determined density of the enamels and assuming the HMMM resin to be 75% solids. Previous work by the authors has shown that during cure, at least a 25% weight loss results from the liberation of by-products from the crosslinking reaction, predominately methanol.

RESULTS

Variable Polyester/Melamine Ratio

Figure 5 shows the relationship between the *determined* VOC at two cure temperatures and the *theoretical* VOC utilizing the calculated, effective HMMM level. The HMMM level increases as the molecular weight of the resins in the enamels is lowered.

When the molecular weight of the resin is lowered, the *theoretical* VOC is continuously decreased. The *determined* VOC values at both temperatures are reduced as the molecular weight is lowered from 1400 to 1000, then these VOC values do not change significantly from 1000 to 650 before increasing between 650 and 600. As the Mn decreases, apparently enough of the resin is lost in the presence of a crosslinker to show the same general effect that occurred without the crosslinker: i.e., that an optimum molecular weight exists for high-solids coatings. For the NPG glycol/phthalic anhydride/adipic acid resin, this value is approximately 1000.

Also of importance in *Figure* 5 is the significant difference between the VOC determined at 325°F and the VOC determined at 250°F. The VOC value was 0.2 to 0.3 pounds lower per gallon of paint at a bake temperature of 250°F than at 325°F. Higher solids or lower VOC coatings can be more easily achieved if lower temperature cures are possible.

Constant Polyester/HMMM Ratio

The experiment designed with a constant polyester/HMMM ratio of 80/20 for each resin showed that the effect of lowering Mn to achieve lower VOC was essentially the same and that a Mn of 1000 was optimum for obtaining the lowest determined VOC (see *Figure* 6). As the Mn of the resins is lowered from 1400 to 1000, the VOC of the enamels is reduced. Lowering the Mn from 1000 to 650 has essentially no effect on the VOC, and lowering the Mn from 650 to 600 increases the VOC of the enamel.

This work indicates that a linear polyester based on NPG glycol, phthalic anhydride and adipic acid and having a Mn of 800–1000 or an excess hydroxyl level of about 50 to 30% was optimum for achieving the lowest determined VOC.

DISCUSSION OF OTHER VARIABLES

Other variables normally associated in polyester resin design, such as the type and ratio of acids, the choice of glycols, and the incorporation of polyols to induce branching probably could also affect the optimum Mn for the lowest VOC. The evaluation of these variables was beyond the scope of this experiment, but the possible effect of these resin variables should be considered when formulating a polyester coatings resin. This work details a method of determining the optimum molecular weight for a given combination of raw materials to achieve the lowest determined VOC. The method described may be more important to resin formulators than the optimum Mn value obtained.

SUMMARY

This work was designed to determine the optimum molecular weight of a polyester resin based on NPG glycol, phthalic anhydride, and adipic acid for lowest determined VOC. A series of resins with varying molecular weights were evaluated with and without hexamethoxymethyl melamine crosslinker, but the conclusion was essentially the same. A number-average molecular weight of about 800–1000 or excess hydroxyl level of 50–30% was optimum for achieving lowest VOC.

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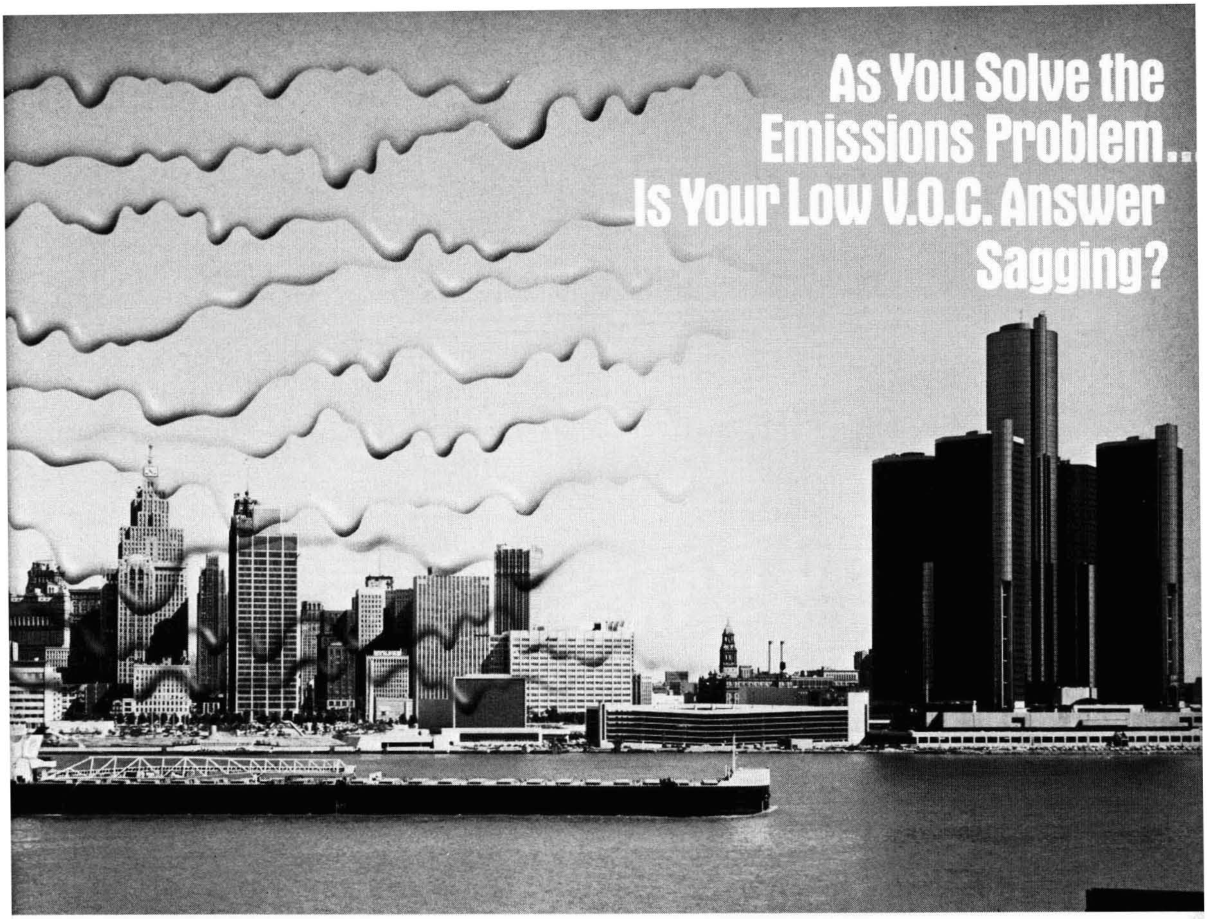
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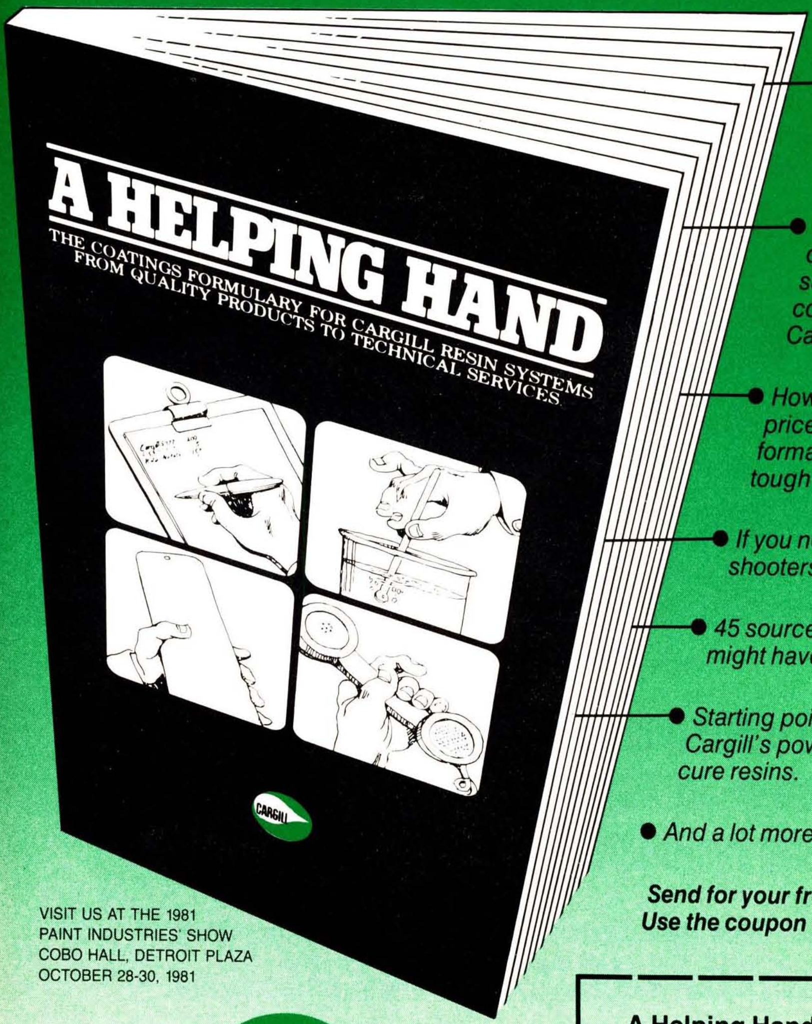

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Electrochemical Techniques To Evaluate Corrosion Of Coated Metal

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Gulf South Research Institute*

The use of electrochemical techniques, particularly the potentiodynamic polarization technique and the linear polarization technique, for evaluating coatings as well as for formulation research is presented. Case studies on the utility of the methods are also presented.

INTRODUCTION

One of the important purposes of organic surface coatings is the protection of metals against corrosion. Several efforts have been made to develop accelerated corrosion tests to evaluate the performance of coatings in order to avoid the long exposure times required for exposure testing. Some of these approaches utilized testing to destruction in severe environments. These approaches gave subjective results.[1,2] Several physical property measurements such as oxygen, water, or ion penetration through the coatings were made to relate these phenomena to the corrosion behavior of these coatings.[3,4] However, if the rate-limiting step in the corrosion reaction is not dependent on the physical property being measured, the utilization of this technique for evaluating coatings can be in serious error.

Since corrosion is an electrochemical reaction, electrical and electrochemical measurements should naturally be a quantitative way to monitor corrosion under coatings. Many studies on the electrical property measurements for coating evaluation have been performed by various researchers over the years. D.C. conductivity measurement of free polymer films was studied by Mayne, *et al.*[5,6] A.C. measurements-mainly equivalent resistances and capacitances—were utilized by several workers.[7-9] Several theories were proposed as justification of all these methods.[10-15] Practical application of any of these techniques independently was rarely fruitful due to experimental problems and difficulties in the interpretation of the data generated. Among other things, most of the researchers neglected the high electrolytic resistance (IR drop) of the wetted coating film which can be as large as 10^4 MΩcm^2 for an average thickness coating.[6,16,17] In addition, researchers have attempted to utilize the initial resistance or capacitance data generated as soon as the coated metal is exposed to electrolyte solution—before equilibrium is achieved. As we found in our laboratory, it can sometimes take 20–30 min to achieve equilibrium (*Figure* 1). Hence, we accounted for these problems and successfully used the electrochemical techniques not only for coatings evaluation, but also for optimizing coating formulations. In this paper, some case studies of successful utilization of these techniques are presented.

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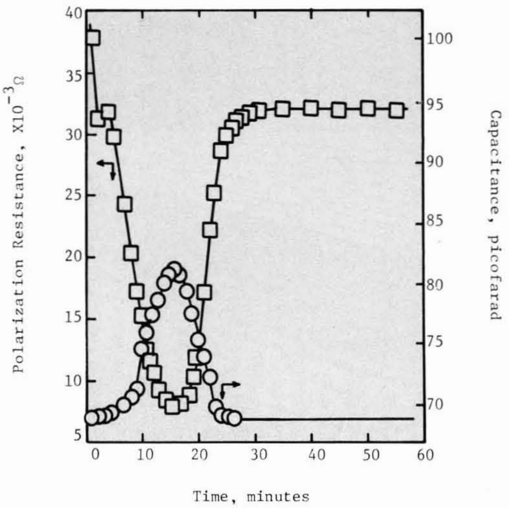

Figure 1—Initial change in resistance and capacitance of 25 μm polyurethane coating on zinc exposed to 0.50M NaCl electrolyte. ○ = capacitance; □ = resistance

THEORY

Many corrosion phenomena can be evaluated in terms of electrochemical reactions. In the present context, the theory is presented corresponding to two main electrochemical techniques, i.e., potentiodynamic polarization and linear polarization. Using several instruments presently available, the results of the two methods are obtained from one experimental run. Several publications explaining both these theories in detail are available.

Potentiodynamic Polarization Technique

Potentiodynamic anodic polarization is the characterization of a metal specimen or a coated metal substrate by its current/potential relationship. A specimen's potential is scanned slowly in the anodic direction, i.e., the specimen is forced to act as an anode such that it corrodes, or forms an oxide coating. These measurements can be utilized to determine corrosion characteristics of the substrate in the environment of interest. A complete scan of the metal substrate from anodic to cathodic regions through the equilibrium corrosion potential constitutes the potentiodynamic polarization technique. A complete current/potential plot of a specimen can be measured in a few hours, or in some instances, in a few minutes.

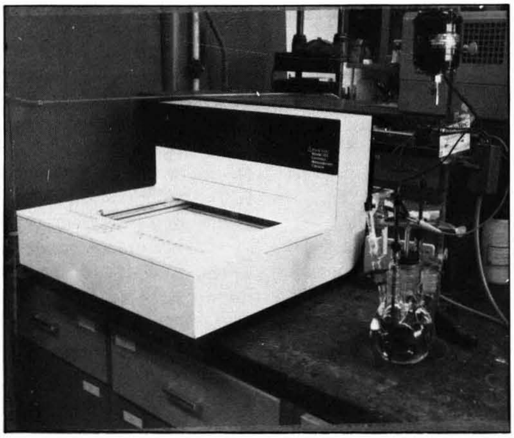

Figure 2—Princeton Applied Research Model 350 computerized corrosion evaluation system

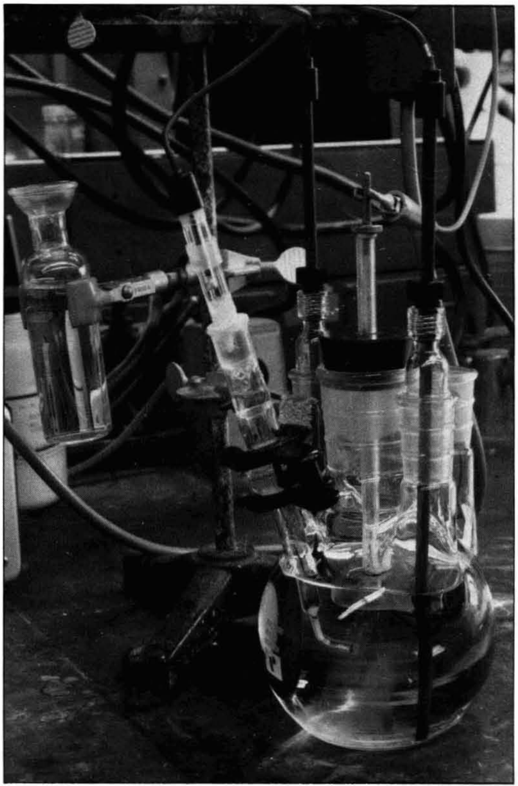

Figure 3—Electrochemical cell for corrosion evaluation

Investigations, such as passivation tendencies and effects of inhibitors or oxidizers on specimens, as well as evaluations and formulations of coatings can be easily performed using this technique.

When a metal substrate is submerged in a corrosion medium, both reduction and oxidation processes occur on its surface. Typically, the specimen oxidizes (corrodes) and the medium (electrolyte) is reduced (with the liberation of hydrogen). The specimen must function as both an anode and a cathode with both anodic and cathodic currents occurring on the specimen's surface. The corrosion current is the result of both these processes.

If the electrochemical function of the specimen is controlled by polarizing it to behave as an anode or cathode, the two processes can be studied separately.

A specimen at "corrosion potential" for E_{corr} has both anodic and cathodic currents present on its surface.

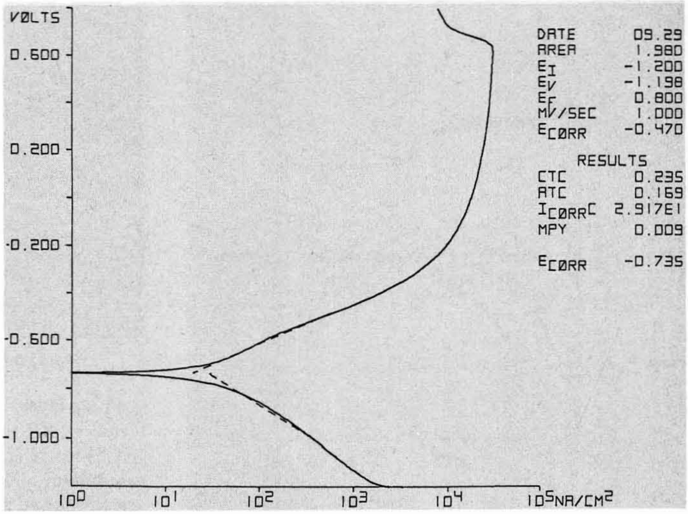

Figure 4—Potentiodynamic polarization curve for unenhanced alkyd coating on steel in simulated aqueous acidic clay soil

These currents are exactly equal in magnitude and, hence, no net current can be measured. The specimen is at equilibrium with the environment, and the rate of oxidation is equal to the rate of reduction.

Linear Polarization Technique

The electrochemical technique of polarization resistance (linear polarization) is another method used for corrosion and coatings evaluations. This technique is performed by applying a controlled potential scan over a small range, typically ± 25 mV with respect to E_{corr}. The resulting current is linearly plotted as a function of potential. The slope of this potential current function at E_{corr} is termed "the polarization resistance."

Linear polarization is an extremely rapid procedure performed at a scan rate of 1 mV/sec. A potential range of 50 mV can be scanned in 10 min. The rapidity of the measurement also makes linear polarization useful for applications such as formulation optimization. In addition, since the applied potential in a polarization resistance measurement in never far removed from the corrosion potential, the surface of the specimen is not drastically affected by the experiment, and thus, a long-term evaluation of a coating can be performed.

EXPERIMENTAL

The coating evaluations were conducted by the potentiodynamic polarization and linear polarization techniques using a Princeton Applied Research Model 350 computerized corrosion evaluation system (*Figure* 2).

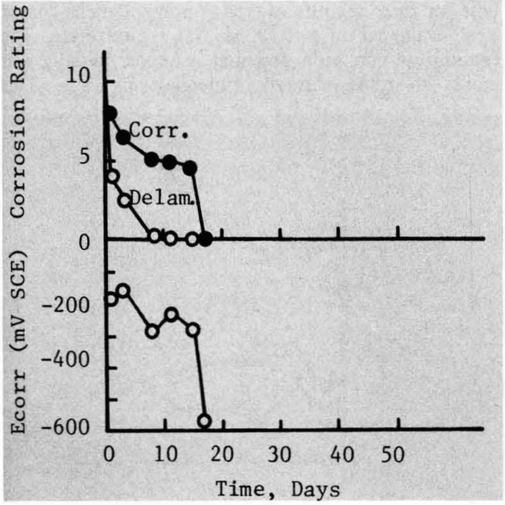

Figure 5—ASTM D610 rating of corrosion and delamination and E_{corr} vs time of exposure to 0.50M NaCl for 4 μm polybutadiene coating

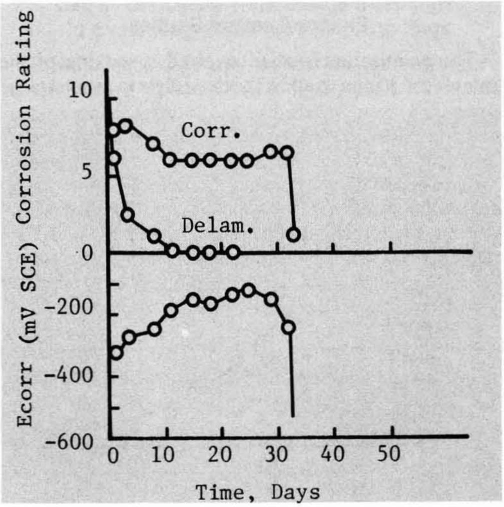

Figure 6—ASTM D610 rating of corrosion and delamination and E_{corr} vs time of exposure to 0.50M NaCl for 9 μm polybutadiene coating

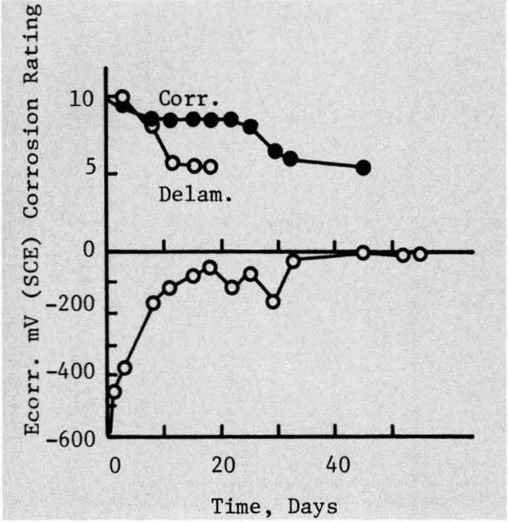

Figure 7—ASTM D610 rating of corrosion and delamination and E_{corr} vs time of exposure to 0.50M NaCl for 24 μm polybutadiene coating

Sample Preparation

The metal samples of 1.27 cm diameter were obtained as rods from commercial sources. Cylindrical sections 1 cm long were metallographically mounted in cold-cure epoxy with one circular face of the sample exposed. The mounted sample was drilled and tapped on the opposite end to fit a standard holder for electrochemical measurements. The sample preparation included a 600 grit final grinding followed by rinsing in distilled water. The dried samples were then coated to appropriate thicknesses using appropriate coatings according to manufacturers' specifications.

Electrochemical Studies

The polarization studies involved a soaking of the sample for 30 min to allow the electrolyte to penetrate the coating layer. The potentiodynamic scan was carried out from −1000 to −250 mV (saturated calomel electrode, SCE) for steel, and from −1500 to −500 mV (SCE) for aluminum alloys at a rate of 1 mV/sec. The reference electrode and auxiliary electrodes for the electrochemical measurements were a calomel electrode and graphite electrodes, respectively (*Figure* 3). Potentiodynamic polarization studies were carried out on coated samples in 2.5% NaCl electrolyte to reproduce seawater behavior unless otherwise specified. From the results generated by the potentiodynamic polarization technique, the polarization resistance of the sample was determined in most cases. However, for use in formulation optimization, only the linear polarization technique was utilized to obtain the polarization resistance. A typical curve generated by the potentiodynamic polarization technique is shown in *Figure* 4.

Figure 9—Typical cathodic delamination of sample

RESULTS AND DISCUSSION

Use of Corrosion Potential

Figures 5–7 present results of the substrate potential vs time for three samples of type A polybutadiene-coated steel evaluated in a 0.50 M NaCl electrolyte. The equilibrium corrosion potential is anodic initially and moves to more cathodic potentials in time. This

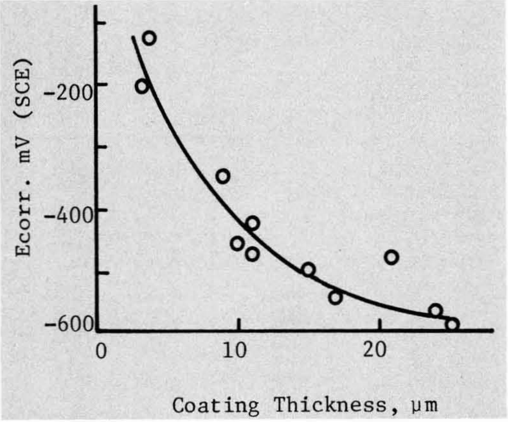

Figure 8—Initial E_{corr} vs coating thickness for polybutadiene coating

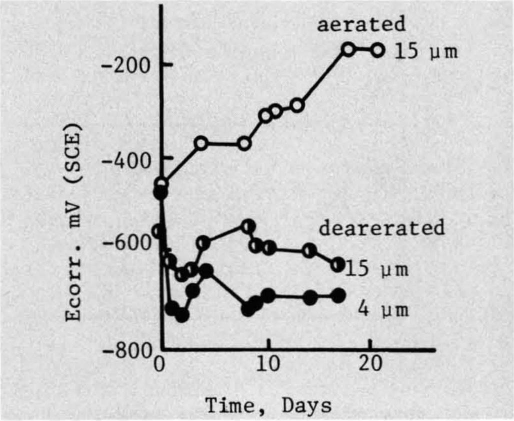

Figure 10—E_{corr} vs time for polybutadiene coated steel in a deaerated and aerated environment

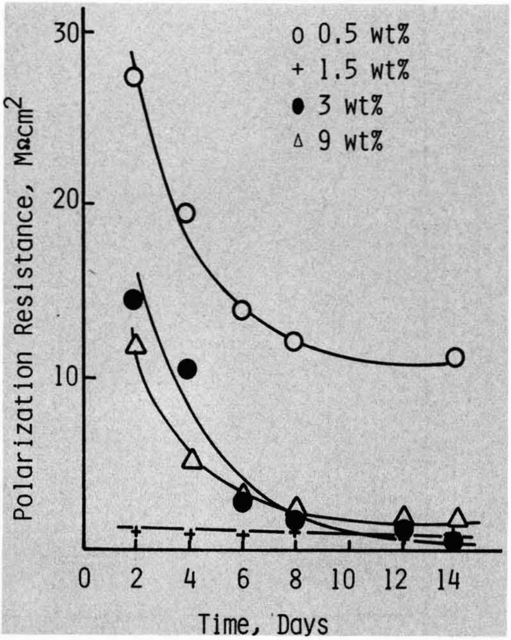

Figure 11—Effect of electrolyte (NaCl) concentration on electrochemical coating evaluation

movement to cathodic regions correlates to the increase of the delamination which occurs around the corrosion spots. Depending on the thickness of the sample, there is a complete failure of the coating after a time, as observed by the formation of black corrosion film over the entire surface. The transition occurs very rapidly within a day and is followed by a fast plunge of the substrate corrosion potential to the vicinity of −650 mV, which is the corrosion potential of steel in the chloride solution.

Figure 8 shows the effect of thickness on the initial corrosion potential. Potential is more cathodic with decreasing coating thickness. This suggests that the cathodic half reaction is rate-controlling in the corrosion under the polybutadiene coating. The relative rate of oxygen penetration of the coatings of the different thicknesses can explain the greater degree of cathodic depolarization in the thinner samples than in the thicker coatings. A typical delamination of the sample is shown in *Figure* 9.

Table 1—Formulation of the Three Primers Based On Basic Zinc Chromate

	Formulation		
Basic Zinc Chromate	1 480g	2 466g	3 473g
Talc	210	210	210
Zinc oxide	270	270	270
Yellow iron oxide	630	630	630
Alkyd resin	900	900	900
Solvent	568	556	561←
Drier	15	15	15
Surfactant	6	6	6

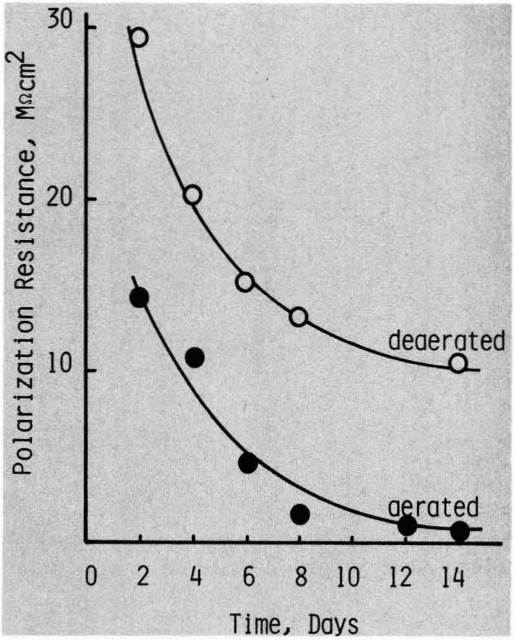

Figure 12—Effect of deaeration on electrochemical coating evaluation in 3 wt% NaCl solution

The explanation of the cathodic half reaction can be substantiated by the results of the corrosion potential measurements carried out in a deaerated system (*Figure* 10). Neither significant corrosion nor delamination occurred for samples in an inert atmosphere. The corrosion potential of the metal substrate remains near −650 mV without moving towards more positive potential as is the case with the aerated systems.

Use of the Linear Polarization Technique In Evaluating and Optimizing Coatings

It has long been determined that the concentration of the electrolyte solution has a significant effect on the corrosion behavior of coated metal. *Figure* 11 shows the effect of the sodium chloride solution concentrations ranging from 0.5 to 9 wt% on the corrosion behavior of a steel sample coated with an acrylic paint. The results indicate that a 9 wt% solution is less deleterious than those which are of a lesser concentration. The rapid drop in the polarization resistance can be correlated with rust spots becoming visible under the coating layer.

To determine the effect of aeration on the corrosion

Table 2—Characteristics of the Basic Zinc Chromate Paints

	Formulation		
	1	2	3
Pigment/dry binder (WW)	2.94	2.92	2.94
Paint density	1.450	1.440	1.460
Solid content (%)	70	70	70

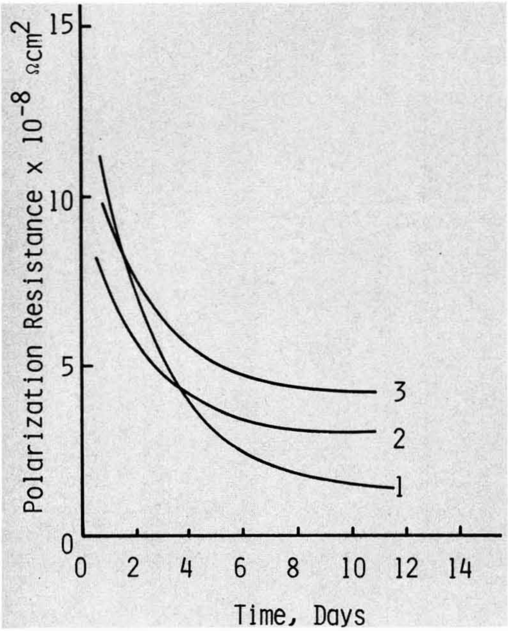

Figure 13—Effect of surface preparation of electrochemical coating evaluations in 3 wt% NaCl solution; steel surface prepared with 80 grit abrasive paper

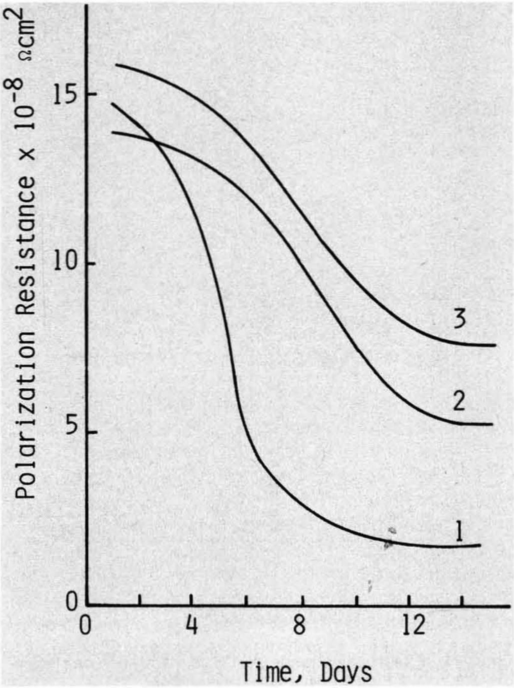

Figure 14—Effect of surface preparation on electrochemical coating evaluation; surface prepared with 600 grit abrasive paper

behavior of the coated steel, the samples were evaluated in 3 wt% NaCl solution, one with air bubbling, and another which was deaerated by nitrogen. The results shown in *Figure* 12 indicate that the polarization resistance drops steeply in the solution which is saturated with air (oxygen) and, thus, oxygen hastens the corrosion process. This also can be (visually) observed by the appearance of corrosion products on the metal surface. The polarization resistance of a deaerated system is higher by a factor of ~ 10 than the resistance of an air-saturated system, thus signifying the effect of deaeration on the corrosion behavior of the coated specimen.

The effect of sample preparation on the corrosion behavior of the coated steel was evaluated. The samples were prepared with two abrasive papers, 80 grit and 600 grit. The polished steel specimens were coated with three zinc chromate-based commercial primers, the formulations of which are shown in *Tables* 1 and 2. The dry film thickness of the coatings was ~ 50–55 μm for each specimen. The results are presented in *Figures* 13 and 14. The polarization resistance values are less for the metal polished with 80 grit paper than for the metal polished with 600 grit paper. Also, by using the finer polishing paper, the three primers can be rated for their corrosion protection efficiency (high R_p signifies better protection). Based on this, it can be said that primers $2 > 3 > 1$. Hence, sample preparation prior to coating is very significant in evaluating coatings, or in this instance, rating several commercial coatings.

The effect of pigment volume concentration (PVC) on the properties of coatings is well known. There is a critical PVC (CPVC) above which the physical chemical properties of the coatings, especially permeability, change drastically. The linear polarization technique can be used to determine the CPVC. Using a commercial zinc chromate pigment, several primers were prepared with the formulations shown in *Table* 3. The thickness of the coating on steel was maintained at 50 μm. *Figures* 15 and 16 show experimental evaluations of polarization resistance as a function of PVC. From these data, it can be

Table 3—Formulation of Primers Containing Zinc Chromate Pigment of Varying PVC

	PVC%							
	20	30	35	40	45	50	55	60
Pigment/dry binder (WW)	0.8	1.38	1.73	2.15	2.64	3.22	3.95	4.82
Paint density	1.080	1.200	1.260	1.335	1.405	1.480	1.565	1.640
Solid content (%)	57	62.8	65.3	68	70.5	72.7	74.6	76.2
Dried film density	1.565	1.805	1.925	2.045	2.165	2.285	2.405	2.525

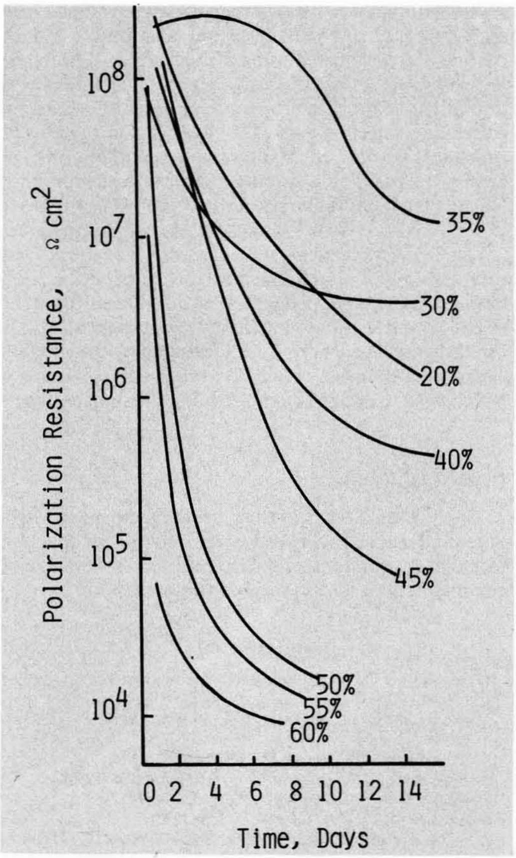

Figure 15—Effect of pigment volume concentration on electrochemical coating evaluation of basic zinc chromate paint

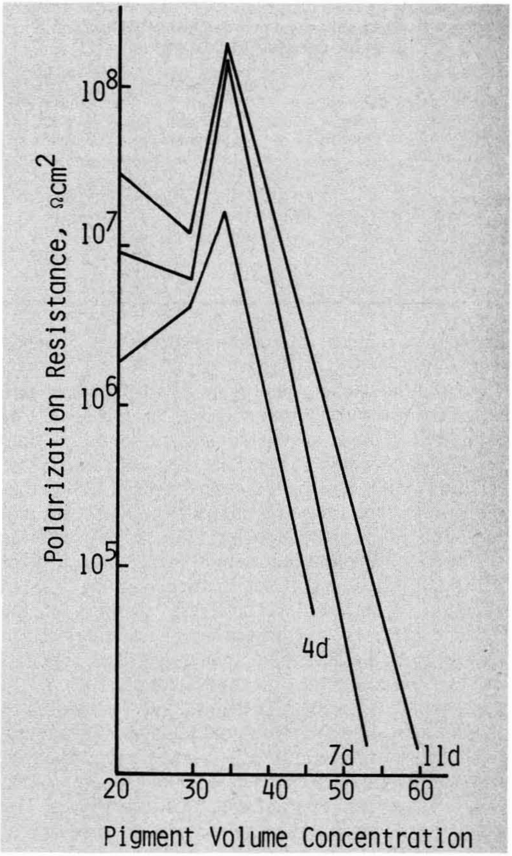

Figure 16—Polarization resistance at different times of exposure vs PVC for basic zinc chromate paint

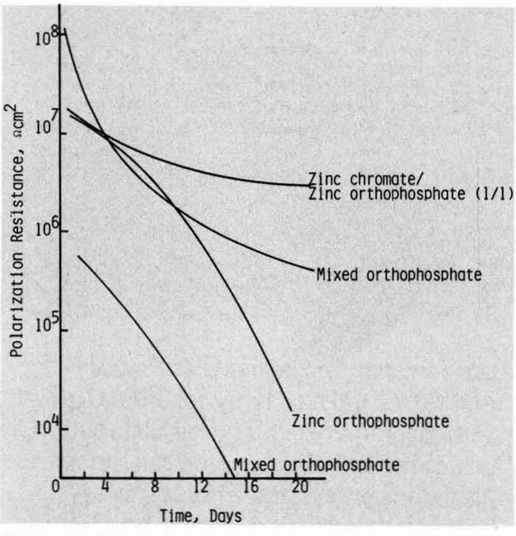

Figure 17—Electrochemical coating evaluation technique for pigment selection

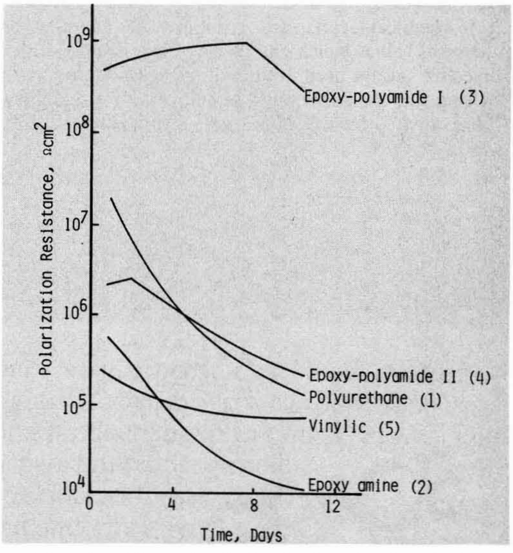

Figure 18—Electrochemical evaluation of paint selection

Table 4—Electrochemical and Salt Spray Evaluations of Six Commercial Coatings

	Salt Fog 5% NaCl 1000 hr	Electrochemical Test 3% NaCl 264 hr	Salt Fog 5% NaCl 500 hr
	A	A	A
Decreasing protection efficiency ↓	C	C	D
	D	D	C
	F	B	F
	B	E	B
	E	F	E

determined that the maximum protection is obtained with a PVC of 35% (CPVC).

Four different zinc phosphate-based pigments were evaluated using the linear polarization technique. The ratio PVC:CPVC was held constant, and the only difference in formulation was the chemical nature of the inhibitor. The experimental results (*Figure* 17) show that the primer containing the mixed orthophosphate pigment does not provide enough protection in the chloride solution after a 480 hr immersion. There is a steep fall of the polarization resistance accompanied by loss of adhesion of the paint film. Severe corrosion on the metallic surface can also be seen using a scanning electron microscope. In addition, the remaining three pigments can be evaluated in the order of decreasing protection of the substrate as $1 > 3 > 2$. These results are comparable to those obtained by the traditional salt spray techniques.

The technique was utilized to compare six basic zinc chromate-based primers. The substrates were coated with two layers to obtain a mean thickness of $75\ \mu m$. The samples were evaluated using the electrochemical techniques for 10 days and the salt spray technique for 1000 and 500 hr. Based on these evaluations, the coatings can be rated as shown in *Table* 4. The results indicate a reasonable agreement between the electrochemical rating and the salt spray tests. The notable feature of the electrochemical technique is that it provides quantitative numerical values which can be classified, instead of the subjective ratings used in the salt spray technique.

Using the electrochemical technique several coatings were evaluated for use on ships for a commercial client. Five coatings, two of which were epoxy polyamide, one epoxy amine, one polyurethane, and one a vinylic coating, were evaluated using the technique. Results are shown in *Figure* 18. Based on these results, a classification of the coatings can be made in order of decreasing corrosion protection as: $3 > 1 \simeq 4 > 5 > 2$. It can also be concluded that the epoxy polyamide coating having the highest polarization resistance offers the best protection for the metallic surface, and that polyamide coatings are superior to polyamine coatings for corrosion protection.

The results obtained with electrochemical and salt spray testing indicate that there is good correlation between the two techniques. By the optimization of the electrochemical techniques, the art of coating evaluations can become a science. By understanding the electrochemical phenomena of failure, a scientific approach can be followed to design better corrosion-resistant coatings.

CONCLUSIONS

The use of electrochemical techniques, particularly potentiodynamic polarization and linear polarization techniques, can be successfully utilized for evaluating coatings as well as optimizing formulations.

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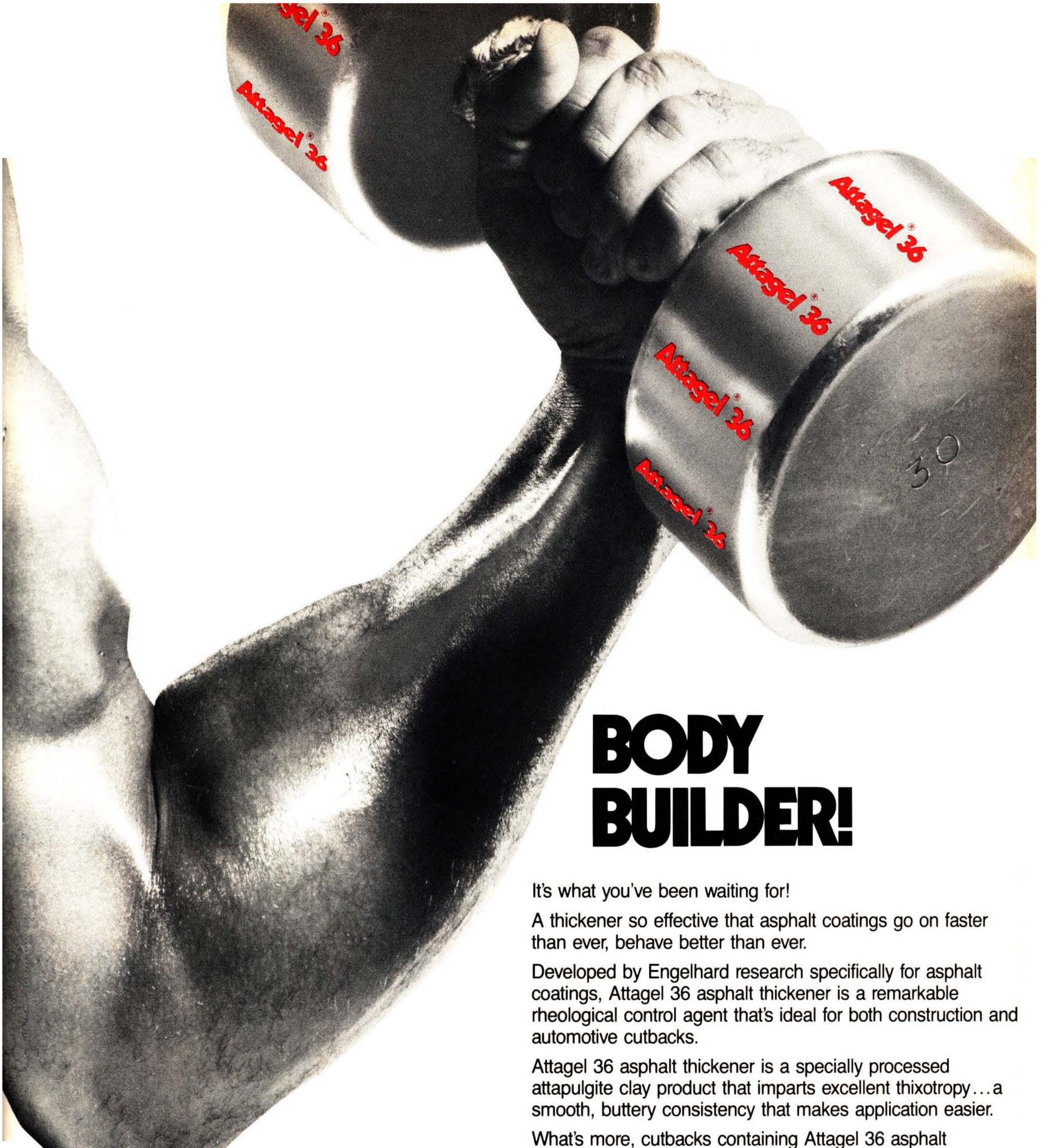
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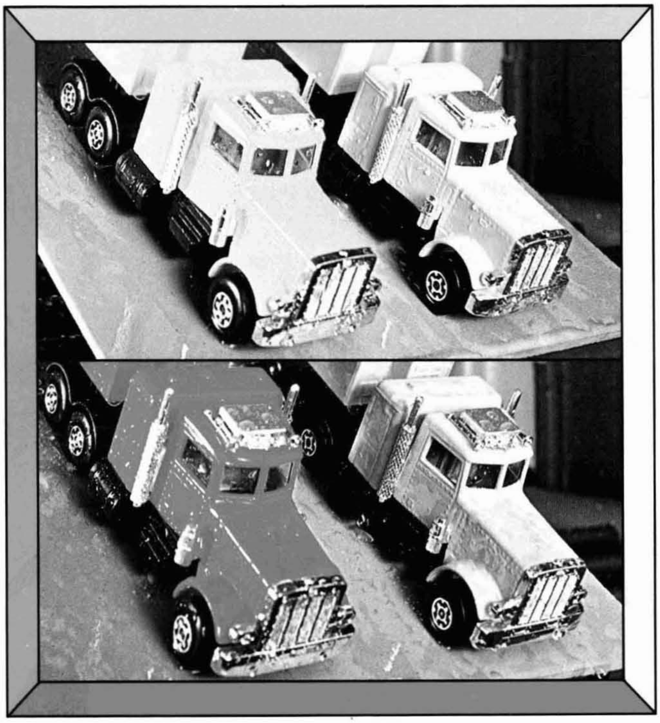


Higher industrial hygienic protection
Increased SO_2-resistance
Increased Hiding Power
Increased brilliancy and colour depth

Two New Pigments with High Fastness Properties

HEUCOTRON-Yellow 5 and HEUCOTRON-Red 23 have excellent fastness to light, weathering and SO_2, and possess more brilliant colour shades than other comparable pigments.

Industrial Hygienic Security

The special merit of HEUCOTRON-Yellow 5 is the low acid soluble lead conten of less than 1% according to DIN 55975 (pigment/hydrochloric acid = 1/1.000).

According to project ISO 6713 second edition 1981 (pigment/hydrochloric acid = 1:15) this means an acid soluble lead content of 1% for both pigments.

This considerable reduction of the acid soluble lead content in both pigments results in a corresponding increase of industrial hygienic security and furthermore these pigments do not have to be marked with the St. Andrews Cross.

SO_2-Test

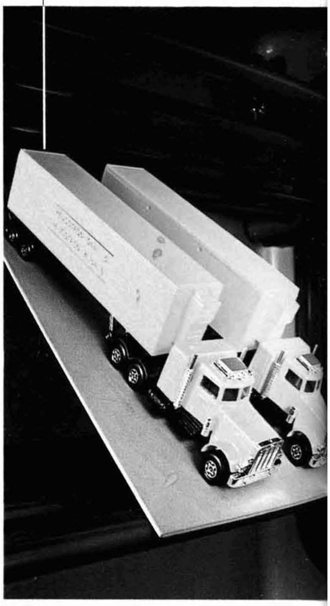
To test for durability panels were coated with an alkyd-melamine resin varnish containing 20% for HEUCOTRON-Yellow 5 and 15% for HEUCOTRON-Red 23, then tested in accordance with DIN 50018 with 2 litres SO_2 in a Kesternich apparatus.

HEUCOTRON-Yellow 5 and HEUCOTRON-Red 23 were compared with high performance pigments from the highly stabilized series.

The Kesternich test has shown that HEUCOTRON-Yellow 5 and HEUCOTRON-Red 23 possess significantly better resistance to SO_2 than other pigments.

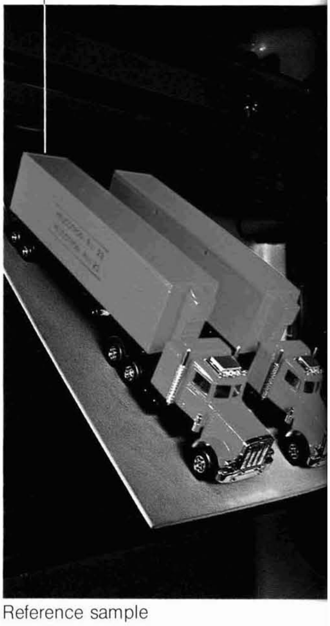
Because of this as well as the excellent fastness to light, weathering and heat HEUCOTRON-Yellow 5 and HEUCOTRON-Red 23 are particularly suitable for use in high quality paint systems.

HEUCOTRON-Yellow 5



Reference sample

HEUCOTRON-Red 23



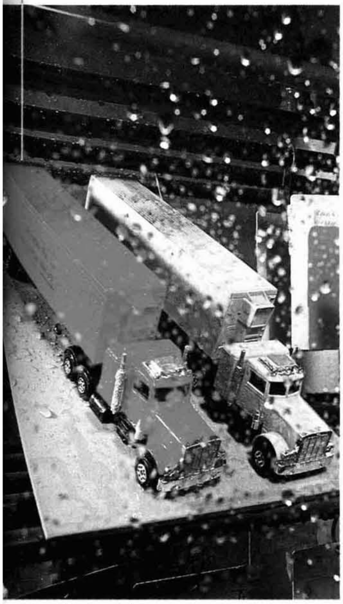
Reference sample

HEUCOTRON® Red 23
HEUCOTRON® Yellow 5

HEUCOTRON-Yellow 5

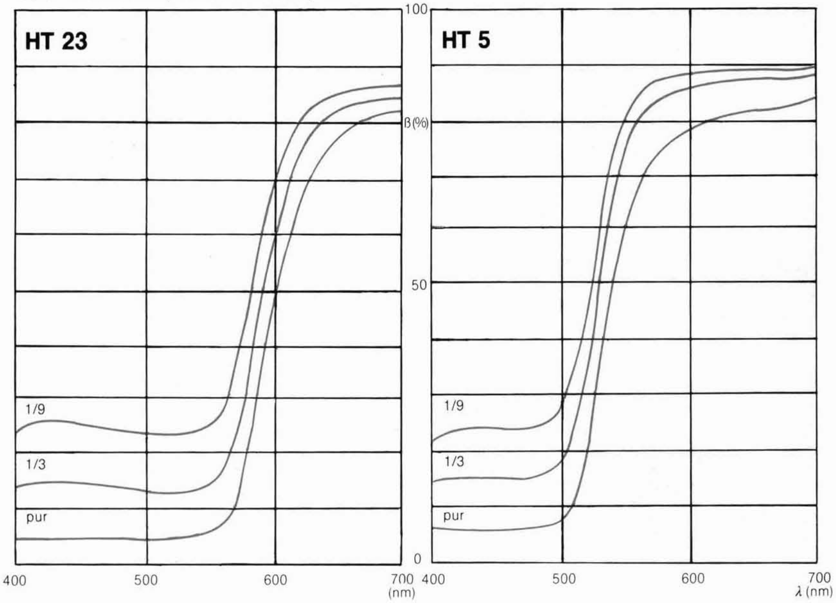
0 cycles Kesternich

HEUCOTRON-Red 23



cycles Kesternich

Colorimetric Data, Illuminant D 65, 10°



Reply Card

Please send me a 500-g-sample each of

☐ HEUCOTRON-Yellow 5

☐ two HEUCOTRON-Standard-Chromium Yellows (medium-stabilized)

☐ general information on the Heubach-Group

Remarks: ____________________

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Technical Data		HEUCOTRON Yellow 5	HEUCOTRON Red 23
Bulking volume	g/ml	0,4	0,7
Tamped volume	g/ml	0,6	0,9
Specific gravity	g/cm³	5,6	5,7
Oil absorption	g/100 g	29,5	25
Hiding power (TiO_2 = 100)		86	160
Heat fastness		200° C	190° C
pH-value		ca. 6	ca. 6
Acid soluble Lead (DIN 55975)		< 1%	< 2%
ISO 6713		< 1%	< 1%

Fastness to:		HEUCOTRON Red 23	HEUCOTRON Yellow 5
light			
Enamel	pur	8	8
	1/3 ST	8	8
	1/9 ST	8	8
Exposure			
Enamel, air-drying	pur	4 d	4 d
	1/3 ST	4 d	4 d
	1/9 ST	4 d	4 d
Enamel, stoving	pur	5–4 d	5–4 d
	1/3 ST	5–4 d	5–4 d
	1/9 ST	5–4 d	5–4 d
Solvents			
Aliph. hydrocarb.		5	5
Arom. hydrocarb.		5	5
Chlor. hydrocarb.		5	5
Esters		5	5
Ketones		5	5
Alcohols		5	5
Plasticizers		5	5
Linseed oil		5	5
Acids		4	4
Alkalis		4	4
Lime		no	no
Cement		no	no
Overspray		yes	yes

Name ____________________

Company + Company Address

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Solvent-Borne Millbase Development For High Speed Dispersion Of Titanium Dioxide

Calvin C. Tatman
Glidden Pigments Group*

The performance of a given grade of titanium dioxide pigment is related to a number of factors including its chemical and physical composition as well as its dispersion and state of dispersion in the medium in which it is incorporated. The present work covers the role dispersion plays in developing the performance properties of gloss, strength, and hide. It reviews the well-known Daniel's Wet-Point/Flow Point and Guggenheim Equation methods designed to provide the formulator with a way to assure optimum millbase composition. The paper concludes with the presentation of laboratory data generated using a procedure derived from those methods that allows a short-cut approach to non-aqueous millbase formulation for those instances where the need for rapid response precludes the more thorough approach of Daniel.

INTRODUCTION

The late Earl K. Fischer[1] summed it up when he wrote, "The optical properties of pigment dispersions are frequently the attributes that establish their utility in consumer products."

The optical performance of titanium dioxide pigment is due to the scattering of visible light determined by the combination of high refractive index and particle size. The first property is inherent in the titanium dioxide and outside our ability to alter it. Primary particle size is determined during manufacture of the pigment. The thoroughness with which the user reduces agglomerates present to dimensions approaching the basic crystallite size (approximately 0.25 μm) and how well that dispersion is stabilized determines the performance value per pound (light scattering).

The significance of this is apparent when you consider, at a selling price of rutile titanium dioxide of $.69 per pound, each 10% loss of efficiency in a formula containing two pounds of TiO_2 per gallon (0.24 kg/L) costs the coatings manufacturer 13 to 14 cents per gallon (3 to 4¢/L). The financial impact may vary from one coatings manufacturer to another, and according to formula, but impact it will.

Dispersibility of pigmentary titanium dioxide is a parameter in which both manufacturer and formulator have a keen interest and part. The effects of proper and improper pigment dispersion on the economic and performance aspects of a coating are well recognized and reported.[2,3] Far too many paint chemists, at one time or another, have experienced the loss of gloss, hide, color, strength, and durability due to the effects of flocculated and/or agglomerated (poorly dispersed) pigments in their coating.

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*Chemical/Metallurgical Div., SCM Corp., 3901 Glidden Rd., Baltimore, MD 21226.

Presented at the Symposium on Formulating For, and Utilization of Pigment Dispersion Equipment sponsored by the Cleveland Society for Coatings Technology Manufacturing Committee on October 7, 1980, at the Cleveland Scientific and Engineering Center.

Table 1—Methods of Evaluating Pigment Dispersion in Coatings Systems

Liquid Coatings	Dry (Cured) Coatings
Hegman, Fineness of Grind (or equivalent)	Tinting Strength Tone
Sedimentation Tests	Hide
Screen Residue	Gloss
Particle Size Analyzers	Texture Electronmicroscopy

Table 2—Physical Parameters for Good HSD* Techniques

with : D = Blade Diameter

then : Tank Diameter = 2.5 - 4.0D

Blade Height from Bottom of Tank = 0.5 - 1.0D

Maximum Batch Load Depth = 2D

Blade Tip Speed = 65-85ft/sec

* High Speed Dispersion

Dispersion

Dispersion control and execution, then, is an important factor in efficient titanium dioxide utilization. A number of techniques are available to assess the thoroughness of dispersion in the millbase, as well as its maintenance in storage through final product application and cure. *Table* 1 lists several ways of evaluating dispersion in the wet paint or the dried paint film. Rackham[4] provides a good starting point for those desiring to know more about the tests (other than Hegman fineness of grind and optical performance) which are available for particle size analysis. This paper limits itself to the use of Hegman fineness of grind, tinting strength, gloss, and texture as a means for determining the relative efficiency of dispersion of different grade types of TiO_2 under various pigment vehicle loadings.

The producer of the titanium dioxide pigment determines the theoretically attainable particle size during processing. Tightly bound doublets, triplets, etc., formed during manufacture cannot be uncemented later by high speed dispersion (HSD). The user must also contend with the compaction effects of the environment the pigment has been subjected to subsequent to manufacture. Through the choice of dispersion equipment and millbase composition, he tries to maximize the development of that "optimum" state but never achieves it. Fortunately, the real world allows some latitude from the theoretical "ideal" dispersion state.

In choosing a high speed disperser, the coatings manufacturer has selected machinery which lies between what Patton[5] picturesquely labels the "smashers" (jet mills) on the one hand and "smearers" (three-roll mills) on the other. This means the coatings formulator must select his millbase viscosity between the low range, which works best with the "smashers," and the high range, which works to best advantage with the "smearers."

The principles of good high speed dispersion involve the development of controlled, smooth, viscous, doughnut-like flow of pigment and vehicle. This laminar flow pattern assures the work of dispersion[6] is engaged in the wetting of the pigment with subsequent disruption of the agglomerates. The outgrowth of these two stages is followed by the development of a millbase stabilized against the optical efficiency robbing effects of London-van der Waal's forces of particle–particle attraction.[8]

It is absolutely necessary to avoid the chaotic, heat generating, poor dispersion conditions of turbulence which Patton determines as happening when one reaches the minimum threshhold of shear stress, i.e., the Reynold's Number of that system, where:

$$N \text{ (Reynold's No.)} = \chi v \rho / \eta \qquad (1)$$

χ = Linear parameter (cm)
v = velocity, avg. (cm/sec)
ρ = liquid density (g/cm^3)
η = viscosity (poise)

The Reynold's Number for laminar flow according to Patton's calculations,[5] will be <2,000 while values >2,000 tend to produce turbulence in the millbase. Guggenheim utilized this concept of Reynold's Number to develop his equation for millbase formulation.

Once one has determined the conditions necessary for good dispersion, it remains to set up the physical conditions needed to assure efficient movement of pigment/vehicle in a laminar manner. A review of the literature on high speed dispersers[1,7] reveals the most satisfactory conditions are those given in *Table* 2.

Formulation of Millbases for HSD Techniques

In 1958, Guggenheim[8] published the following formula based on manipulation of the Reynold's Number equation given earlier.

$$\frac{W_v}{W_p} = (0.9 + 0.0069S + 0.025\eta)\frac{OAc}{100} \qquad (2)$$

where:

$\frac{W_v}{W_p}$ = Vehicle to pigment ratio (by weight)
S = % Vehicle solids (by weight)
η = Vehicle viscosity (poise)
OA_c = Gardner Coleman Oil Absorption

The resulting form provided an oil absorption factor derived from the use of percent vehicle solids and vehicle viscosity in poises. That "oil absorption factor for high speed impeller equipment" when multiplied by the oil demand (Gardner-Coleman technique)[9] of the pigment gave the pounds of oil needed in the batch to provide viscous laminar flow at a velocity close to the critical point where turbulence would be encountered. Patton used Guggenheim's equation to develop the nomogram in *Figure* 1. This made it easier to pick out the pigment/vehicle ratio needed for optimum dispersion.

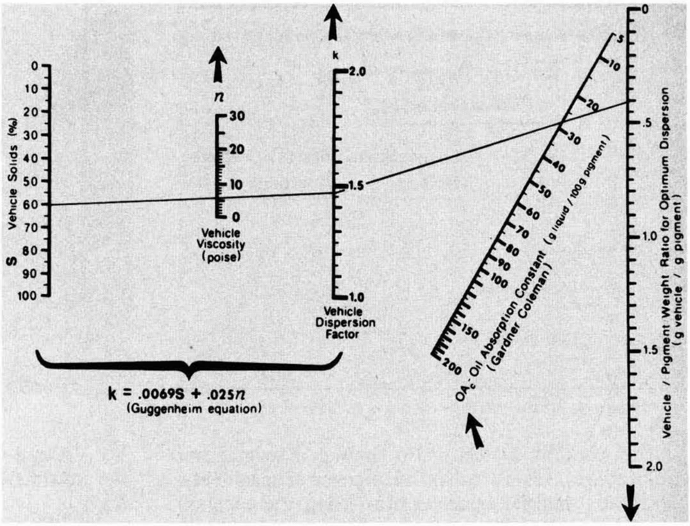

Figure 1—Patton's original nomograph

Daniel[10] presented a detailed study on HSD millbase composition in which he discussed the importance and effect of millbase rheological character on the efficiency of the dispersion operation. He noted that a degree of dilatancy is beneficial and one could not effectively formulate a base using "material constants per se." Dilatancy at low shear rates, according to Daniel, provides the formulator with valuable information on the rheological behavior of the system under study and cites abrupt consistency change and cohesion/adhesion as two characteristic ways in which the behavior is manifest. When both mechanisms work in concert, rapid, efficient dispersion is obtained. Daniel contends the "Wet Point/Flow Point" technique provides a means for accomplishing this balance. By way of identification, the Wet Point is obtained by titrating the pigment with the vehicle in question to a point identical in character to that of the Gardner-Coleman oil absorption technique. That is, there is the formation of a single lump of paste, or smearing of the wall of the container (in which the measurement is carried out) with oil. The Flow Point of Daniel's method occurs at that point which meets the following criteria: (1) the paste flows or drops from a vertically held spatula; (2) a spatula moved rapidly across the surface of the paste @ 1/32″ thick path) yields light drag or less; (3) any ridges made by the spatula motion immediately disappear; and (4) the gloss of the surface of the paste is regained rapidly.

EXPERIMENTAL METHODS AND RESULTS

Of the two procedures, the Guggenheim approach provides the most rapid means of arriving at starting point values for millbase formulation. It came closest to meeting our original objective of providing a less detailed approach to millbase formulation when time would not permit the thoroughness provided by the Daniel procedure. We were concerned, though, that the use of the Gardner-Coleman oil demand would yield pigment:vehicle ratios different from those required to give good millbase composition when vehicles were used which differed in wetting from the Gardner-Coleman oil.

If the vehicle in which the titanium dioxide was to be dispersed was significantly different in wetting than the Gardner-Coleman test oil, the pigment:vehicle ratio derived following Guggenheim's approach would likely produce the undesirable effect of too high or too low a millbase viscosity. Our experience indicated we should expect vehicles with excellent pigment wetting properties to provide the formulator with a greater degree of latitude in millbase formulation since dispersion would more likely than not be accomplished and maintained with relative ease. An important consideration, then, was to modify the Guggenheim approach to eliminate, or at the very least minimize, the effect of these wetting differences just mentioned.

Modification of the Guggenheim Approach

To determine whether or not this concern was legitimate, comparative Hegman fineness of grind and texture ratings were conducted. (A detailed description of the Hegman fineness of grind and texture tests is found in the Appendix, Parts I.A. and I.B.)

The procedure followed was, first, to determine the pounds of vehicle needed to wet-out an enamel grade of TiO_2 using the Gardner-Coleman oil demand value as Guggenheim did in his reported work.[8] Next, the pounds of vehicle needed to wet-out the same TiO_2 was determined, but this time replacing the Gardner-Coleman oil with the long oil alkyd resin actually used in making the dispersion. The values obtained appear in *Table* 3. Although relatively good wetting properties are displayed by both the oil and alkyd, the millbase composition determined using the alkyd rather than the oil to determine vehicle absorption of the TiO_2 gave noticeably better dispersion performance data as shown in *Figures* 2 and 3.

Table 3—Guggenheim and Specific Vehicle Approach

Vehicle / Pigment Ratios

(Enamel Grade TiO_2)

	Guggenheim Method	Specific Vehicle Approach
Titanium Dioxide Oil Absorption	21.6	—
Alkyd Vehicle Absorption	—	28.0
Vehicle / Pigment Ratio	0.40/1	0.55/1

The work by Daniel[10] also showed the significant influence of vehicle solids on pigment dispersibility. Therefore, vehicle:pigment ratios using the long oil alkyd reduced to 30%, 40%, and 50% solids by weight were developed. (The first data described above was developed using the long oil alkyd as supplied, i.e., 60% solids by weight.)*

Encouraged by the positive result of this limited preliminary evaluation, more extensive studies were conducted comparing an empirical (trial-and-error) vs a Specific Vehicle Approach (modified Guggenheim) to millbase formulation in a number of different conventional-and-high solids nonaqueous resins. The resins included short, medium, and long oil alkyds, polyester, and amino resins. Further, the number of TiO_2 grades evaluated was increased to include enamel, general purpose, and durable grades. (See Appendix, Part II for a brief, general description of those grade types.) In general, the data obtained with the various resin-based systems showed the same trends. The following data developed using alkyd-urea baked and alkyd high gloss air-dry enamel systems serve to point out the utility of the Specific Vehicle Approach.

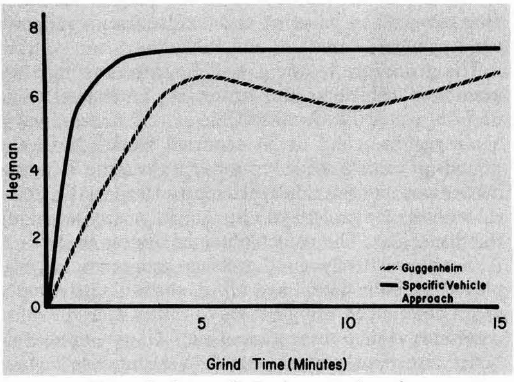

Figure 2—Long oil alkyd—enamel grade

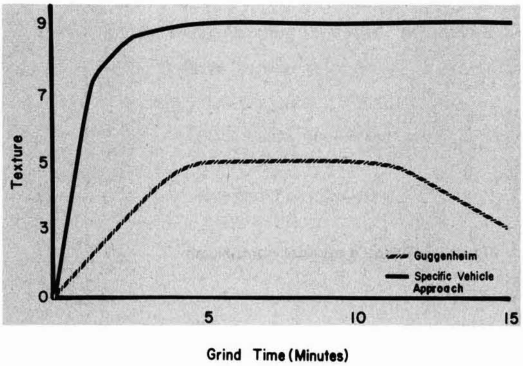

Figure 3—Long oil alkyd—enamel grade

Alkyd-Urea Baked Enamel—Dispersion And Optical Performance Comparisons

Empirical and Specific Vehicle Approach methods derived millbases were developed using the formula and following the specific steps outlined in the Alkyd-Urea section of the Appendix (Part IV).

The millbases were evaluated for fineness of grind using the Hegman gauge, and texture. The development of those performance qualities were plotted as a function of high speed dispersion time and are presented in *Figures* 4 through 7. As the data shows, the Specific Vehicle Approach reduced to approximately one-third the amount of time required for good dispersion over that needed using an empirical approach to millbase formulation. In a properly formulated millbase (Specific Vehicle technique) both general purpose and exterior grades dispersed equally well; in a poorly balanced composition, the exterior grade was found to perform well below its design potential.

To determine the effect of millbase composition on gloss development properties, the millbases were letdown to yield an enamel corresponding to the formula in the Alkyd-Urea section of the Appendix. As shown in *Figures* 8 and 9, 20° gloss data plotted vs high speed dispersion time indicates the Specific Vehicle Approach provided maximum performance development in the

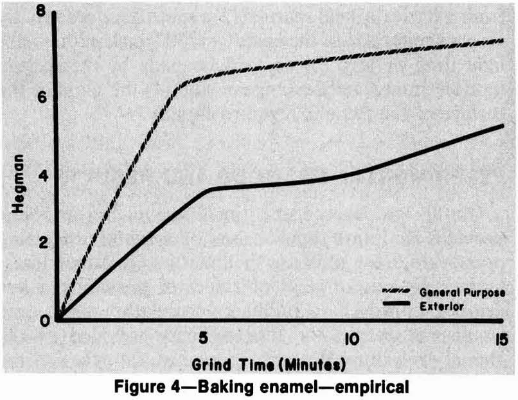

Figure 4—Baking enamel—empirical

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* The information relating to this portion of our work is found in part III.C. of the Appendix. It confirmed Daniel's work that lower vehicle solids could afford more rapid dispersion.

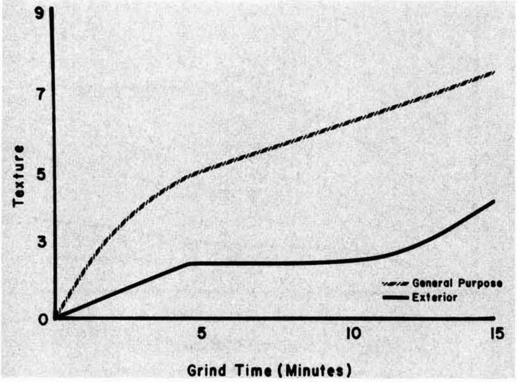

Figure 5—Baking enamel—empirical

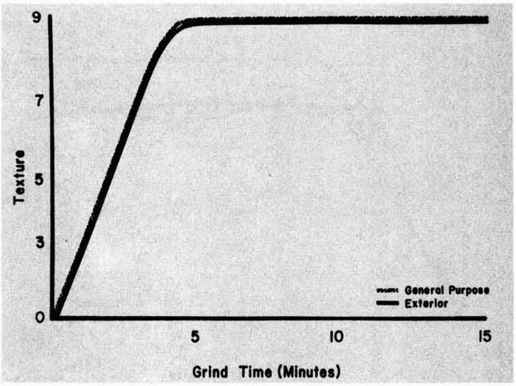

Figure 7—Baking enamel—specific vehicle approach

gloss of the TiO_2 grades tested. That development was in one-third the time shown by the trial-and-error empirical approach.

Up to this point, work had been conducted using the short oil alkyd resin at the solids level at which it was supplied. The next step was to evaluate the effect(s) of short oil alkyd resin solids on the same properties just discussed. Of the three TiO_2 grades used in this work, the exterior grade of TiO_2 appeared to be the most sensitive to changes in millbase composition. Therefore, that grade was selected to explore the resin solids effect employing the Specific Vehicle technique.

Hegman fineness of grind and texture ratings (plotted vs dispersion time in *Figures* 10 and 11) indicate that, in the alkyd-urea baking enamel formula used in this project, short oil alkyd resin solids (weight basis) at and above 44% produced slower development of Hegman fineness of grind and texture while improvement could be noted in dispersibility at or below 34% alkyd solids (weight basis). Further, during the let-down of the millbases formulated to lower than 34% solids (weight basis) it was found there was a high tendency to shock the dispersion. This condition seemed to be more sensitive up to a point (≅20%) as the solids dropped. Although the lower solids did give the most rapid dispersion data, the risk of shocked millbase weighed heavily against that approach. In the cases where shock occurred, the Hegman fineness of grind, texture, and gloss of the Baked Enamel were quite poor as would be expected. Forty percent vehicle solids on a weight basis in this system gave a good balance of dispersion and optical performance development and freedom from the danger of system shock.

Air-Dry Alkyd High Gloss Enamel—Dispersion and Optical Performance Comparisons

The development of comparative data in the medium oil alkyd gloss enamel formula (Appendix V) followed closely the procedures used with the Baked Enamel. First, enamel, general purpose, and exterior grades of TiO_2 were compared for dispersibility using the empirical and Specific Vehicle techniques (plots of the data are found in *Figures* 12 through 15). Those millbases were subsequently let-down to yield air-dry alkyd high gloss enamels of the composition given in the Alkyd Gloss Enamel section of the Appendix. A portion of the white enamel was combined with a dispersion of lampblack (ground in the same alkyd resin) to give a light-to-medium grey tint (ANLAB brightness approximately 74-75% reflectance) to measure tint strength development (*Figures* 16 and 17). Finally, the exterior grade of TiO_2 was dispersed using the Specific Vehicle

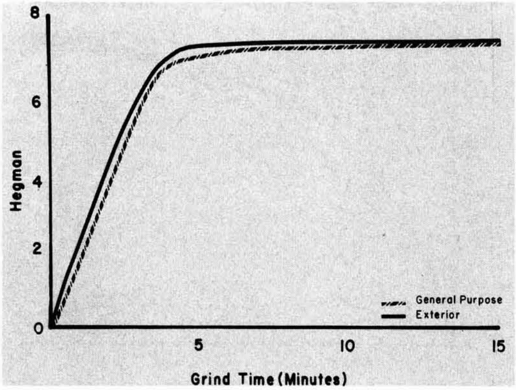

Figure 6—Baking enamel—specific vehicle approach

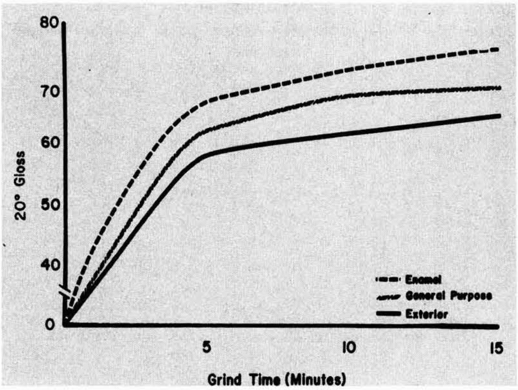

Figure 8—Baking enamel—empirical

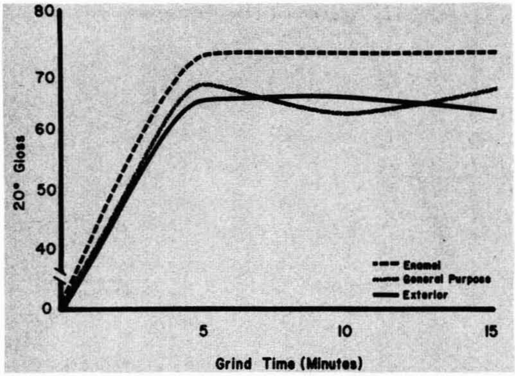

Figure 9—Baking enamel—specific vehicle approach

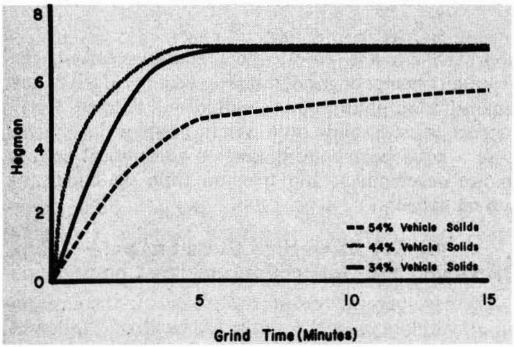

Figure 10—Baking enamel—exterior grade specific vehicle approach

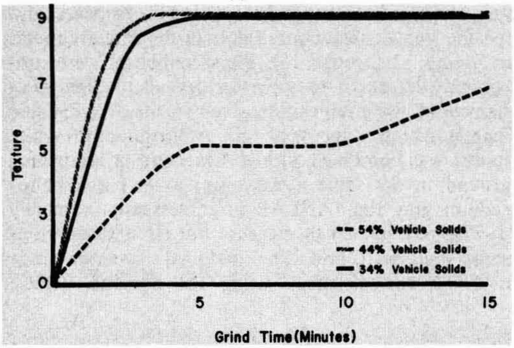

Figure 11—Baking enamel—exterior grade specific vehicle approach

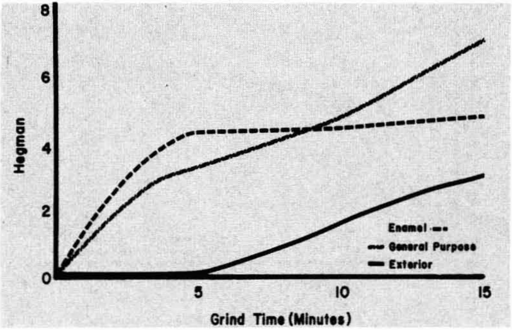

Figure 12—High gloss enamel—empirical

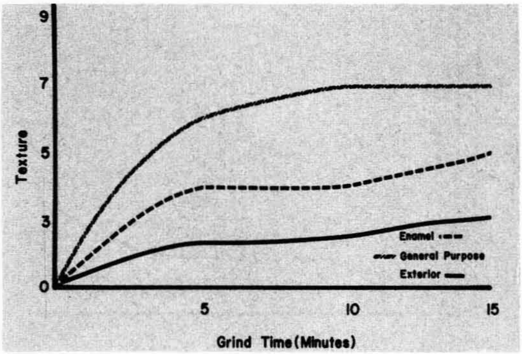

Figure 13—High gloss enamel—empirical

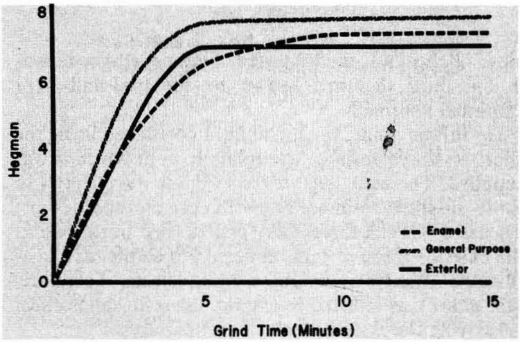

Figure 14—High gloss enamel—specific vehicle approach

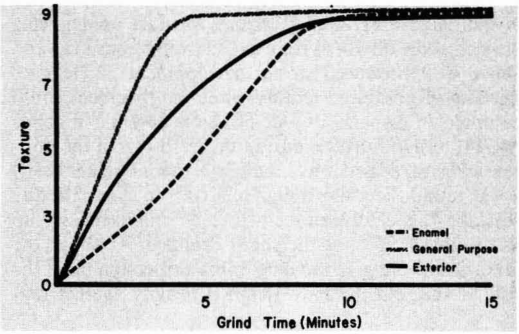

Figure 15—High gloss enamel—specific vehicle approach

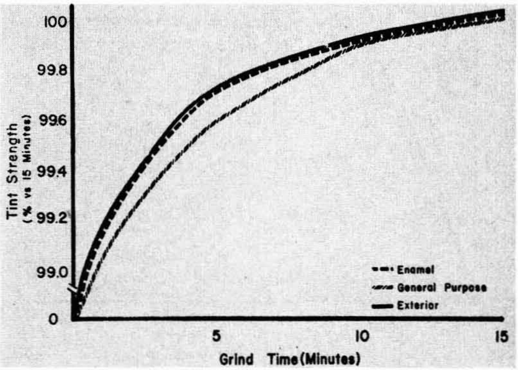

Figure 16—High gloss enamel—empirical

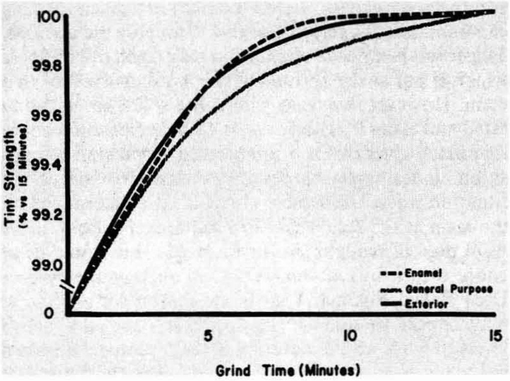

Figure 17—High gloss enamel—specific vehicle approach

Approach observing high speed dispersibility at various vehicle solids composition (*Figures* 18 and 19).

As shown in the referenced plots, dispersion and tint strength development were accomplished in one-third less time with the Specific Vehicle technique over that achieved under empirical approach conditions. Alkyd solids levels by weight between 35–40% and lower gave rapid dispersion and cleanliness of dispersion, while above 40% solids produced comparable results only after a three-fold increase in dispersion time. There was less of a tendency toward shocking of the dispersion during let-down with this system than with the alkyd-urea baked enamel, so of the two, somewhat more flexibility would exist in millbase formulation of this alkyd enamel.

SUMMARY

Based on the foregoing work, the use of the Daniel's Wet Point value using the specific resin(s) to be employed in the dispersion process rather than the Gardner-Coleman value in the Guggenheim equation gave rise to a Specific Vehicle Approach equation for help in designing an optimum millbase composition for high speed dispersion equipment.

$$\frac{W_v}{W_p} = (0.9 + 0.0069S + 0.025\eta)\ \frac{DWP}{100} \qquad (3)$$

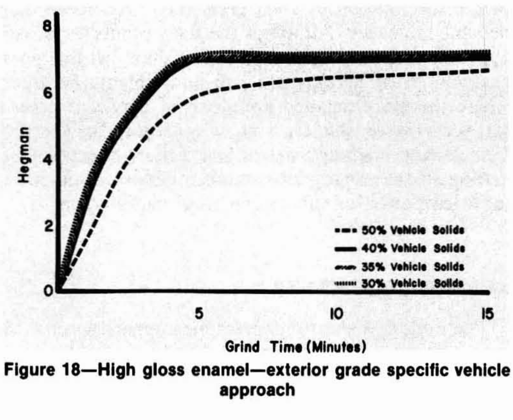

Figure 18—High gloss enamel—exterior grade specific vehicle approach

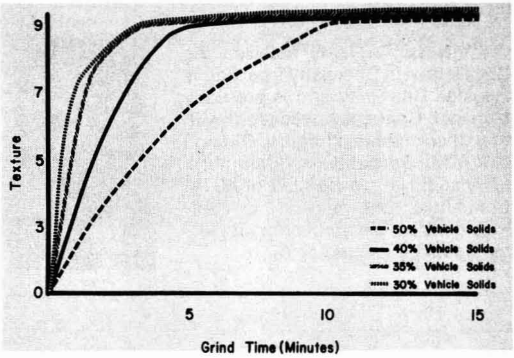

Figure 19—High gloss enamel—exterior grade specific vehicle approach

where:

$\frac{W_v}{W_p}$ = Vehicle to pigment ratio (by weight)
S = % Vehicle solids (by weight)
η = Vehicle viscosity (Poise)
DWP = Daniel's Wet Point

The effect of this modification of the Guggenheim equation was particularly noticeable when poorer wetting vehicles were involved (short oil alkyd); with vehicles possessing better wetting properties, there were minimal differences in dispersion and optical performance development. With the alkyd discussed here, the medium oil length product gave moderately good wetting while the long oil alkyd gave excellent wetting.

Patton's Nomograph which provided a graphical solution to millbase formulation based on Guggenheim's work[8] was found to be capable of extended utility by

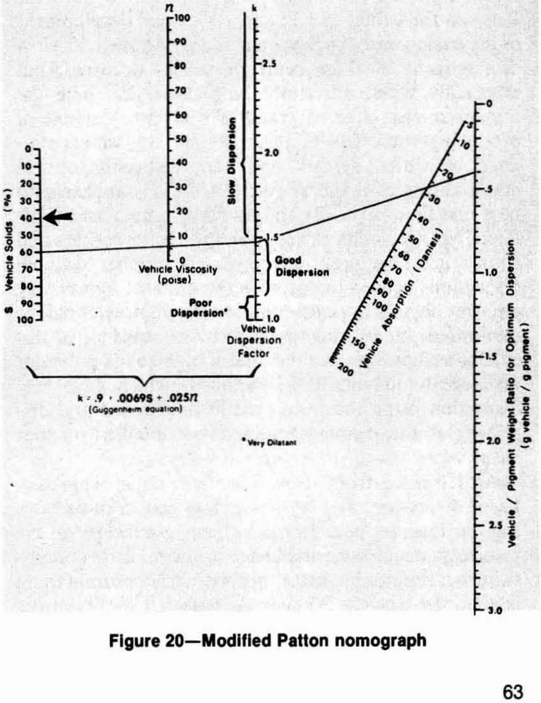

Figure 20—Modified Patton nomograph

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introducing a couple of relatively minor modifications. The first was to relabel the "Gardner-Coleman Oil Absorption Constant" scale to indicate it was the "Daniel's Wet-Point Vehicle Absorption" value being used. It is important to note that *no* scalar change was necessary. The viscosity vehicle dispersion factor, and Vehicle/Pigment Weight Ratio Scales were extended maintaining the same scalar unit divisions. This provided scalar components able to handle the formulation of millbases utilizing the newer, higher solids resin systems. *Figure* 20 shows the Patton Nomograph incorporating these changes. (The original nomograph is shown in *Figure* 1.) The Nomograph was found to be quite useful in that it provided some insight into what was likely to happen in millbase dispersion and optical performance development.

In general, referring to *Figure* 20, when the line drawn connecting the solids of the vehicle being used in the millbase and its viscosity at that solids level was extended to the "Vehicle Dispersion Factor" scale, the area of the scale involved provided a good approximation of the results expected under high shear dispersion conditions. Between the values of 1.15 and 1.50, rapid development of dispersion and optics were realized. Above 1.50, slow development of those same properties occurred, but eventually with sufficiently long dispersion time the maximum that a given grade of TiO_2 was capable of producing could be obtained. Below 1.15, we encountered very dilatant flow and poor dispersion/optical development with the vehicle tested. This appeared to be a real time-saver. By simply making up a set of different vehicle solids mixes, running the viscosities and connecting the appropriate points, the number of actual dispersions needed to optimize the millbase by weeding out the obviously poor composition choices could be minimized. Indeed, for the majority of resins tested this held true; however, we did find a high solids polyester resin (85% nonvolatile as supplied) which gave best dispersion using the resin exactly as supplied and dispersing at the pigment:vehicle ratio obtained on that basis.

Also learned from these Specific Vehicle Approach based dispersions and let-downs was that in some cases a given formula places *practical use constraints* on the vehicle/pigment ratio and hence on the millbase composition determined by that Approach. The important thing is that the Specific Vehicle Approach clearly defines those pitfalls *before* the grind is made. By way of example, the resin and/or solvent content in a given formula can limit the solids level available to prepare the millbase. This formula-imposed limitation may result in a millbase which is not at the optimum vehicle solids level for that resin. However, working within the solids level(s) dictated and using that nonvolatile with the Specific Vehicle Approach gives the best compromise dispersion composition under those conditions. Related to this is the situation where the vehicle:pigment ratio determined on the resin at the solids supplied requires the use of more resin than is available in the formula. This would be of concern in a mixed vehicle system such as the Alkyd-Urea Baked Enamel. That is the reason we used what may appear to some to be "peculiar" or "odd" solids levels to work with in developing the reported data when the alkyd is supplied at 60% solids. The third and last condition to be mentioned was also found with the Baked Enamel formula. At the 53.6% solids level the vehicle required to wet-out the exterior grade of titanium dioxide gave rise to higher volume than the two-times the blade diameter considered by some to be the maximum practical volume before losing dispersion efficiency. Had a trial-and-error approach been used, this would only have been discovered after the waste of time and material.

Based on this work, it appeared that conventional titanium dioxide pigmented solvent-borne coatings systems (i.e., total formula nonvolatile of 40-50% by weight) millbases gave optimum development of dispersion and optical performance, and were not sensitive to shocking on let-down when formulated around resins with nonvolatile content adjusted to approximately 35-40% by weight. Low solids (lacquer type) systems were best dispersed at as high a vehicle solids level as possible. Depending on the particular system involved, it may be possible to go as low as 25% vehicle solids before undue risk of millbase shock occurs on let-down. That would have to be determined experimentally for each resin.

CONCLUSIONS

Studies involving several different types of TiO_2 in a number of coatings resins indicate that one can employ a modification of the Guggenheim equation and Patton's Nomograph to achieve a relatively quick approach to the formulation of TiO_2 pigmented high speed dispersion millbases. Although the data points to broad application for this approach (other than just the gloss enamels tested here), there will undoubtedly be areas where the more detailed approach of Daniel is necessarily warranted. But, for a majority of cases, the Specific Vehicle Approach appears to give a more direct way of getting to the same goal—sound millbase formulation for a realization of efficient coatings manufacture.

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Acknowledgment is also due Wiley Interscience Publishers for permission to reproduce Figure 1 from their book *Paint Flow and Pigment Dispersion*.

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APPENDIX

SOLVENT-BORNE MILLBASE DEVELOPMENT FOR HIGH SPEED DISPERSION OF TITANIUM DIOXIDE

I. HEGMAN FINENESS OF GRIND AND TEXTURE RATINGS

A. Hegman Fineness of Grind Ratings:

Hegman fineness ratings were taken using a 0–8 scale, one-inch wide single path Fineness of Grind gauge manufactured by Precision Gauge and Tool Co. The depth of the path at "0" is four mils.

The procedure for reading the gauge followed that outlined in ASTM Method D-1210-79 with the exception that scatter or cleanliness was rated additionally as

clean	0–2	particles above the main pattern
very slightly dirty	2–8	particles above the main pattern
slightly dirty	9–15	particles above the main pattern
dirty	15–30	particles above the main pattern
very dirty	>30	particles above the main pattern

B. Texture Ratings:

A portion of dispersion millbase was removed from the grind vessel at preplanned intervals of milling time and applied to the sealed side of an all-white cardboard drawdown chart using a two-mil (50.8μ) Bird Film Applicator. This approximately 6-in. (15.24-cm) × 10-in. (25.4-cm) rectangular area of millbase drawdown was immediately evaluated visually vs a set of known standards for cleanliness, i.e., freedom from speckiness. The rating system used is based on a scale running from 10–1 with the surface of a film having a 10 rating being completely speck-free. A 1 rating indicates a heavy population of large undispersed pigment particles somewhat similar to what one would expect from a drawdown of a millbase prepared by hand-mixing TiO_2 into a vehicle. Intermediate values between these two extremes indicate varying levels of speckiness. It is important to understand the rating is based on number rather than size of agglomerates (specks) noted.

II. TiO_2 TYPE

	Enamel	General Purpose	Exterior
ASTM D476-73 Designation	Type II	Type II, IV	Type IV
% TiO_2	92% min	92% min	80% min
Oil absorption, spatula rub-out technique	14–17	18–22	18–22

III. PRELIMINARY HIGH-SPEED DISPERSION STUDIES—LONG OIL ALKYD RESIN

A. Rate of Dispersion using Guggenheim procedure and Enamel Grade of Titanium Dioxide:

(1) Optimum vehicle/pigment ratio according to the Guggenheim Approach

a. Enamel Grade Oil Absorption (using Gardner-Coleman Method) ... 21.6

b. Guggenheim Vehicle/Pigment ratio .. 0.40/1

This value may be obtained from use of either Guggenheim's equation (1) or Patton's Nomograph (*Figure* 1). If the equation is chosen, one inserts the following data into the appropriate place in the formula:

TiO_2 Oil Absorption	21.6
Resin, solids (Long Oil Alkyd, wt. basis)	60
specific gravity	0.925
viscosity (poise)	27.5

Performing the indicated operations yields the above ratio. With the nomograph, locate 60% on the *Vehicle Solids scale* and mark that point. Going to the *Vehicle Viscosity scale* locate and mark the 27.5 poise point. Connect these two points with a straight line continuing the line to intersect the *Vehicle Dispersion Factor scale* (2.0). A line is constructed next which connects the 2.0 on the vehicle dispersion factor scale and the 21.6 oil absorption value on the *Vehicle Absorption scale*. Extend the line to the *Vehicle/Pigment Weight/Ratio scale* to obtain 0.40/1 ratio.

(2) Grind base composition based on the Guggenheim Approach derived vehicle/pigment weight ratio

	Parts by Weight
Enamel Grade TiO_2	450.0
Long Oil Alkyd, 60%	180.0
Disperser blade diameter	2 in. (5.08 cm)
Shaft speed	5,000 rpm
Blade tip speed	2,617 ft/min (13.294 m/s)

(3) Hegman Fineness of Grind and Texture Ratings

Dispersion Time (min)	Enamel Grade TiO_2 Hegman Fineness	Texture
1	0 dirty	<3
3	1 dirty	<3
5	6.5 sl. dirty	5
7	6.5 sl. dirty	5
10	6.5 sl. dirty	5
12	6.5 sl. dirty	5
15	6.5 sl. dirty	5

B. *Rate of Dispersion using the Specific Vehicle Approach*[a] *(modification of the Guggenheim Method) and Enamel Grade of Titanium Dioxide:*

(1) Optimum vehicle/pigment ratio according to the Specific Vehicle Approach

Long Oil Alkyd, % solids (wt. basis).. 60
specific gravity 0.925
viscosity (poise).................. 27.5
Enamel Grade Vehicle (Long Oil Alkyd)
Absorption...................... 28
Specific Vehicle (Long Oil Alkyd)/
Pigment Ratio................... 0.55/1

(2) Grind base composition based on the Specific Vehicle Approach derived vehicle/pigment ratio

TiO_2 enamel grade .... 400 parts by wt
Long oil alkyd, 60% solids .. 220 parts by wt
Disperser blade diameter .... 2 in. (5.08 cm)
Shaft speed .... 5,000 rpm
Blade tip speed .... 2,617 ft/min (13.294 m/s)

(3) Hegman Fineness of Grind and Texture Ratings

Dispersion Time (min)	Enamel Grade TiO_2 Hegman Fineness	Texture
1	1.25 dirty	<3
3	5.5 dirty	5
5	7 v. sl. dirty	9
7	7 v. sl. dirty	9
10	7 v. sl. dirty	9
12	7 v. sl. dirty	9
15	7 v. sl. dirty	9

C. *Effect of Vehicle Solids:*

(1) Optimum vehicle/pigment ratio according to the Specific Vehicle Approach

Long Oil Alkyd, % solids (wt basis)	30	40	50
specific gravity	0.848	0.872	0.898
viscosity (poise)	0.12	0.32	2.12
Enamel Grade TiO_2 Vehicle (Long Oil Alkyd) Absorption	23.3	24.8	27.4
Specific Vehicle (Long Oil Alkyd)/Pigment Ratio	0.26/1	0.29/1	0.35/1

(2) Grind base compositions based on the Specific Vehicle Approach derived vehicle/pigment ratios

	Percent Vehicle Solids 30	40	50
TiO_2, enamel grade (parts by wt)	450	450	450
Long oil alkyd (reduced solids)(parts by wt.)	117[a]	130	158

Dispersion blade diameter .... 2 in. (5.08 cm)
Shaft speed .... 5,000 rpm
Blade tip speed.............. 2,617 ft/min (13.294 m/s)

(3) Hegman Fineness of Grind and Texture Ratings (See Appendix Table 1).

Note: Dispersion time was taken to yield a 7 Hegman fineness and 9 texture.

IV. ALKYD-UREA BAKED ENAMEL

A. *Formula:*

Material	Lbs	Gal
Short non-oxidizing oil (modified) alkyd (60% nonvolatile)	305.0	35.5
Butylated Urea-Formaldehyde Resin (60% nonvolatile)	204.0	24.0
Xylene	115.0	15.9
n-Butanol	107.0	15.9
Anti-silking agent	1.5	0.2
Titanium Dioxide, rutile	318.0	8.5
Totals	1050.5	100.0

---

[a] In order to avoid confusion between data developed following Guggenheim's original technique and data obtained using the modification to Guggenheim's technique discussed in the text, the author has chosen to designate that modified technique the "Specific Vehicle Approach" since the actual vehicle in the millbase is used to develop the millbase composition.

[a] An additional 6 parts by weight (5%) of 30% solids vehicle was necessary to provide proper millbase viscosity. No additional vehicle was necessary with the 40% or 50% solids levels.

Appendix Table 1—Hegman Fineness of Grind and Texture Ratings

Dispersion Time (min)	Enamel Grade TiO_2 30% vehicle solids[a] Hegman Fineness	Texture	40% vehicle solids[a] Hegman Fineness	Texture	50% vehicle solids[a] Hegman Fineness	Texture
1	7 v.sl.d.	9	6.5 v.sl.d.	7	6 sl.d.	5
3	—	—	7 v.sl.d.	9	7 v.sl.d.	8
5	—	—	—	—	7 v.sl.d.	9

[a] An additional 6 parts by weight (5%) of 30% solids vehicle was necessary to provide proper millbase viscosity. No additional vehicle was necessary with the 40% or 50% solids levels.
v.sl.d. = very slightly dirty
sl.d. = slightly dirty

B. Vehicle/pigment ratio:

(1) Using Specific Vehicle Approach to optimize composition of millbase

a. Short Oil Alkyd,

% solids (wt basis)	43.6	43.6	43.6
specific gravity	0.981	0.981	0.981
viscosity (poise)	3.0	3.0	3.0
TiO_2 Vehicle absorption,			
Enamel grade	28.0	—	—
General purpose grade	—	33.8	—
Exterior grade	—	—	32.9
Specific vehicle (short oil alkyd)/Pigment ratio			
Enamel grade	0.36/1	—	—
General purpose grade	—	0.45/1	—
Exterior grade	—	—	0.42/1

b. Grind base compositions based on the Specific Vehicle Approach derived vehicle/pigment ratios

	Parts by Weight		
TiO_2			
Enamel grade	541.8	—	—
General purpose grade	—	541.8	—
Exterior grade	—	—	541.8
Short oil alkyd (60% solids)	141.6	177.2	165.4
Xylene	53.4	66.8	62.2

Dispersion blade diameter ....2 in. (5.08 cm)
Shaft speed ....5,000 rpm
Blade tip speed ....2617 ft/min (13.294 m/s)

c. Hegman Fineness of Grind, Texture, Gloss Ratings

On completion of grinding at each time interval reported below, the grind paste was evaluated for Hegman fineness and texture. A weighed portion of the grind paste was then let-down with the remaining formula materials to a finished baking enamel and tested for gloss quality. Gloss measurements were taken on baked films applied to uncoated aluminum panels with a #28 Wirecator; D.F.T. approximately 0.8 mils (20.32μ). Films were cured after a ten-minute flash period by baking at 310°F (154°C) for five min.

Dispersion Time (min)	Property Evaluated	Type of TiO_2 Enamel	General Purpose	Exterior
1	Hegman Fineness	1.5 dirty	1 dirty	5.25 dirty
	Texture	<3	<3	<3
	Gloss, 20°	74	60	60
	60°	86	82	84
3	Hegman Fineness	6.5 sl.dirty	6.75 sl.d.	7.25 v.sl.d.
	Texture	4	7	9
	Gloss, 20°	74	64	66
	60°	86	83	84
5	Hegman Fineness	6.5 sl.dirty	7 v.sl.dirty	7.25 v.sl.d.
	Texture	5	9	9
	Gloss, 20°	74	69	66
	60°	85	84	84
7	Hegman Fineness	7 v.sl.dirty	7.25 v.sl.d.	7.25 v.sl.d.
	Texture	8	9	9
	Gloss, 20°	73	61	66
	60°	86	83	85
10	Hegman Fineness	7 v.sl.d.	7.25 v.sl.d.	7.25 v.sl.d.
	Texture	9	9	9
	Gloss, 20°	74	63	65
	60°	86	83	84
12	Hegman Fineness	7.25 v.sl.d.	7.25 v.sl.d.	7.25 v.sl.d.
	Texture	9	9	9
	Gloss, 20°	75	68	68
	60°	86	84	85
15	Hegman Fineness	7 v.sl.d.	7.25 v.sl.d.	7.25
	Texture	9	9	9
	Gloss, 20°	75	64	64
	60°	86	84	85

(2) Using an empirical approach to millbase formulation (assumes qualified technician; the technique would propose more difficulty to a novice)

In general, this technique involved developing a mixture of pigment and resin with subsequent solvent addition to yield a millbase which "appeared right" for high-speed dispersion. That millbase was processed and evaluated as the ones described in IV.B.(1)c, above, with the following results.

Dispersion Time (min)	Property Evaluated	Type of TiO_2 Enamel	General Purpose	Exterior
1	Hegman Fineness	0 dirty	3.25 dirty	0 dirty
	Texture	<3	3	<3
	Gloss, 20°	68	60	45
	60°	83	82	74
3	Hegman Fineness	4.5 dirty	3.5 dirty	2 dirty
	Texture	<3	3	<3
	Gloss, 20°	69	61	55
	60°	84	82	80
5	Hegman Fineness	6 dirty	6.5 sl.dirty	3.75 dirty
	Texture	<3	5	<3
	Gloss, 20°	72	63	58
	60°	84	83	82
7	Hegman Fineness	6.5 dirty	6.5 sl.dirty	4 dirty
	Texture	3	5	<3
	Gloss, 20°	72	64	60
	60°	85	83	83

10	Hegman Fineness	6.5 dirty	7 sl.dirty	4.25 dirty
	Texture	3	6	3
	Gloss, 20°	72	69	62
	60°	85	84	84
12	Hegman Fineness	6.5 dirty	7.25 v.sl.d.	4.5 dirty
	Texture	3	7	4
	Gloss, 20°	73	70	63
	60°	85	84	84
15	Hegman Fineness	6.5 dirty	7.25 v.sl.d.	4.75 dirty
	Texture	5	9	5
	Gloss, 20°	76	70	65
	60°	86	85	86

(3) Specific Vehicle Approach applied to adjusted short oil alkyd resin solids to develop optimized millbase composition

a. Short Oil Alkyd,

% solids (wt. basis)	33.6	43.6	53.6
specific gravity	0.946	0.981	1.02
viscosity (poise)	0.5	3.0	34.8
TiO_2 vehicle absorption exterior grade	29.3	32.9	44.1
Specific Vehicle (Short Oil Alkyd)/Pigment Ratio Exterior Grade TiO_2	0.33/1	0.42/1	0.95/1

b. Grind base compositions based on the Specific Vehicle Approach vehicle/pigment ratios

	Parts by Weight		
	Vehicle Solids, %		
	33.6[a]	43.6	53.6
TiO_2, Exterior Grade	541.8	541.8	541.8
Short Oil Alkyd	100.1	171.6	459.8
Xylene	78.7	64.6	54.9

Dispersion blade diameter...2 in. (5.08 cm)
Shaft speed ....5,000 rpm
Blade tip speed ....2,617 ft/min (13.295 m/s)

c. Dispersion and Gloss development as a function of resin solids using Exterior Grade of TiO_2

Dispersion Time (min)[b]	Property Evaluated	Resin Solids, % by Wt. 33.6[c]	43.6	53.6
1	Hegman Fineness	6.5 dirty	6.5 sl.d.	1 dirty
	Texture	3	9	<3
	Gloss, 20°			
	60°			
3	Hegman Fineness	7 sl.dirty	7	3.5 dirty
	Texture	5	9	3
	Gloss, 20°		63	
	60°		84	
5	Hegman Fineness	7 v.sl.d.		5 dirty
	Texture	9		5
	Gloss, 20°	65		
	60°	84		
7	Hegman Fineness			5.5 sl.d.
	Texture			5
	Gloss, 20°			
	60°			
10	Hegman Fineness			5.5 sl.d.
	Texture			5
	Gloss, 20°			
	60°			
12	Hegman Fineness			5.5 sl.d.
	Texture			7
	Gloss, 20°			
	60°			
15	Hegman Fineness			5.75 sl.d.
	Texture			7
	Gloss, 20°			60
	60°			83

V. MEDIUM OIL ALKYD ENAMEL

A. Formula:

Material	Lbs	Gal
Medium Oil Alkyd (50% nonvolatile)	578.0	75.60
Mineral spirits	96.2	14.80
Cobalt drier, 6%	7.1	1.00
Zirco drier catalyst, 18%	4.2	0.40
Antiskinning agent	1.0	0.10
Lampblack	1.5	0.10
Titanium Dioxide, rutile	272.9	8.00
Totals	960.9	100.00

B. Vehicle/Pigment Ratio:

(1) Using Specific Vehicle Approach to optimize millbase composition

a. Medium Oil Alkyd,

% solids (wt. basis)	50.0	50.0	50.0
specific gravity	0.925	0.925	0.925
viscosity (poise)	18.2	18.2	18.2
TiO_2 Vehicle Absorption, Enamel Grade	28.0	—	—
General purpose grade	—	31.0	—
Exterior Grade	—	—	30.5

(a) Required an additional 10% of vehicle @ 33.6% solids (wt basis) to achieve proper milling rheology.

(b) Dispersion was taken to either a 7 Hegman fineness and 9 texture or 15 min total grind whichever occurred first. Gloss data were reported at that time.

(c) Required an additional 10% of vehicle @ 33.6% solids (wt basis) to achieve proper milling rheology.

Specific Vehicle (Medium Oil Alkyd)/Pigment Ratio			
Enamel Grade	0.50/1	—	—
General Purpose Grade	—	0.55/1	—
Exterior Grade	—	—	0.55/1

b. Grind base composition based on the Specific Vehicle Approach derived vehicle/pigment ratios

	Parts by Weight		
TiO_2			
Enamel Grade	409.6	—	—
General Purpose Grade	—	409.6	—
Exterior Grade	—	—	409.6
Medium Oil Alkyd (50% solids, wt.)	204.8	225.2	225.2

Dispersion blade diameter .... 2 in. (5.08 cm)
Shaft speed .... 5,000 rpm
Blade tip speed .... 2,617 ft/min (13.294 m/s)

c. Hegman Fineness of Grind, Texture, Tint Strength Ratings

Hegman fineness and texture ratings were obtained following the procedure outlined above. Tint strength values came from a letdown of the grind base to yield a coating whose composition was that of the formula given in V.A. The resulting grey coating was applied to an all-white sealed cardboard test chart with a .002″ (2-mil) Bird Applicator. After overnight drying at ambient conditions, Hunterlab Color meter readings were taken using the ANLAB Scale.

Dispersion Time (min)	Property Evaluated	Type of TiO_2 Enamel	General Purpose	Exterior
1	Hegman Fineness	0 dirty	5.5 dirty	4 dirty
	Texture	<3	3	<3
	Tint Strength; ANLAB Brightness, L_A	74.8	74.0	73.5
	L_A, % of 15 min[a]	99.6	99.6	99.4
3	Hegman Fineness	5.25 sl.d.	6.75 sl.d.	6 sl.d.
	Texture	5	6	7
	Tint Strength; ANLAB Brightness, L_A	74.9	73.9	73.6
	L_A, % of 15 min[a]	99.7	99.5	99.4
5	Hegman Fineness	6.5 sl.d.	7.5 v.sl.d.	7 sl.d.
	Texture	5	9	7
	Tint Strength; ANLAB Brightness, L_A	74.9	74.0	73.7
	L_A, % of 15 min[a]	99.7	99.6	99.7
7	Hegman Fineness	6.75 sl.d.	7.5	7 v.sl.d.
	Texture	6	9	9
	Tint Strength; ANLAB Brightness, L_A	75.0	73.9	73.7
	L_A, % of 15 min[a]	99.9	99.5	99.7
10	Hegman Fineness	7.25 v.s.d.	7.5	7 sl.d.
	Texture	9	9	9
	Tint Strength; ANLAB Brightness, L_A	75.1	74.2	73.8
	L_A, % of 15 min[a]	100.0	99.9	99.9
12	Hegman Fineness	6.75 vsd	7	7 sl.d.
	Texture	9	9	9
	Tint Strength; ANLAB Brightness, L_A	75.0	74.3	73.9
	L_A, % of 15 min[a]	99.9	100.0	100.0
15	Hegman Fineness	7.25 v.sl.d.	7.5	7 v.sl.d.
	Texture	9	9	9
	Tint Strength; ANLAB Brightness, L_A	75.1	74.3	73.9
	L_A, % of 15 min[a]	100.00	100.0	100.0

(2) Using an empirical approach to millbase formulation (re: Section IV.B.(2))

Dispersion Time (min)	Property Evaluated	Type of TiO_2 Enamel	General Purpose	Exterior
1	Hegman Fineness	1.5 dirty	1.25 dirty	0
	Texture	<3	<3	<3
	Tint Strength; ANLAB Brightness, L_A	74.8	74.0	73.3
	L_A, % of 15 mins[a]	99.7	99.7	99.2
3	Hegman Fineness	3.25 dirty	2.25 dirty	0
	Texture	3	3	<3

(a) Dispersion time L_A.

	Tint Strength; ANLAB Brightness, L_A ...	74.8	74.0	73.6
	L_A, % of 15 mins[a] ..	99.7	99.6	99.6
5	Hegman Fineness ..	4 dirty	3.5 sl.d.	0
	Texture	3	5	<3
	Tint Strength; ANLAB Brightness, L_A ...	74.9	74.1	73.7
	L_A, % of 15 mins[a] ..	99.8	99.9	99.7
7	Hegman Fineness ..	4.25 dirty	4 sl.d.	1 dirty
	Texture	4	6	<3
	Tint Strength; ANLAB Brightness, L_A ...	74.9	74.1	73.8
	L_A, % of 15 mins[a] ..	99.8	99.9	99.6
10	Hegman Fineness ..	4.25 dirty	4.5 sl.d.	4.25 dirty
	Texture	4	7	4
	Tint Strength; ANLAB Brightness, L_A ...	74.9	74.1	74.9
	L_A, % of 15 mins[a] ..	99.8	99.9	99.8
12	Hegman Fineness ..	4.5 dirty	5 v.sl.d.	4.5 dirty
	Texture	5	7	5
	Tint Strength; ANLAB Brightness, L_A ...	75.0	74.2	75.0
	L_A, % of 15 mins[a] ..	100.0	100.0	100.0
15	Hegman Fineness ..	4.5 dirty	7 sl.d.	4.5 dirty
	Texture	5	7	5
	Tint Strength; ANLAB Brightness, L_A ...	75.0	74.3	75.0
	L_A, % of 15 mins[a] ..	100.00	100.0	100.0

(3) Specific Vehicle Approach applied to adjusted short oil alkyd resin solids to develop optimized millbase composition

a. Medium Oil Alkyd,

% solids (wt. basis)	30%	35%	40%
specific gravity	0.861	0.875	0.890
viscosity (poise)	0.10	0.30	1.00
TiO_2 vehicle absorption Exterior Grade.......	27.1	27.6	28.5
Specific Vehicle (Medium Oil Alkyd)/Pigment Ratio Exterior Grade TiO_2........	0.31/1	0.32/1	0.34/1

b. Grind base compositions based on the Specific Vehicle Approach vehicle/pigment ratios

	Parts by Weight		
	Vehicle Solids %		
	30	35	40
$TioO_2$, Exterior Grade.............	614.4	614.4	614.4
Medium Oil Alkyd.............	177.7[a]	196.5	208.8

Dispersion blade diameter ....2 in. (5.08 cm)
Shaft speed ....5,000 rpm
Blade tip speed ....2,617 ft/min (13.294 m/s)

c. Dispersion and Tint Strength development as a function of resin solids using exterior Grade of TiO_2

Dispersion Time (min)	Property Evaluated	Resin Solids, % by Weight 30	35	40
1	Hegman Fineness..	5.5 sl.d.	6.5 sl.d.	6 sl.d.
	Texture	7	9	7
3	Hegman Fineness..	7 v.sl.d.	7 v.sl.d.	6.5 v.sl.d.
	Texture	9	9	9
	Tint Strength; ANLAB Brightness, L_A ..	74.7	74.8	
	L_A, %[b] ...	100.4	100.5	
5	Hegman Fineness			7 v.sl.d.
	Texture			9
	Tint Strength; ANLAB Brightness, L_A			74.8
	L_A, %[b]			100.5

Note: Dispersions were run until a 7 Hegman fineness and 9 texture were obtained or 15 min milling time was reached, whichever came first. Tint Strength was run at that point.

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[a] Required 5% additional 30% solids alkyd for good dispersion viscosity.
[b] Dispersion time relative to 50% resin solids L_A value at 15-min dispersion time.

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June 1981 Subcommittee Reports of ASTM Committee D-1

The June 1981 meeting of ASTM Committee D-1 on Paint and Related Coatings and Materials was held on June 21-24 at the Biltmore Plaza Hotel, Providence, Rhode Island. In the three and one half days preceding the final report session and general meeting of Committee D-1, approximately 150 members and guests met in 162 scheduled meetings of D-1 subcommittees and working groups. The present membership of Committee D-1 is 530.

One of the highlights of the meeting was the activation of working groups under the new Sub. D01.48 on Zinc Rich Coatings. Another highlight was the presentation of a series of awards to D-1 members. Chairman S.B. Levinson and L.S. Birnbaum were elected as Honorary Members of ASTM. Joy Turner Luke was presented with the Henry A. Gardner Award for her outstanding work in organizing and conducting the business of Sub. D01.57 on Artists' Paints and Related Materials. G.W. Grossman was presented with the William T. Pearce Award for his definitive paper on "Correlation of Laboratory to Natural Weathering."

Subcommittee Officers appointed by Chairman S.B. Levinson were: D01.48 on Zinc Rich Coatings—P. Litzinger to replace M. Tellor as Chairman; D01.93 on Meetings and Sites—H. Fujimoto to replace J. Csernica as Chairman with C.K. Schoff as a new member; D01.94.01 on Henry A. Gardner Award—H.K. Hammond III to replace H.M. Werner as Chairman with C.K. Schoff as a new member; and Ad Hoc Committee on Indexing—S. Le Sota as Chairman.

Highlights

The following projects of major interest to the coatings industry represent areas of new or increased emphasis since the previous reports:

D01.20—survey to determine if present D3980 sampling practice adequately covers procedures for sampling multiple containers packed in units and bulk raw materials of Federal Standard 141, method 1022.

D01.21.13—agreement of California Air Resources Board to review ASTM test methods recommended to that board.

D01.21.25—revision of D 2832 into four separate practices on NV/VOC determination.

D01.22—revision and updating of several flash point methods.

D01.23.10—round robin on "pull off by tensile" tester adhesion test.

D01.23.14—survey to determine if there is interest in developing a method for measuring hardness with a pendulum type hardness tester.

D01.26.23—development of a method to test horizontal coatings for retroreflectance with portable instruments.

D01.26—formation of a new task group on infrared properties of coatings.

D01.27.02—round robin to compare the various water tests currently in use.

D01.27.09—development of new cyclic weathering test methods that may correlate better with field experience in the transportation industry.

D01.31—updating a number of pigment specifications.

D01.32—revising a number of specifications on drying oils for reapproval.

D01.33.12—round robin on isophorone diisocyanate and hexamethylene diisocyanate using gas chromatograph.

D01.33.24—continuing work on practice for nitrogen resins.

D01.33.26—preparation of a proposed method for volatile organic content of emulsions.

D01.35.01—evaluating an improved gas chromatographic method for measuring aromatics in mineral spirits.

D01.35.03—continuing work on gas chromatographic assay of 2-ethylhexanol to incorporate various type columns.

D01.42.02—round robin across a number of paint soils and stains with a sponge wet with two different cleaning agents.

D01.42.04—screening various wet adhesion test methods used in industry.

D01.42.06—developing practice for testing latex gloss and semigloss paints.

D01.44—revising and updating a number of test methods for traffic paints.

D01.46.02—development of a practice for field measurement of steel surface profile.

D01.46.07—continuing work on revision of D 3276, "Guide for Painting Inspectors."

D01.46.09—preparing guide for topcoating zinc coated steel.

D01.48.02—soliciting information on test methods for determining cure of zinc rich coatings.

D01.48.03—developing test methods on mechanical and performance properties of applied zinc rich paints.

D01.48.04—determine volume solids and evaluate it in comparison to the theoretical spreading rate.

D01.52.12—round robin on four types of textured panels with a standard dirt and abrasive cleaner to develop a test for durability.

D01.56.09—new task group to develop test for measuring water absorbency of printing inks.

D01.56.10—new task group to develop method on volatile content applicable to printing inks.

D01.57.03—evaluating a newly developed innovative tinting strength method.

D01.57.08—finalizing action on labeling for chronic toxicity for artists' paints.

Next Meetings

January 17-20, 1982—New Orleans, Louisiana (Monteleone)

June 1982—Toronto, Canada (Sheraton Center or Harbour Castle Hilton)

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SUBCOMMITTEE D01.15 LECTURES AND SYMPOSIA

H.A. Wray, Chairman

E.A. Praschan, of General Motors, agreed to consider presenting a talk on new application techniques and paint formulations in automotive finishing. He will contact Ford personnel to have a Ford representative join him in presenting talks on the subject at the January meeting of D-1 in New Orleans.

As recommended at the January 1981 meeting in Orlando, FL, a symposium will be held at the January 1983 meeting in conjunction with the Steel Structures Painting Council. D.M. Berger will be the D-1 Co-chairman and R. Wint will be Co-chairman for SSPC. The subject will be "New Approaches to Protect Steel Structures." It is proposed that the Steel Structures Painting Council meet with Committee D-1. D-1 would meet on Monday, Tuesday, and Thursday with the symposium on Wednesday. SSPC would meet Tuesday and Thursday and possibly on Friday. Consideration will be given to inviting ASTM Committees A-1 and G-1 to attend the symposium or to participate in it.

DIVISION 1 ADMINISTRATIVE

SUBCOMMITTEE D01.16 DEFINITIONS

S. Le Sota, Chairman

The results of the letter ballot for definitions for acid number, batch, soil, edge-tracking, natural spreading rate, and stain were reviewed. A number of editorial changes were made and two negative ballots were resolved. In the "edge tracking" definition, the group changed "which trails" to "characterized by trails" and in the definition on "natural spreading rate," the group combined the two definition choices involving "mass" in one case, and "volume" in the other. This now reads "the area covered by a unit volume or mass of coating material applied to a specific substrate in a manner natural to the rheology of the coating and to the technique of the applier by a particular method under practical conditions. *Note*: The numerical value generally varies from operator to operator but a series of coatings are usually ranked in the same order by different operators. It may be expressed as ft^2/gal, m^2/L, or m^2/kg."

DIVISION 20 RESEARCH AND GENERAL METHODS

SUBCOMMITTEE D01.20 STATISTICS AND SAMPLING

H.E. Ashton, Chairman

The revision to D 3925, "Sampling Practice," is on the June Society ballot so that results were not yet available. The Practice for Interlaboratory Testing of Paint, D3980, was approved on the January Society ballot without comment. It will be available as a separate standard in 1981 and will appear in the 1982 *Book of Standards* at which time the related sections can be removed from the D-1 Handbook. Revisions to this Practice that were on concurrent main committee and subcommittee ballot did not receive any comment but one negative and one affirmative with comments were submitted on the standard as a whole. The negative was withdrawn on the understanding that when all the revisions to the Practice are completed, the definitions and terms will be submitted to the Committee on Terminology at the time of D-1 ballot. After consensus is reached in D-1, the Practice will be sent to Committee E-11 for comment.

More complete revisions that had been discussed at the previous meeting but not submitted to ballot were reviewed. These were approved with a few minor changes and it was agreed to send the revisions to simultaneous subcommittee and main committee ballot. When the complete revision is approved, ASTM headquarters will be asked to send the recommended precision statement to all subcommittees and task group chairmen.

With regard to new work, it was decided to survey D-1 membership to determine if the present D3980 sampling practice adequately covers procedures needed to sample multiple containers packed in units and bulk raw materials of Federal Standard 141, Method 1022.

SUBCOMMITTEE D01.21 CHEMICAL ANALYSIS OF PAINT AND PAINT PRODUCTS

R.W. Scott, Chairman

Group 13, Coordination of VOC Standards, J.C. Weaver, Chairman, reported that H. Fujimoto, of D01.21, was able to attend the California Air Resources Board's "Organic Solvent Analysis Committee" and report the final action taken by the task groups of Sub. D01.21 to determine VOC in paints and coatings. After hearing this presentation on February 5, 1981, Chairman R. Adrian agreed to recommend to CARB, the following test methods developed by Sub. D01.21: D 2369-81(B) (for volatiles), D 3792 (water by gas chromatography), D 4017 (water by Karl Fisher), and D 3960 (practice for determining VOC). On April 13, 1981, H. Wong-Woo, chief of CARB's Stationary Source Control Division, requested all California pollution control officers to review the above test methods as the standards to be used throughout the state. It was reported that the U.S. Environmental Protection Agency is drafting relief legislation on VOC for the automobile manufacturers which should be published in the *Federal Register* around August. The automobile companies have been granted extensions on meeting the 2.816 pounds of VOC per gallon of paint until 1986. The U.S.-EPA has developed a gas chromatographic method to determine exempted halo hydrocarbons, i.e., dichloromethane, Freon 113 and 1,1,1 trichloroethane. The method is a modification of D 3792, "Water Content of Water Reducible Paints by Direct Injection into a Gas Chromatograph." Sub. D01.21 was asked to evaluate it. Even though the method appears to be applicable, the task group decided not to form a new task group at this time to measure exempted solvents in coatings. This task group plans to publish an STP and a JCT article pertaining to the efforts of Sub. D01.21 in developing test methods to determine VOC in coatings as quickly as time permits.

Group 23, Hot Melt Traffic Marking Paint Analysis, D.R. Miller, Chairman, discussed results on the percent binder and percent glass beads to be submitted for statistical analysis. The method will be rewritten and submitted for main committee letter ballot. Results on the round robin of chemical analysis of titanium dioxide and lead chromate vary and the results and method is undergoing evaluation and study.

Group 26, Revision of D 2697, "Volume of Nonvolatile Matter in Clear or Pigmented Coatings," M. Sites, Chairman, reported preliminary evaluation of the data obtained from the first round robin in which four representative coatings, two solvent and two water-reducible paints, were run using the methods stainless steel disks and a modified method using aluminum tubes, showed there was no significant difference in the precision obtained. D 2697 will be revised to contain a precision statement and the revised D 2369-81 (B), one hour at 110°C, for determining the nonvolatile content of the coating plus editorial changes and then submitted for sub and main committee letter ballot.

Group 42, AAS Analysis of Pigment, W.V. Moseley, Jr., Chairman, discussed negatives and comments received as a result of the recent subcommittee letter ballot on the method for titanium dioxide.

Group 46, X-ray Analysis of Pigment, H. Neubold, Chairman, discussed results of the fourth round robin on an X-ray fluorescence method for the measurement of titanium dioxide in paints indicate high solids coatings produce less accurate results possibly because they exceed the requirements of a thin film. The chairman will rerun the samples and dilute the coatings as needed. The statistical evaluation of the data will be done and the method submitted for subcommittee letter ballot. A procedure using X-ray diffraction analysis for determination of pigment components will be reviewed.

Group 25, Revision of D 2832, D.L. Campbell, Chairman, reported on two standard practices which have been balloted through Sub. D01.21. They are: "Volatile and Nonvolatile Content of Pigments," and "Volatile and Nonvolatile Content of Driers, Drying Oils, Naval Stores and Solvents." After the comments received are incorporated into the practices, they will be mailed for balloting by the main committee. The standard practice for determining "Volatile and Nonvolatile Content of Cellulosics, Emulsions, Resin Solutions, Shellac and Varnishes" is ready for a subcommittee letter ballot. The practice for paint and related coatings is also ready for a subcommittee letter ballot.

Group 71, Revision of D 3335, H.D. Swafford, Chairman, discussed another method of sample preparation under study. The new technique uses Teflon lined acid digestion bombs which incorporates nitric acid and a wet digestion procedure instead of the dry ashing technique used in D 3335. All test results have not been submitted. The statistical evaluation will be made at the January 1982 meeting.

Group 72, Metals in Air Particulate, L. Di Carlo, Chairman, reported that the review of the statistical data indicating the determination of lead and chromium in air samples containing lead chromate type pigment dust is ready for subcommittee letter ballot. Lead silico chromate pigment dust is undergoing round robin test. The next goal is to analyze paint overspray dust containing the above lead and chromium pigments.

General—No negatives were received on the 10 items on the recent main committee letter ballots. All comments received were acceptable and the necessary editorial changes will be made. A Society ballot negative vote was received on D 4017. The negative pointed out a typographical error in that a weighing specification of 0.1 mg read 1 mg. This will be corrected and the negative will be withdrawn. Two negatives received on the new method for titanium dioxide in pigments recovered from whole paints during the current ballot are being worked on and should be resolved before the next meeting. Other items appear to be passing at this time.

SUBCOMMITTEE D01.22 HEALTH AND SAFETY

H.A. Wray, Chairman

It was reported that D 1310, "Flash Point by Tag Open Cup," had received no negative votes but there were several comments. A revision will be prepared based on these comments. The revision of D 3941, "Finite Closed Cup Flash Point of Liquids by the Equilibrium Method," was also balloted and no negative votes were received. This revision reflects the adoption of a voter's request to eliminate the use of the preliminary test in calculating the final results and a review of the comments received on the ballot. The revised draft will be forwarded for main committee ballot. On D 3934, "Closed Cup Flash-No-Flash Method-Equilibrium Method," two negatives had been received on a previous ballot. One voter objected to the use of ISO precision and accuracy statements in an ASTM method. The other voter agreed to withdraw his negative on certain statements in the draft if they were revised accordingly. On the proposed Standard on the Disposal of Hazardous Laboratory Wastes, there were four negative votes. After careful consideration of this proposal, it was questioned whether this subcommittee should actively pursue this standard. It was reported that ASTM legal counsel feels that ASTM should not offer advice on how individual firms should get rid of their hazardous waste materials. It was decided to drop this activity from the Sub. D01.22 agenda. For the round robin on D 3278, "Flash Point of Liquids by Seta Flash Closed Tester," various materials in the Z-7 to Z-10 viscosity range are still needed. The present scope of this method applies to materials with viscosities of 500 stokes. It is desired to extend the range.

Regarding a proposed Practice on Labeling, it was decided to abandon plans to work on this after discussing the results of the meeting in Washington, D.C. on April 9th with representatives of government agencies and a review of proposed labeling of the Chemical Manufacturers Association and NPCA. On fire resistant tests, Methods D 1360, "Cabinet Method," and D 3806, "Two Foot Tunnel Test," were discussed and the question arose as to the need for these methods. It was decided to send a questionnaire to the membership asking who makes fire retardant paints and who needs these two methods. In addition, the chairman will write Committee E-5 proposing that these methods will be revised when they become due for revision in 1983 taking into account their suggestions and any information gathered from the proposed questionnaire.

Regarding the status of regulations on flash points, the chairman informed the group of the proliferation of flash point ranges controlling flammability and combustibility definitions among the various governmental agencies, i.e., DOT, Coast Guard, CPSC, etc. The lack of uniformity is shocking. At a hearing in Washington, D.C. on April 9th where OSHA requested information on how they should proceed to govern safety and health regulations for the chemical industry, the chairman gave his views on flash point testing in general.

Several activities of the Coordinating Committee on Flash Point were reported. One was a request to D-1 to process two "Sustained Burning Tests" through to Society ballot. The other was the adoption of a definition for a flammable solid as follows: "a solid material, other than an explosive, which can be ignited by common ignition sources and when ignited, burns vigorously and persistently." It was suggested that in the example given for ignition sources, two of the most important, i.e. pilot lights and sparks were not mentioned. The Department of Transportation's recent definition of a flammable solid, along with various tests suggested, was published in the *Federal Register* in May 1981. DOT is asking for comments on their proposal. In addition in the *Federal Register* of June 18, 1981, the DOT proposed definition of an oxidizer appeared. Both of the above proposals and their suggested test methods have questionable features. The Coordinating Committee on Flash Point Determination is selecting liquids to cover a wide range of flash points. N-butanol is being looked at as a replacement for ethylene glycol monomethyl ether which is giving inconsistent flash points in tests. On the definition of a solid, DOT has suggested a test whereby a solid can be defined as a material which will not flow when a quart can of the material is turned over. The CCFP committee feels the test needs to be refined to include parameters such as how far will the material flow in what length of time. On the determination of volatile content of drying oils by flash point, it was agreed to turn this matter over to Sub. D01.32 on Drying Oils because it does not fall in the category of Health and Safety.

SUBCOMMITTEE D01.23 PHYSICAL PROPERTIES OF APPLIED PAINT FILMS

M.P. Morse, Chairman

A negative vote on the revision of D 2370, "Test for Tensile Properties of Coatings," was received in the recent main committee letter ballot. The technical change proposed has been considered persuasive and the method will be revised accordingly. However, since the method is badly overdue for reapproval, an attempt will be made to persuade the negative voter to withdraw his negative vote on the basis of assurance that his suggested revision will be incorporated at a later date.

Group 10, Adhesion, H.E. Ashton, Chairman, reported on the preparation for suitable coated panels exhibiting differences in the medium range of adhesion, for a round robin on a "pull-off by tensile tester" adhesion test. A round robin on the Bell Scrape Adhesion Tester is planned to establish a precision statement for this instrument. A revision of D 3359, "Adhesion by the Tape Test," is being made to inform the user that the manufacturer of the tape specified in the method has changed the properties of the tape and that users should check whether the new tape properties provide comparable results.

Group 11, Wet Film Thickness, H.A. Ball, Chairman, reported on a round robin in progress to evaluate the Weftig wet film thickness gauge. A recommended practice for the use of notch type gauges is being prepared.

Group 12, Dry Film Thickness, K.A. Trimber, Chairman, discussed that the two revised methods for dry film thickness, D 1186 and D 1400, have been approved by Society ballot. The accuracy of these methods is being determined by comparison with microscopic measurements of cross section of the coatings used in the round robin to establish precision. Some major discrepancies were found and additional microscopic measurements will be made. The group is planning to conduct a round robin to determine the precision of D 1005, "Destructive Test for Film Thickness Measurement," if sufficient cooperators can be found.

Group 14, Abrasion Resistance, M.P. Morse, Chairman, reported that three abrasion methods, D 658 on "Abrasion by Falling Abrasive," D 968 on "Air Blast Abrasion," and a new method, "Abrasion by Taber Abraser," were approved by D-1 letter ballot. Some editorial changes were suggested, most of which have been incorporated into the methods which will be submitted to Society ballot. A survey will be made of D-1 members to determine if there is interest in developing a method for determining hardness with a pendulum hardness tester.

Group 15, Slip Resistance, G.D. Ernst, Chairman, reported on a round robin test being conducted in which the static coefficient of friction of coatings will be measured with Instron tensile testers using an Instron sled and a Liberty Mutual sled. The results will be compared with the results obtained with the James, Brungraber, and Liberty Mutual slip resistance testers.

Revisions are being made in D 2794, "Resistance of Coatings to the Effects of Rapid Deformation," and this method will be resubmitted for D-1 letter ballot. Group 22 is being reactivated to handle the revisions needed in the methods for tensile properties of free films, elongation, and impact resistance of coated substrates.

SUBCOMMITTEE D01.24 PHYSICAL PROPERTIES OF LIQUID PAINTS & PAINT MATERIALS

C.K. Schoff, Chairman

Group 19, Viscosity by Efflux Cups, C.K. Schoff, Chiarman, reviewed the draft of the proposed test method for viscosity by dip type viscosity cups. Corrections and changes have been made and the method will be reballoted at the subcommittee level. The other item discussed was Method D 1200, "Viscosity by Ford Cup." Changes had been suggested previously to make the method reflect the lack of temperature control and the fact that cups should be used with Newtonian and near-Newtonian materials. Amended versions of D 1200 including these suggestions and a proposed precision statement were handed out and discussed. The method also needs a section on significance. This will be added and the final version will be submitted for concurrent subcommittee and main committee letter ballot.

Group 20, Rotational Viscometers, D. Howard, Chairman, discussed the results of the recent main committee letter ballot on the revision of D 2196, "Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer." There were no negatives and the few comments received have been incorporated into the text. The method will be submitted for Society ballot. It was decided that another round robin must be run for the precision statement for the method. Eight cooperators at six different laboratories have volunteered for the round robin.

Group 21, Stormer Viscometer, M.P. Morse, Chairman, discussed the results of the recent main committee ballot on the revision of D 562, "Consistency of Paints Using the Stormer Viscometer." Several editorial changes have been made and the method will be submitted for Society ballot. Since there were no further activities for the group, it voted to go on an inactive status.

Group 23, High Shear Viscosity, C.K. Schoff, Chairman, reviewed the latest draft of the proposed method for determination of viscosity of paints and varnishes at a high rate of shear by the ICI cone and plate viscometer. Several changes were made. After the precision statement has been prepared from the results of the recent round robin, the method will be submitted for main committee ballot.

Group 25, Surface Tension, C.K. Schoff, Chairman, reviewed possible surface tension measurement techniques for paints, including the DuNuoy ring (D 1331 for detergent solutions is applicable to paints also), Euverard's bubble tube method, the drop weight method as described by Patton, the Wihelmy plate (including a disposable version), and the Madison-Kipp differential bubble pressure instrument. The group decided that the DuNuoy ring method was acceptable for paints and that no new ASTM method was necessary. Method D 1331 will be referenced in relevant recommended practices with indications of the precautions necessary for use with paints (i.e., viscosity interferences, need for careful cleaning of the ring immediately after use, etc.). This completes the work of this group which then became inactive.

General—Other business included a discussion of D 3539, "Evaporation Rates of Volatile Liquids," which was on the last subcommittee and main committee ballots. It received no negatives, but several comments. The phrase "by Shell Thin Film Evaporometer" will be added to the title to make the latter more descriptive. A number of typographical errors will be corrected and several editorial changes will be made. Following that, the method will be submitted for Society ballot.

SUBCOMMITTEE D01.26 OPTICAL PROPERTIES

C.J. Sherman, Chairman

Group 2, Color Measurement, C.J. Sherman, Acting Chairman, reported that Methods D 1729, "Visual Evaluation of Color Difference of Opaque Materials," and D 3134, "Selecting and Defining Color and Gloss Tolerances of Opaque Materials and Evaluating Conformance," will be revised to include editorial comments and significance and use statements and submitted for simultaneous main and subcommittee ballot. The proposed Standard Practice for Visual Evaluation of Metamerism received one negative and several comments from the main committee balloting. The negative was withdrawn and the comments incorporated in the method. It will go to Society ballot. Method D 2244, "Instrumental Evaluation of Color Difference of Opaque Materials," was edited to correct many typographical errors and revised. It will now be submitted for simultaneous main and subcommittee ballot.

Group 6, Hiding Power, C.J. Sherman, Chairman, discussed Method D 344, "Relative Dry Hiding Power of Paints," which was balloted by the subcommittee for reapproval, and received several comments. The method was revised and will be submitted for simultaneous main and subcommittee ballot. A proposal to develop a method to determine and/or prepare a panel with total hiding power was discussed but was considered unnecessary.

Group 11, Gloss and Goniophotometry, B.T. Merriman, Chairman, discussed a proposed method for Visual Evaluation of Gloss which received two negatives and several editorial comments from subcommittee balloting. The method will be revised and submitted for simultaneous main and subcommittee ballot.

Group 19, Hemispherical Reflectance, K. Luyk, Chairman. Due to the absence of the chairman, no meeting was conducted.

Group 23, Retroreflectance of Horizontal Coatings, N.L. Johnson, Chairman, discussed the proposed method of test for Specific Luminance of Horizontal Coatings which was revised to include the editorial comments from the recent balloting and will be submitted for Society ballot. A method to test horizontal coatings for retroreflectance with portable instruments will be developed.

New Business—The results of a questionnaire sent to D-1 members on Infrared Reflecting and Absorbing Coatings indicated sufficient interest to develop methods. A new task group on Infrared Properties of Coatings was formed.

SUBCOMMITTEE D01.27 ACCELERATED TESTS FOR PROTECTIVE COATINGS

E.A. Praschan, Chairman

The status of the 23 methods for which Sub. D01.27 is responsible were reviewed. Negatives from the recent D-1 letter ballot have been acted upon as follows: D 660, "Evaluating Degree of Checking of Exterior Paints," D 661, "Evaluating Degree of Cracking of Exterior Paints"; D 662, "Evaluating Degree of Erosion of Exterior Paints" and D 772, "Evaluating Degree of Flaking of Exterior Paints." These methods all have a similar format and describe the evaluation of the coating defect(s) by comparing to pictorial standards. A negative vote was received on each of these methods from the same voter. The negatives were found persuasive by the subcommittee. Since the changes proposed were editorial in nature (changing wording in the scope and more thoroughly describing the source of the pictorial standards) the subcommittee agreed to make the suggested changes, add a "Significance and Use" statement, and submit the four methods to Society ballot. The negative voter concurred with this proposed action.

The subcommittee agreed to discontinue efforts to withdraw D 1150, "Single and Multiple Panel Forms for Recording Results of Exposure Tests of Paints." This was done at the recommendation of D-1 Executive Subcommittee when it had been determined that the paint evaluation forms are still being purchased. The method will be updated and put on letter ballot for reapproval. A member agreed to editorially revise D 2485, "Coatings Designed to be Resistant to Elevated Temperature During Their Service Life," prior to submission for reapproval action. A group will be activated to pursue technical changes which have been suggested.

Group 2, Water Tests, G. Grossman, Chairman, reported on a round robin to compare the various water tests currently in use which will be conducted. The possibility of studying cyclic water tests in the future was discussed and will be considered.

Group 4, Light and Water Exposure Apparatus, S.M. Totty, Chairman, discussed editorial comments from the recent D-1 letter ballot incorporated into D 3361 which will be submitted to Society ballot. Round robin comparison of an experimental cycle to the standard cycle in D 822, "Carbon Arc Practice," showed that the experimental cycle offered no advantage. No further work on this cycle is planned. The group will investigate test cycles for G-53 (QUV, etc.).

Group 6, Detergent Testing, H.M. Leister, Chairman, discussed editorial revisions to D 2248, "Detergent Resistance of Organic Finishes," which were agreed upon. Sections on Significance and Applicable Documents will be incorporated prior to the D-1 ballot. Future work will include investigation of panel masking and bath agitation.

Group 9, Evaluation of Corroded Specimens, R. Williamson, Chairman, reported on editorial revisions resulting from the recent D-1 ballot on D 1654 which were agreed upon and this method will be submitted for publication in the 1982 *Book of Standards*. The scope of this task group will be expanded to include other corrosion test methods. It was agreed to pursue development of new cyclic methods that may correlate better with field experience in the transportation industry.

Group 10, Accelerated Weathering, M.P. Morse, Chairman, discussed a new draft of the practice for conducting accelerated outdoor weathering exposure tests of coatings. This draft incorporated changes suggested in a recent subcommittee ballot. When changes based on the discussion are made, the proposed practice will be submitted to simultaneous main and subcommittee ballot.

Group 14, Filiform Corrosion, R. De Graeff, Chairman, discussed several comments received from the recent subcommittee ballot on the revision of D 2803, "Filiform Corrosion," and revisions will be incorporated. The new draft will be submitted for simultaneous main and subcommittee ballot. This revision of D 2803 incorporates the ISO method as an alternate procedure.

Group 16, Chalk Tests, J. Robbins, Chairman, reported on a third draft which is being prepared for a new chalk evaluation method incorporating various instruments used in the coatings industry. The Jacobsen Tester was discussed again but no participants have been found. Two new instruments based on measuring light interference by chalk pickup on transparent tape will be demonstrated at the next meeting.

Group 17, Evaluating Weathering Effects, D. Gleason, Chairman, discussed negative votes from the recent D-1 letter ballot on D 660 "Checking," D 661 "Cracking," D 662 "Erosion," and D 772 "Flaking," and appropriate editorial revisions that will be incorporated. Editorial suggestions for D 1540, "Effect of Chemical Agents on Finishes Used in the Transportation Industry" were discussed. It was agreed to redesignate D 1540 as a Standard Practice rather than a Method of Test. Suggested editorial changes were incorporated into D 1006, "Exposure of Paints on Wood," and D 2246, "Humidity/Thermal Cycle Cracking," for submittal to Society ballot.

SUBCOMMITTEE D01.28
BIODETERIORATION
D.L. Campbell, Chairman

Group 1—Package Stability. W.B. Woods, Chairman, discussed the rapid detection of microbial contamination in paints using the following devices: Oxoid Industrial Dip Slide, Easicult—Orion Diagnostic and Ames Biostix. The first two devices consist of agar culture media supported on a plastic backing that is submerged into the test sample. The culture medium contains an indicator that assists in the detection and enumeration of microbes present in the test sample. One possible advantage of this system of detection compared to other rapid detection devices is the large variety of culture media that are available. A disadvantage is a limited storage life under refrigerated conditions. The Ames Biostix device consists of a dry medium with indicator affixed to a plastic strip. The principle of detection is similar to that of the other devices. The Biostix has a longer storage life than the refrigerated devices; however, the media selection is more restricted. Preliminary tests with the Oxoid Dip Slide and the Ames Biostix using spoiled acrylic latex paint indicates that these devices can be used to detect and possibly semi-quantitively enumerate microbes in paints. It was proposed to test the performance of the rapid detection devices versus the more involved standard microbiological methods for detection and enumeration of microbes commonly isolated from paint.

Group 2—Rapid Determination of Enzyme Presence. A. J. Desmarais, Chairman, discussed several methods which may be applicable to prediction of viscosity losses due to enzyme presence or redox reactions in water-borne coatings or raw materials. An instrument which measures the pressure increase from the liberation of gases resulting from the combination of a reagent with certain enzymes is being investigated. A test procedure for detecting enzymes in latex paint is being reviewed by subcommittee members.

Group 3—Accelerated Tests. K.A. Haagenson, Chairman, noted that early results of the exterior exposure study, which are to be compared with the results of the accelerated exposure portion of the program, are insufficient to allow revision of D 3273 before the end of the year. It had been hoped that D 3273 could be revised in 1981 to include a method for exterior coatings. D 3273, "Standard Test Method for Resistance To Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber," has been submitted for reapproval with editorial changes.

Group 4—Algae Resistance of Paint Films. W.B. Woods, Chairman, reviewed additional photomicrographs of algal defacement on coatings and one at 39× magnification was chosen to be included in a revision of D 3274, "Evaluating Degree of Surface Disfigurement of Paint Films by Fungal Growth or Soil and Dirt Accumulation." This revision will be submitted to subcommittee members for ballot in the fall of 1981.

Group 5—Recoating Mildewed Surfaces. A.B. Juby, Chairman, reviewed results of a subcommittee ballot on the second draft of the Standard Guide for Determining the Presence of and Removing Fungal Growth on Paint and Related Coatings. Several comments will be incorporated into the third draft which will be submitted to subcommittee members for review in the fall of 1981.

DIVISION 30
PAINT MATERIALS

SUBCOMMITTEE D01.31
PIGMENT SPECIFICATIONS
C.W. Fuller, Chairman

A number of specifications were reviewed and the following actions taken: On D 604, "Diatomaceous Silica Pigment," it was agreed that the present specification does not define adequately the term "diatomaceous." The task group will develop a more definitive description to be part of the Scope and Composition. On D 963, "Copper Phthalocyanine Blue Pigment," it was reported that a suitable replacement has been recommended for use in place of obsolete, Glyptal ZA-262, in the flocculation test. A round robin will be organized to test the replacement resin. With D 153, "Specific Gravity of Pigments," a number of editorial comments concerning this method were approved. Major points were the retention of specific gravity instead of density, revision of the formula for specific gravity, use of silicone lubricants and PTFE coated stopcocks instead of castor oil and glycerine, and changing from X to V in 14.1, 15.1, and 16.1 as being more representative of the volume symbol. Minor editorial changes were incorporated into D 561, "Carbon Black Pigment for Paint"; D 1649, "Strontium Chromate Pigment"; and D 3619, "Aluminum Silicate Pigment." These three standards will be submitted for subcommittee balloting in 1981 followed by main committee balloting in early 1982. D 520, "Zinc Dust (Metallic Zinc Powder) Pigment"; D 605, "Magnesium Silicate Pigment"; and D 3021, "Phthalocyanine Green," will be revised editorially and submitted for simultaneous main and subcommittee balloting in 1981. A preliminary review was made of three iron oxide pigment specifications D 3721, D 3722, and D 3724. These will be referred to the task group chairman for minor editorial changes and balloted in 1982.

A suggestion regarding improved liaison with NPCA and greater sophistication of pigment specifications was discussed. Improved liaison was regarded as an excellent suggestion which would benefit both groups. Regarding the incorporation of greater sophistication into ASTM standards, it was agreed that some changes can be made as standards come up for review to better define grades within a standard. Regarding numerical color specifications, it was felt that the ASTM standards would become much too lengthy to categorize each color grade. Furthermore, before numerical limits could be established, the sample preparation procedure, the reference standard, and the method of measurement would have to be defined. Currently there is much disagreement on how this should be done.

SUBCOMMITTEE D01.32 DRYING OILS

P.C. Stievater, Chairman

Negative votes on items on the recent D-1 letter ballot were resolved as follows: On D 234, "Specification for Raw Linseed Oil," the negative consisted of four parts. Three of these parts were considered to be in the nature of clarification and were accepted. The fourth implied that the iodine value requirement should be revised to a minimum of 175 since half of the raw linseed oils listed in the NPCA Index have iodine numbers below 177 and ISO 150 (1980) specifies 175. The subcommittee agreed that the iodine value of raw linseed oil seldom runs below 182–183 and that further opening of the specification is not warranted. While it was desirable to agree with ISO specifications, it would be more appropriate in this case for the ISO specification to raise the minimum value. The subcommittee voted to find this negative nonpersuasive for the reasons listed. Comments from those listing minimum 175 iodine values in the NPCA Index, as well as from those in charge of the ISO specification, are requested. On D 2079, "Nonvolatile Matter (Solids) in Fatty Quaternary Ammonium Chlorides," the negative consisted of three parts. One was judged to be a clarification of the method and was accepted. The second part requested a change to controlling an oven temperature to plus or minus 2° C instead of plus or minus 3° C. This was accepted on the basis that present ovens are easily capable of this degree of control. The third part questioned why the two ovens involved in the procedure were set at different temperatures, one at 100°C and one at 105°C, and implied that they should be the same as some laboratories use only one oven at 105°C. The subcommittee found this to be nonpersuasive since the method works properly as written and a change of this type, while most likely not affecting the test results, is nevertheless a substantial change and would require round robin testing. Those using one oven are, technically, not following the method. On D 2082, "Percent of Non-Amines in Fatty Nitrogen Compounds," the negative consisted of four parts. Three were considered to be in the nature of clarification and were accepted. The fourth requested that term, "evaporate" be changed to "evaporate or distill." The subcommittee felt there was no need to add the alternative to distill as there is no need for the further use of any distillate, and evaporation is only being used to reduce the volume. Since the three methods were also voted negatively by the same party on the concurrent subcommittee ballot, they will be reballoted at the main committee level with the voter's comments attached as well as the reasons why they were found nonpersuasive by the subcommittee.

As a result of affirmative ballot comments received on 16 methods up for reapproval (D124, D 234, D 601, D 1392, D 1462, D 1467, D 1966, D 2072, D 2073, D2074, D2075, D 2076, D 2077, D 2080, D 2081, and D 2575), editorial changes were agreed upon prior to submittal for main committee ballot.

SUBCOMMITTEE D01.33 VARNISH & RESINS, INCLUDING SHELLAC

A.C. Abbott, Chairman

Group 1, Varnishes, A.C. Abbott, Acting Chairman, reported that at the January 1981 meeting, a government representative was requested to survey government agencies to determine their interest in retaining Method D 1643, "Test for Gas Checking and Draft Test of Varnishes." He stated that this method is used by GSA in several documents and should be retained. Further, the method is cited in Federal Standard 141. The task group agreed to retain the method and will add significance and precision statements on revision.

Group 6, Drying Time, H.M. Werner, Chairman, reported that no negatives had been received on the revision of Method D 1640, "Drying, Curing or Film Formation of Organic Coatings at Room Temperature." The method will be referred to main committee for ballot.

Group 12, Urethanes, R.A. Foss, Chairman, reported on two methods being considered for possible development for the detection and quantification of free isocyanate monomers in urethane resins. High pressure liquid chromatography may have lower detection limits; however, potential problems exist due to inconsistencies in chromatographic columns. Gas chromatography appears more widely applicable but an earlier round robin using this method was inconclusive. The task group will conduct a round robin using isophorone diisocyanate and hexamethylene diisocyanate using gas chromatography. Nine laboratories agreed to participate. The task group will also consult with the HPLC column manufacturer to resolve any differences observed in column sensitivity and separation. If columns can be obtained that are reproducible in results, an HPLC method will be considered at a later date.

Group 14, Alkyds, R.F. Malek, Chairman, reported that a transesterification test for ortho phthalic and oil content was found unsatisfactory. Two members will submit nuclear resonance methods for ortho phthalic and oil content for review and possible round robin testing by the task group.

Group 23, Epoxy and Phenolic Resins, P. Kamarchik, Chairman, discussed subcommittee ballot for the proposed Standard Practice for Epoxy Resins. Two negatives were received and found to be editorial in nature. Corrections were made in the draft and it will be forwarded to ASTM for main committee ballot. Results of a round robin for determination of total chlorine in epoxy resins were discussed. A method will be drafted and submitted for subcommittee ballot. A second round robin may be conducted to refine precision if sufficient participants can be found. A round robin for determination of acid volume of phenolic resins by a new procedure resulted in inconclusive findings. Participants reported difficulty in solubilizing the phenolic resins in the solvent combination used in the method. Participants agreed to reevaluate the solubilizing steps of the method and will report results of test if solubilization can be accomplished.

Group 24, Nitrogen Resins, J.H. Smith, Chairman, discussed a first draft of a Standard Practice for Nitrogen Resins. Editorial corrections will be made and the draft submitted to nitrogen resin manufacturers for comment. They will be asked to offer alternative methods of test for solvent tolerance of nitrogen resins. The task group reaffirmed balloting for withdrawal of Method D 1597," Melamine Content of Nitrogen Resins," and D 1727, "Urea Content of Nitrogen Resins" by Society ballot.

Group 26, Polymer Emulsions, O.E.

Brown, Chairman, reviewed results of the subcommittee ballot on Standard Practice for Testing Latex. There were no negatives and the draft will now be submitted for main committee ballot. Proposed standard for Nonvolatile Content of Latices was reviewed by the editorial group with recommendations for corrections. There was a negative on the basis of precision data analysis and statement. This negative was found to be nonpersuasive since corrections are being made in the calculations and statement. The method will be submitted to the main committee for ballot when editorial corrections are complete. The task group considered possible activity in new method development and agreed to prepare a proposed method for volatile organic content of emulsions. At a later date, methods will be proposed for the determination of second order transition (Tg) and/or seed content.

SUBCOMMITTEE D01.35 SOLVENTS, PLASTICIZERS AND CHEMICAL INTERMEDIATES

L.R. Thurman, Chairman

Group 1, Hydrocarbon Solvents, S.A. Yuhas, Jr., Chairman, reviewed the results of the recent subcommittee ballot. Since an insufficient number of ballots were returned, it was recommended these five items be balloted concurrently with the next main committee ballot to maintain the proper time schedule. However, editorial changes were made from the few ballots received. Three specifications were assigned for review. An improved gas chromatographic method for measuring aromatics in mineral spirits was submitted for consideration at the next task group meeting.

Group 2, Oxygenated Solvents, T.H. Golson, Chairman, reviewed the recent main committee letter ballot items and recommended editorial changes as required. Three negatives were considered and found nonpersuasive. On the revisions of D 1718, "Specification for Isobutyl Acetate (95% Grade)" and D 3130, "Specification for n-Propyl Acetate (90 to 92% Grade)," the negative vote was on the basis that no reference had been made to Method D 3545, a modern method for the determination of purity of acetate esters. These negatives were considered nonpersuasive because D 3545 imposes purity requirements not intended in these specifications. On the revision of D 2917, "Specification for Methyl Isoamyl Ketone," the negative requested that the value for acidity as acetic acid, weight percent in this specification be changed from 0.01 maximum to 0.02 maximum on the basis that no manufacturer supplies a product to meet the 0.01 maximum acidity value. This was found nonpersuasive on the basis that there was no documentation to support this contention and no other producers were present for discussion. The present value has been in the standard since 1976 and was not changed on the present revision. Continuing work on a test method for low level water in urethane solvents was discussed. A Karl Fisher method previously used will be reviewed and additional methods will be solicited from interested parties. Members having the same type of KF instrumentation will be asked to participate in a round robin test.

Group 3, Chemical Intermediates, J.M. Kauffman, Chairman, reviewed the recent main committee letter ballot items and recommended editorial changes as required. A preliminary test method for gas chromatographic assay of 2-ethylhexanol is being written to incorporate various columns being used in the industry. E-15 will be contacted as to the status of the Sulfuric Acid Color Test Method of Plasticizer Alcohols. Three standards were assigned for review.

Twenty-three standards and methods were submitted for subcommittee letter ballot.

DIVISION 40 PAINT PRODUCTS APPLIED ON SITE

SUBCOMMITTEE D01.41 CRITERIA FOR THE PURCHASE OF COMMERCIAL PAINTS AND COATINGS

R.A. Brown, Chairman

The subcommittee reviewed the results of the round robin test program in which 12 white latex flat wall paints were evaluated for opacity, gloss, washability, and scrubbability by nine cooperating laboratories. Since the last meeting in January, an additional round robin test program was conducted on the same 12 paints for porosity using ASTM Method D 3258. This was done by four cooperating laboratories. Agreement on test results was good by three out of four laboratories. Test data was distributed to those present. A draft for a Standard Guide for purchasing interior latex paint was distributed. It was requested that members review the document, make comments and suggested changes, and return the draft promptly to either the chairman or vice-chairman.

There is some confusion between ASTM staff personnel and subcommittee members concerning whether the criteria developed by this group shall result in a GSA Commercial Item Description or shall be used to write an ASTM Standard for use in procuring commercial paints and coatings. Most subcommittee members feel this information was developed to assist the General Services Administration in writing a C.I.D. Paint members present did not feel that ASTM should decide on the level of quality of paints that the government should buy. It was their opinion that government should make this decision.

The vice-chairman also submitted a draft document for the purchase of exterior latex paint and asked that a round robin test program be started to develop criteria. The decision of the subcommittee was to hold off further round robin test work until the problem on intended usage can be resolved. The chairman stated he would contact GSA to discuss this matter.

SUBCOMMITTEE D01.42 ARCHITECTURAL PAINTS

R.S. Armstrong, Chairman

Group 1, Scrub Resistance by Weight Loss, M.S. Abriss, Chairman, reported that this new method received two negative votes as well as a number of comments during the recent main committee letter ballot. These suggested changes were discussed and a number of editorial changes will be made in this method. The two negatives were resolved by making changes in the method to comply with the suggestions of the voters.

Group 2, Practical Stain Removal, C.C. Tatman, Chairman, This group is attempting to develop a method to evaluate stain removal or cleanability of a paint. A round robin was run prior to the meeting which consisted of removing a number of soils and stains from three different cured paint films with a sponge wet with two different cleaning media. The results of this round robin were discussed. Refinements will be made in the method and another round robin will be conducted prior to the next meeting.

Group 3, Leveling of Paints by Drawdown Bar, J. Desmaries, Chairman, reported that this new method was submitted for main committee ballot. Several comments were received and discussed. A number of editorial changes will be made in the method to comply with these suggestions.

Group 4, Wet Adhesion, F. Winkelman, Chairman, reported that this group is attempting to develop a method to evaluate wet adhesion of a paint film. It is a recently formed task group and so far no procedure has been established. Various wet adhesion test methods used in the industry will be screened and a round robin will be started at the next meeting.

Group 5, Chalk Adhesion, P. Smith, Chairman, reported that this is a recently formed task group attempting to develop a method to evaluate chalk adhesion. No procedure has been established as yet.

Group 6, Recommended Practice for Testing Latex Gloss and Semi-Gloss Paints, S. Le Sota, Chairman, presented a list of possible test methods to be recommended for this method. The suitability of each method was discussed. Some methods were deleted and others were added to the list. These recommended test methods will now be presented in an ASTM format for review and discussion at the next meeting.

Group 7, Sag Resistance, L. Schaeffer, Chairman, This recently formed task group is attempting to develop a test method to evaluate sag. The chairman reviewed and discussed various test methods used in the industry to evaluate sag.

Group 9, Color Compatibility, R.H. Rowland, Chairman, reported that this method was submitted for a main committee letter ballot prior to the last meeting. Although the basic test procedure was accepted, many people objected to evaluating color difference by reflectance readings. It was therefore decided to use color difference, ΔE measurements. Since many people thought that the precision statement would no longer be valid, a new round robin will be run to generate precision data.

Group 16, Practical Opacity, R.S. Armstrong, Chairman, presented several different substrates that could be used for this method. These substrates were discussed and a substrate, which will be a modification of some of the panels presented, will be prepared for evaluation.

SUBCOMMITTEE D01.44 TRAFFIC COATINGS

W.V. Moseley, Chairman

Group 1, Thermoplastics, D.R. Miller, Chairman, reported on round robins underway on bond strength, reflectance, binder, and bead content. Also reported were the results of a chemical analysis round robin conducted by Sub. D01.21.23. Considerable discussion was held on a chrome yellow analysis conducted by Sub. D01.21.42.

Group 2, Traffic Paints, E.J. Morgan, Acting Chairman, discussed several traffic paints to be evaluated by D 711, "Dry to No-Pick-Up Time." Consideration will be given to inserting a statement in the method regarding the proper procedure of wiping the wheel between each roll over the paint sample. Several members of Sub. D01.44 have questioned the repeatability of D 869, "Evaluating Degree of Settling of Paint," and D 1309, "Settling Properties of Traffic Paints on Storage." Additional paints will be run by the chairman to determine the reproducibility of the method. A member agreed to coordinate a round robin to develop precision statements for D 868, "Evaluating Degree of Bleeding of Traffic Paints," and D 969, "Laboratory Tests for Degree of Bleeding of Traffic Paint." The suggestion was made that contrast ratio measurements might be preferable to the use of photographic standards. A suggestion was made that the task group review D 913, "Evaluating Degree of Chipping of Traffic Paint," and D 821, "Evaluating Degree of Abrasion, Erosion, or a Combination of Both, in Road Service Tests of Traffic Paints" to see whether the rating systems can be brought into closer agreement.

Group 2A, Chlorinated Rubber, The following was approved as the scope: "To evaluate new methods for the determination of chlorinated rubber in traffic paints." Since January 1981, the chairman organized a round robin with nine cooperators to evaluate a column chromatographic method proposed by Hercules. Samples of four paints have been sent to each cooperator and results should be available for discussion at the January 1982 meeting. The group discussed the Utah method of analysis based on gas chromatography.

Group 3, Night Visibility, J. Ritter, Chairman, reported on a proposed field test. Cold plastic lines will be available within the next month for field testing in New Orleans in January 1982. Test panels will be sent to all who wish to make readings to compare with light tunnel readings. There was some difference of opinion as to whether we were just going to be looking at the agreement between instruments or if the results of field evaluation would be used to determine minimum values. It was reported that samples for the glass bead round robin are packaged and ready for mailing.

Group 4, Catalyzed Coatings, D. Miller, Chairman, will prepare a list of the pertinent test methods identified as useful in the testing of these coatings. This list is to be mailed to all members of the subcommittee by the end of July for comments.

Group 5, Water Borne Coatings, E.J. Morgan, Chairman, Task group members suggested that this group be put on inactive status until such time as technology comes up with a more serviceable water-borne coating, which will dry more rapidly and have satisfactory early water resistance. No action will be taken on this until January 1982.

Group 6, Bead Retention, W.V. Moseley, Jr., Acting Chairman, has collected photos and information regarding modification to a Hobart Mixer to perform this test. Information will be sent to the group shortly.

General—Negative votes were received on the following items during the recent main committee ballot: D 1309, "Settling Properties of Traffic Paints on Storage"; D 2205, "Recommended Practice for Testing Traffic Paints"; and D 821, "Evaluating Degree of Abrasion, Erosion, or a Combination of Both in Road Service Tests of Traffic Paints," The negatives were found to be persuasive and the items were removed from balloting for further study or revision. While no negatives were received on the other items under ballot, there were numerous editorial changes and some revisions were made. These changes will be forwarded to ASTM headquarters. Further study is planned on three of the methods in this group: D 868, "Evaluating Degree of Chipping of Traffic Paint," D 913, "Evaluating Degree of Chipping of Traffic Paint," and D 713, "Conducting Road Service Tests on Traffic Paint."

SUBCOMMITTEE D01.45 MARINE COATINGS

L.S. Birnbaum, Chairman

Activities of *Group 5, Algae Control; Group 6, Dynamic Testing;* and *Group 7, Antifouling Rating* were reviewed by the chairman. The minutes of three Group 6 meetings held in 1977 will be circulated for discussion at the January 1982 meeting. The current panel preparation and exposure program for Group 7 was reviewed. Due to changes in key personnel in the Navy, approval for exposure at Pearl Harbor may not be attainable. Should such be the case, Mid-Atlantic Testing Service agreed to expose that set of panels at Stone Harbor, NJ. All paints for the program have been received from the cooperators. It is hoped that panel preparation will be completed by Labor Day.

Consideration will be given to calling a fall meeting of the subcommittee at the Naval Ship R & D Center in Annapolis, MD. This would be combined with a tour of the Navy test facilities. The chairman will try to arrange a spring meeting in conjunction with the NPCA Marine Coatings Conference in March 1982.

SUBCOMMITTEE D01.46 INDUSTRIAL PROTECTIVE PAINTING

D.M. Berger, Chairman

Group 2, Surface Preparation, J.D. Keane, Chairman, reviewed the recent meeting of ISO (International Standards Organization) TC35/SC 12, Steel Structures, which met at the Toronto NACE conference as TAG 40. This Technical Advisory Group is divided into three task groups as follows: (1) Profile; (2) Cleanliness; and (3) Specifications. A standard practice for field measurement of surface profile will be developed. This practice will include procedures for use of Textex Tape, Keane-Tator Profile Comparator, and Clemtex Coupons. Other methods and previous test methods will be reviewed. The SSPC microscopic method will be used as a reference and a chart will be produced to compare the measurements made with the various techniques. The ISO group has designed a triangle comparator 150 mm on each side which would provide profile limits of 25-50 μm, 50-75 μm, and 75-125 μm. Steel grit is used. This type of comparator is considered to be too limited. The U.S. representative has also recommended that abrasive sand be used. Difficulties in reproducing these visual standards has been a problem from a production point of view. The work on this project is being done by ICI of England. Rigid epoxy replicas are being considered.

Group 3, Compatibility of Topcoats, D. Noxon, Chairman, prepared drafts on (1) Field Determination of Generic Coating Types and (2) Evaluation of the Conditions of Coatings Prior to Repainting.

Group 4, Pull-Off Adhesion Test, A. Cunningham, Chairman. The questionnaire sent out to the committee determined that most evaluators use the 1000 lb tests. Epoxy and cyanoacrylate or two component cyanoacrylate adhesives are used for testing the adhesion by placing the aluminum dollies onto either concrete or steel coated surfaces. Tests have been run on epoxy, vinyl, inorganic zinc, urethanes, alkyds, chlorinated rubber, and coal tar epoxy. Two thirds of the investigators score around the dolly. These observers also use knife and cross hatch adhesion as well. The test method will be sent out for subcommittee ballot.

Group 5, PACE, J. Bruno, Chairman, J. Keane reviewed this extensive project. After five years, some correlation has emerged between salt fog testing vs marine and mild industrial environments. Successful salt fog provides successful field exposures, however, poor salt fog results do not always show poor field results. A report is expected to be issued in November. This study includes the use of alternate surface preparation methods, low-solvent and water-borne coatings, and alternate pigment studies.

Group 7, Inspection, K. Trimber, Chairman, reported that test method D 1014, "Conducting Exterior Exposure Tests of Paints on Steel," will be sent out for main committee ballot. Alterations include references to black box tests, reducing the panel size to 6″ × 12″ and more detail on panel preparation. The second draft on D 3276, "Guide of Painting Inspectors," created considerable discussion. The document has been revised and several new considerations were added. These include: (1) a job description of inspectors' duties; (2) inclusion of specific instructions for abrasive blast cleaning and high pressure water blast cleaning inspection procedures; and (3) a separate standard recommended practice will be developed to outline the specific step by step inspection functions plus a reference list of sources of other information.

Group 9, Zinc Rich Coatings is now Sub D01.48, P. Litzinger, Chairman.

Group 10, Topcoating Zinc Rich, The first draft of the Guide for Topcoating Zinc Coated Steel was reviewed. Recommendations were made to refer to ASTM Standards to designate the type of galvanized steel being painted such as A 525 or A 591 for electrodeposited zinc on steel. Caution was made not to specify latex directly on galvanized for use in high humidity areas. Recommend wash primer intermediate be used. Expand the guide to include the use of zinc rich to touchup or recoat galvanized steel. Types of zinc rich primer used for touchup include epoxy-polyamide, chlorinated rubber, phenoxy, and TT-P-641G. Water-base epoxy and acrylic or vinyl modified polyurethanes are to be included as possible topcoats in the tables which review the performance of various generic types.

General—It was recommended that certain standard specifications on surface preparation of aluminum and magnesium be turned over to Committee B08.07. D 1730, D 1731, and D 1732 will no longer be within the jurisdiction of Sub. D01.46.

SUBCOMMITTEE D01.48 ZINC RICH COATINGS

S. Mark, Chairman, pro tem

Group 2, Determination of Cure, A. Cunningham, Chairman, adopted the scope to develop or select standards for the determination of various stages or degrees of cure of different zinc rich coatings. The chairman of the group will contact individuals known to be experts in the field soliciting information on pertinent test methods currently in use.

Group 3, Laboratory Evaluation of Zinc Rich Films, R. Wakefield, Chairman, Members listed 15 existing test methods considered pertinent to the group's purpose: (1) salt fog with scribe; (2) condensation; (3) dynamic corrosion D 2933; (4) accelerated weathering; (5) immersion tests; (6) exposure to corrosive environment; (7) Taber abrasion test; (8) tape adhesion D 3359; (9) impact D 2794; (10) conductivity tests; (11) galvanic protection; (12) v-notch; (13) exterior exposure; (14) weldability; and (15) flexibility (mandrel tests)—cone D 522, cylindrical D 1737. The scope agreed upon was the development and selection of methods of tests of mechanical and performance properties of applied zinc rich coatings excluding top coats. To prepare for the next meeting, the chairman will distribute copies of the bullet hole (or circle test) method as a basis for discussion.

Group 4, Void Space (Porosity) and Solids by Volume, The scope of this task group was defined as follows: To determine the volume solids of a zinc rich coating and to relate it to the theoretical spreading rate and to the void space in the film.

Group 5, Topcoating, A survey of industry members will be made to list methods presently in use to evaluate top coats on zinc rich primers. A scope for the task group was adopted as follows: The selection development of test methods for evaluating top coats on zinc rich primers.

DIVISION 50 PAINTS FOR FACTORY APPLICATION

SUBCOMMITTEE D01.52 FACTORY-COATED WOOD PRODUCTS

R.C. Marck, Chairman

A negative vote on D 2691, "Methods for Microscopal Measurement of Dry Film Thickness of Coatings on Wood Products," concerned discrepancies in the precision statement. The statistical analysis and other editorial changes have been reworked so this standard will be submitted for reapproval. A note from ASTM headquarters concerning the status of D 2830, "Durability and

Compatibility of Factory Primed Wood Products," and D 2336, "Specifying the Properties from the Liquid State to Cure Stage," will be researched. A proposed new standard, "Estimating Package Stability of Coatings for Ultraviolet Curing," has been approved by the subcommittee and will now be submitted for main committee ballot. The task force is considering a suggestion to explore the use of the Sward Rocker for evaluating cure of UV cured coatings.

Group B, Hardboard, J.J. Medica, Chairman, The objective of this new task force project is to develop test methods which insure the satisfactory performance of field applied finishes on hardboard siding. Two test methods were proposed and discussed. Additional test methods are needed and will be discussed at the January meeting.

Group 12, Textured Panels, R.C. Marck, Chairman, reported that the group has shipped samples of four types of textured panels along with standard dirt and abrasive cleaner for a round robin to develop a performance test for determining the durability of textured surfaces. Method D 3450 will be used for evaluating these panels. It was also decided to investigate a scuff type test using a pendulum type tester.

SUBCOMMITTEE D01.53 FACTORY-COATED STRIP METAL

E.E. Haney, Chairman

Group 1, Formability, J.I. Maurer, Acting Chairman, discussed the recent preliminary subcommittee ballot for the proposed "Standard Method on Formability Characteristics." All comments will be considered in preparing the final draft for balloting.

Group 3, Pretreatments, R.L. Williamson, Chairman, discussed the proposed method for the "Determination of Phosphate Coating Weight on Zinc." Results of the recent preliminary subcommittee ballot were discussed. One member felt that this group's endeavors should be assigned to Committee B-8 on pretreatments. This method is specifically a coil coating method that will be used to replace our reference to the NCCA method in D 3794 for "Practice for Testing Coil Coatings." It was voted to keep this task group intact. J.M. Turner will contact B-8 to make certain there is no conflict. If this is resolved, the editorial changes will be made and it will be ready for ballot.

Group 5, T-Bend Flexibility, A.C. Greenberg, Chairman, received extensive technical and editorial changes in the preliminary subcommittee ballot for the "Method on T-Bend Flexibility." These changes were discussed and will be incorporated into the method. The revised test method will be ready to circulate for balloting.

Group 6, Drawdowns, R.W. Reinsel, Chairman, discussed the preliminary subcommittee ballot results for the "Standard Practice for Applying Coatings Using the Wire-Wound Drawdown Bar." A negative and several comments were received from one voter. He stated that this is a method and not a practice and should be included under D 823. The ASTM definitions of method and practice were given considerable discussion. The task group voted to retain it as a practice. It was also felt that it should be kept separate since it is a specific coil coating method and fits into D 3794 on "Practice for Testing Coil Coatings." This was found nonpersuasive. The negative voter stated that this practice could be used for other than roll coated materials. After discussion the task group decided that, although this might be possible, the purpose of this practice is to simulate roll coating. The voter stated that the practice should state that the diameter of the wire on the bars controls film thickness. A statement to this effect will be added. He also stated that the sentence under "Sampling" was not appropriate. The task group agreed and after additional checking, it was decided to drop this section as it does not apply to this practice. The voter suggested running a round robin to get a precision statement. It was pointed out that the purpose of this practice is not for precision but to allow an operator to get a desired film thickness. The actual drawbar and coating may vary. Other changes will be incorporated before balloting.

SUBCOMMITTEE D01.55 FACTORY-APPLIED COATINGS ON PREFORMED PRODUCTS

F.J. Steslow, Chairman

Group 1, Coatings for Wood Products, M.E. Mull, Chairman, D 3002, "Practice for Evaluation of Coatings for Plastics," and D 3023, "Resistance of Factory Applied Coatings on Wood Products to Stains and Reagents," reviewed in January 1981, and later modified and approved by concurrent task group and subcommittee ballot, were submitted for main committee ballot. Although they were on a letter ballot, it has been indicated that further modification may be necessary to conform to current mandatory ASTM guidelines on style and form to add statements on significance and use as well as precision and accuracy where applicable. These changes have been made and both methods will appear on the current Society ballot. D 2571, "Practice for Testing Wood Furniture Lacquer," received a negative vote on a joint subcommittee and main committee ballot. Editorial changes were made and the negative was withdrawn after the voter's suggestions were accepted. This method is ready for Society ballot. D 2199, D 3732, D 2353, D 3133, and D 3260 will be reviewed at the January meeting.

Group 7, Water Reducible Industrial Coatings, F. Zurlo, Chairman, reviewed the proposed practice for Testing of Industrial Water Reducible Coatings. Each paragraph was checked for technical quality. A number of changes were made. Items to be considered for addition are dilution stability (D 1416), yellowness, skinning, and VOC content.

New Business—E.A. Praschan commented on D 3170, "Test for Chip Resistance of Paint, Varnish, Lacquer and Related Products." When this method was issued, one type of gravel was used. Now a new friable gravel is being supplied. Concern over a drift in results was expressed. Control on the gravel is inadequate. The author of the comment will review and recommend changes.

SUBCOMMITTEE D01.56 PRINTING INKS

J.M. Fetsko, Chairman

Group 6, Ink Tack, C. Shepard, Chairman, reviewed suggested test method for "Apparent Tack of Printing Inks by Inkometer" for technical quality. Editorial and technical changes were incorporated and the precision statement was written. After review by the D-1 Editorial and Statistics Subcommittee, this method will be ready for a joint main and subcommittee ballot.

Group 7, Smoke Test, J. Coleman, Chairman, reported round robin results based on returns from five of the eight cooperators. While the results showed some promise, it was noted that the tests were run on samples of different film thicknesses. It was decided to await results from the other three cooperators and a judgement by the chairman on the value of all of the data and the need for a second round robin.

Group 8, Tinting Strength, A.N. Scarlotti, Chairman, will attempt to consolidate his proposed test method on "Color and Strength of Pigments, Pigment Dispersions and Printing Inks" with Method D 387 and report at the January 1982 meeting. If consolidation is not practical, the June 1981 draft will be updated to become a proposed standard.

Group 9, Water Take-up of Inks, G. Bien, Chairman, reported that no standard exists for measuring the water absorbency of ink. This group will investigate proprietary methods such as Duke Custom Systems Ink-Water Tester although the value of existing tests is questionable in spite of the fact that certain customers demand certain test results. Further discussion developed two criteria which seem more important, namely, rheology and emulsification. A round robin to measure water absorption was organized. At least five selected inks will be tested by eight cooperators, six of whom will use a regular mixmaster. The chairman will supply two black inks, one high water pick up and one low water pick up; a member will supply two blue heat set inks, one of which prints well and one which does not; and another will supply two red inks. The chairman of Sub. D01.56 will organize the methodology for the round robin and the task group chairman will coordinate the testing and reporting.

Group 10, Volatile Content of Inks, B. Blom, Chairman, examined Method D 2369 and found it not useful by printers because of the greater thicknesses and shorter drying times of inks they need. The chairman will organize a round robin and provide two ink samples.

General—On method D 3424, "Standard Method of Evaluating Light Fastness of Printing Matter," two reviewers suggested a major updating was needed. Pigment suppliers will be invited to join a task group to be appointed by the chairman.

SUBCOMMITTEE D01.57 ARTISTS' PAINTS AND RELATED MATERIALS

J.T. Luke, Chairman

Group 2, Lightfastness of Pigments, H.W. Levison, Chairman, gave a progress report on the series of lightfastness tests he is conducting. Both sun exposures and xenon-arc exposures are complete. The exposure to fluorescent illumination should be completed in September or October with a final report by the January meeting.

Group 3, Tinting Strength of Pigments, I. Shack, Chairman, Ruth Johnston-Feller, a consultant for the Center for Research on Materials for Artists and Conservators at the Carnegie-Mellon Institute, described an innovative tinting strength method she is developing which can be used with either a spectrophotometer or colorimeter. It was decided to begin a round robin to evaluate how well the test results correlate with the colored pigment content of known formulations.

Group 7, Physical Tests, H.W. Levison, Chairman, read and discussed his report on his extensive investigation into the proper substrate for artists' paint films to be used in flexibility and/or distensibility tests. Thickness of paint film, rate and degree of bending, and methods of accelerated aging were also addressed.

Group 8, Labeling for Chronic Toxicity, W. Stopford, Chairman. During the meeting attended by ten guests from the art material field, a draft of a practice for labeling of artists' materials for chronic toxicity was unanimously approved. A subcommittee ballot on this approved version will be circulated as quickly as possible because of Congressional interest in the subject.

Technical Articles in Other Publications

Compiled by the Technical Information Systems Committee—H. Skowronska, Chairman

Pigment & Resin Technology

Published by Sawell Publications, Ltd., 127 Stanstead Road, London SE23 1JE

Vol. 10 No. 1 — January 1981

Walton, A.J.—"Applications of Gas Chromatography in Paint and Allied Industries. Part 2: Raw Materials"; 4-6, 10.

Anon.—"Coatings Update: New Raw Materials" (Literature review); 7-10.

Khan, M.I., Chandra, S., and Vasishtha, A.K.—"Leather Finishes Based on Polyvinyl-Chloride and Polystyrene Resins"; 12-15.

Vol. 10 No. 2 — February 1981

Anon.—"Coatings Update: Trends in the Coatings Industry" (Literature review); 4-9.

Walton, A.J.—"Applications of Gas Chromatography in Paint and Allied Industries. Part 3: Binder resins"; 10-14, 18.

Smith, C.A.—"Printing Ink Problems" (Health and safety); 15-18.

Plaste und Kautschuk
(In German)

Published by VEB Deutscher Verlag fur Grundstoffindustrie, 27 Karl-Heine-Strasse, DDR-7031 Leipzig

Vol. 28 No. 1 — January 1981

Berlin, A.A., Zukerman, A.M., and Schutow, F.A.—"Foamed Polymer Materials — Principles of Classification, Research Problems and Prospects of Development"; 1-5.

Naber, B.—"Antistatic Treatment of Polymers — A Review"; 6-9.

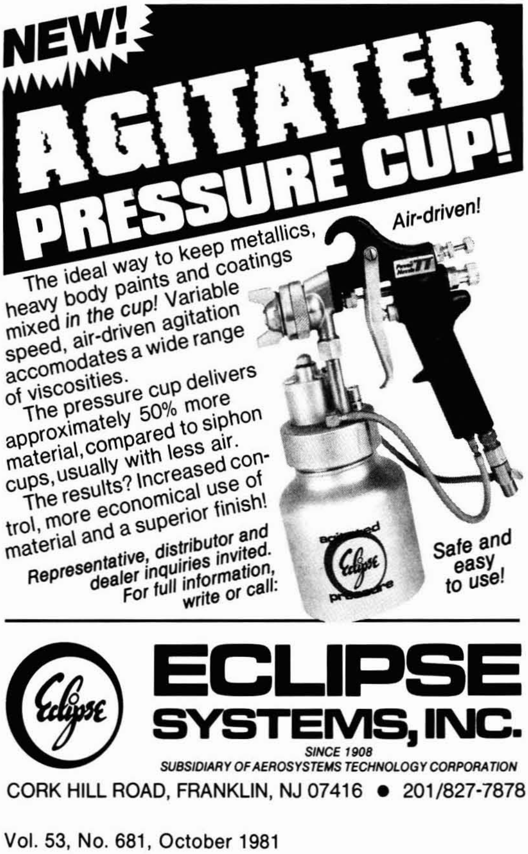
Popov, G., Stiebitz, V., and Schwachula, G.—"Styrene — Divinyl Benzene Copolymers. Part XVII"; 10.

Bukowski, A. and Osowiecka, B.—"Synthesis and Properties of Polyester-Bitumen Blends"; 11-14.

Opitz, G.—"Thermal Degradation of Polyoxymethylene and Its Copolymers With 1,3-Dioxolane. Part II"; 15-18.

Vadasz, E.—"Comparative Studies in Constructional Plastic Coatings"; 33-35.

Muschik, D. and Ananew, W.—"Temperature Dependence of the Flow Characteristics of Thermoplastic Polyurethanes"; 45-47.



Meetings/Education

Experts on Bridge Painting Systems to Meet at First World Congress

The first World Congress on Protective Coating Systems for Bridges and Structures will be held November 3-4 at the Holiday Inn, La Guardia Airport, New York, NY. The conference, sponsored by the University of Missouri-Rolla in cooperation with the Institute for Bridge Integrity and Safety, the Federal Highway Administration, the Steel Structures Painting Council, and the New York City Department of Transportation, is part of the UMR chemistry department's coatings continuing education program.

Featured at the Congress will be a four-part seminar that will explore all aspects of bridge repainting. Procedures that have proved helpful in safeguarding bridges against deterioration in most of the world's climate zones will also be discussed.

Scheduled for the two-day program are the following topics and speakers:

"Common Causes of Paint Failure and Who's to Blame"—Kenneth Tator, Tator Associates.

"Status and Role of New Alternate Corrosion-Inhibiting Pigments"—John Keane, Steel Structures Painting Council.

"Permanent Initial Coatings Systems for Difficult-to-Reach Parts"—Frank Neary, American Welding Society.

"Xenon Flash Lamps for Cleaning Structural Steel"—Henry Bleile, U.S. Navy.

"Air-Water-Sand Method for Cleaning Steel"—Tom Kelsall, Kue Ltd.

"Citric Acid Cleaning of Structural Steel"—Joahn Peart, Avondale Shipyards.

"On-site Quality Control"—Derek Baylis, ITI Corrosion Ltd.

"Performance Testing and Qualified Product List"—Gary Tinklenberg, Michigan Department of Transportation.

"How We Repainted the Boston Bridges"—Leo Stevens, Massachusetts Department of Transportation.

"Repainting the Pittsburgh Area Bridges"—Fred Graham, Allegheny Department of Public Works.

"Topcoats for Organic and Inorganic Zinc Rich Paints"—Steel Structures Painting Council.

"Readying Shop-Coated Metal for Field Application"—John Conomos, Conomos Painting Co.

"Cost Effectiveness of Shop Applications of Multi-Coat Systems"—Edward Gleason, MPC Facilities, Inc.

John Gordon, Director of Coatings Continuing Education at the University of Missouri-Rolla, and Sol Galler, President of the Institute for Bridge Integrity and Safety, are Co-directors of the Congress. Abel Banov, author of the *Paints and Coatings Handbook* and Senior Editor of the *American Paint and Coatings Journal*, is General Chairman.

For further information, please contact: Norma R. Fleming, conference coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401.

'Women In Coatings' Seminar To Be Held Oct. 25-27 In Detroit

The University of Missouri-Rolla will be sponsoring its second "Women in Coatings" seminar Oct. 25-27 at the Pontchartrain Hotel, Detroit, MI.

The seminar is held to assist women in sales, management, and technology to fully realize their potential in the coatings industry.

The program is divided into three basic sessions, with the first discussing the challenges that face women in the coatings industry. The second session focuses on the skills needed to succeed, with individuals analyzing their feelings and attitudes toward female authority. Each person has the opportunity to learn to use influence and leadership strengths positively by negotiating, managing conflict, and learning assertive behavior. The final session will discuss the importance of support groups that can provide the female professional with the advice and encouragement to pursue a meaningful career in the coatings industry.

Faculty will include Ada C. Nielsen, Marketing Manager of Specialty Chemicals, Nalco Chemical Co., and adjunct Professor of Chemistry at UMR; Linda L. Moore, Director of the Women's Institute in Kansas City; and John A. Gordon, UMR chemistry faculty member and Chairman of the Education Committee for the Federation of Societies for Coatings Technology.

The seminar fee is $365, which includes text and workbooks, classroom handouts, dinner on Sunday night, lunch on Monday and Tuesday and coffee breaks. Lodging is not included.

For more information, contact Norma Fleming, Coordinator, Arts & Sciences Continuing Education, UMR, Rolla, MO 65401, 314-341-4201.

Univ. of Detroit Is Site of Sponsored Coating Courses

The Polymer Institute of the University of Detroit, the Detroit Society for Coatings Technology, and the Detroit Paint & Coatings Association are jointly sponsoring coating courses currently being held at the university. Beginning in September, the courses offered include:

"Principles of Color Technology"—Designed as an introduction for those with no previous education in the field, this seven-week, "hands-on" course will deal with color matching and color control.

"Fundamentals of Automotive Paint Systems"—This 12-week course is a comprehensive survey of basic automotive paint raw materials and process systems.

"Modern Resin Technology"—The sessions of the 12-week course include lectures on modern resin technology which illustrate the relationship between the structure of the resins and the properties of coatings. Pertinent Federation Series books are also included.

"Coatings Laboratory"—The seven-week course, beginning October 22, emphasizes "hands-on" experience as it covers the use and operation of equipment used in quality control and R & D laboratories.

For further information, contact Bohdan Melnyk, Chrysler Corp., Dept. 2520, 12800 Lynn Townsend Dr., Highland Park, MI 48203.

UMR Announces Coatings Industry Advisory Group

Ten executives from industry will serve on a newly formed advisory committee on surface coatings courses at the University of Missouri-Rolla.

Marvin W. Barker, Dean of the UMR College of Arts and Sciences, said that the group will provide guidance to help UMR keep its academic and continuing education courses in that field relevant to the needs of the coatings industry.

Members of the committee are: Ronald R. Brown, Group Manager, Coatings Technical service, Union Chemicals Division, Tech Service Center, Charlotte, NC; John L. Gardon, Vice-President, Coatings Research & Development, Sherwin-Williams Co. Research Center, Chicago, IL; Phil W. Harbaugh, Technical Director, Resins Operations, Reliance Universal, Inc., Louisville, KY.; Howard Jerome, Technical Director, Spatz Paint Industries, St. Louis, MO; Lewis P. Larson, Painteco, Columbus, OH; Stan Lopata, Chairman of the Board, Carboline Co., St. Louis; Warren O. Manley, Director of Research, Cook Paint & Varnish Co., Kansas City, MO; Ada C. Nielsen, Marketing Manager, Specialty Chemicals, Nalco Chemical Co., Oak Brook, IL; Lowell D. Pals, Director, Sales and Marketing, IMC Chemical Group/NP Division, Des Plaines, IL.; Walter F. Rhoades, Chairman of the Board, Standard-T Chemical Co., Chicago.

The advisory group will meet annually on the UMR campus to consult with faculty and students and review credit and non-credit coatings programs.

In addition to its on-campus academic programs for chemistry and chemical engineering students, UMR offers numerous continuing education courses for people employed in the coatings field. About 12 courses are offered each year on campus and in cities around the country in trade sales, industrial coatings, management and research and development, and for contractors and maintenance painters.

UMR's undergraduate and graduate programs are supported by the coatings industry through scholarships and research grants. Scholarships include the Wouter Bosch Surface Coating Scholarship Fund for chemistry and chemical engineering majors and the Monty M. Horst Memorial Scholarship contributed by Morehouse Industries Inc. Research projects include screening compounds for antifouling coatings funded by the U.S. Navy, an ongoing project on mildew defacement of coatings funded by the Paint Research Institute, and other projects for paint industries and governmental agencies.

John Gordon, former manager of Polymer Technical Services, AMSCO Division, Union Oil Co., directs coatings continuing education at UMR.

Color Seminars Sponsored by HunterLab

HunterLab is presenting its series of two-day seminars on color from October through June 1982 in various cities throughout the United States. These seminars are introductory courses which provide appearance technologists with a basic knowledge of color science. They feature both theory and practice in the description, specification, and measurement of color, and are of interest to personnel in the paint, textile, paper, plastics, food, pharmaceutical, metal, and cosmetic industries.

The opening day of the program is devoted to lectures, discussions, and practical demonstrations. Featured in the second day are a brief summary, specific application studies, and an instrument laboratory session where staff members will be on hand to discuss particular product requirements.

The seminar schedule is as follows:

Oct. 15-16	Dallas, TX
Nov. 4-5	Philadelphia, PA
Nov. 9-10	Canada
Nov. 12-13	Canada
Nov. 18-19	Detroit, MI
Dec. 2-3	Dalton, GA
Jan. 6-7	Columbus, OH
Jan. 20-21	Los Angeles, CA
Mar. 24-25	New Orleans, LA
Apr. 7-8	Chicago, IL
Apr. 28-29	Saddlebrook, NJ
May 3-4	Portland, OR
May 6-7	San Francisco, CA
May 26-27	Kansas City, MO
June 16-17	Boston, MA

The seminar fee of $125 includes lunches, reference material, and a copy of R.S. Hunter's "The Measurement of Appearance".

Additional information and application forms can be obtained from Dorothy C. Minner, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090.

John Gordon, of the University of Missouri-Rolla (center), was presented with checks for $150.00 each from Dick Warren, President of the Kansas City Society for Coatings Technology (left) and Ray Frederick, Treasurer of the Kansas City Paint & Coatings Association (right), for the Wouter Bosch Surface Coatings Scholarship Fund

Baltimore Society Co-Sponsors Basic Coatings Course

The Baltimore Society for Coatings Technology, in cooperation with the Essex Community College, is sponsoring "Basic Coatings Technology," a non-credit, continuing education course designed to meet the needs of technicians and chemists just entering the coatings industry as well as marketing, production, and administration personnel who wish to broaden their background in coatings fundamentals and theory.

Along with a history of paint and the materials used in coating manufacture, the course will provide a basic understanding of formulating techniques and will present new trends, advances, and restrictions in the industry. Instruction will be delivered by practitioners and experts in the field of coatings technology.

For detailed course and registration information, contact Essex Community College, Office of Continuing Education, Rossville Blvd., Baltimore, MD 21237.

CALL FOR PAPERS

Regional Technical Conference
"The Versatile Thermosets"

Oakbrook, IL
March 3–5, 1982

The Chicago Section of the Society of Plastics Engineers Inc. and the Thermoset Division invite all interested persons to submit papers for presentation.

Papers relating to the following topics are welcomed: conventional processes, injection molding, new advances and applications in the thermoset field, and future use and growth of thermosets.

All inquiries should be made to Paul Fina, College of DuPage, Box P, Riverside, IL 60546.

Macbeth Color Seminars Are Scheduled for 1982

Macbeth, a Div. of Kollmorgen Corp., Newburgh, NY, will sponsor its seminar, "The Fundamentals of Color," at locations throughout the United States and Canada. Held for the fourth straight year, the seminar will be divided into two one-day sessions which will feature the problems associated with the measurement, specification, and control of color.

The first day is devoted to lectures and practical demonstrations. The fee for the first day is $125 which includes reference materials, workbooks, and lunch. The second day, for which there is no fee, is an informal session of hands-on use of visual standards, lighting control, and instrumentation.

The locations and dates for the first half of 1982 are: San Francisco, CA, Feb. 18–19; Newton, MA, Mar. 18–19; Cherry Hill, NJ, Apr. 22–23; Chicago, IL, May 20–21; and Columbus, OH, June 10–11.

Additional information and application forms can be obtained from Jeanne M. Dolan, Macbeth, Div. of Kollmorgen Corp., Little Britain Rd., P.O. Box 950, Newburgh, NY 12550.

OCCA To Sponsor 34th Annual Exhibition, April 27–29

The Exhibition Committee of the Oil and Colour Chemists' Association will hold its 34th Annual Exhibition and International Forum for the Surface Coatings Industries at the Cunard International Hotel, Hammersmith, London, England, on April 27–29.

The exhibition will present commercial and technical information relating to raw materials, and equipment used in the paint, polymer, printing ink, color, adhesive, and allied industries. Manufacture, processing, and application will also be featured.

The Committee welcomes exhibits from companies relating to the new energy efficient, low-polluting technologies, including powder coatings, high-solids coatings, radiation curing, water-based coatings, and other developments.

As an innovation in 1982, the opportunity is being presented to exhibitors to present 30-minute discourses on a commercial theme concerning the background of their exhibits and their companies' future developments, research programs, and new products. These discourses will take place at selected times in the morning periods of the exhibition and will be chaired by members of the Association. The program will be subject to the approval of the Exhibition Committee and will be published in the Journal of Oil and Colour Chemists and in the Official Guide.

The Association's Biennial Dinner Dance will be held Wednesday, April 28, at the Savoy Hotel, London.

The hours for the three-day exhibition are: Tuesday, April 27, 9:30 am to 5:30 pm; Wednesday, April 28, 9:30 am to 5:30 pm; and Thursday, April 29, 9:30 am to 5:30 pm.

For more information, write R.H. Hamblin, Director and Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HA0 2SF.

CALL FOR PAPERS

ASTM Symposium On "Terminology: The Cornerstone of Global Communications Through Standards"

Toronto, Canada
June 21–25, 1982

Sponsored by the American Society for Testing and Materials Standing Committee on Terminology, the symposium will provide a forum for the review and discussion of basic principles and methodologies in the preparation and use of standard terminology by both man and machines.

Authors are invited to present original, tutorial, and review papers on the following and related topics: basic principles in preparing terminology standards; case studies illustrating the importance of standardized vocabularies; the role of dictionaries in standards development; methods, principles, and guidelines for terminology work; established and use of computer-aided data banks in terminology; future developments and national and international activities in the field; general concept definitions vs technical definitions; and establishing terminology to be used in emerging technical fields.

Prospective authors are invited to submit a title, a 300–500 word abstract, and an ASTM Paper Submittal Form by November 2, 1981 to Symposium Chairman Wayne P. Ellis, H.B. Fuller Co., P.O. Box 625, Spring House, PA 19477; or to Kathy Greene, ASTM Publications Div., 1916 Race St., Philadelphia, PA 19103.

New York Society Is Cohost of Fall Coatings Courses

The Joint Education Committee of the New York Society for Coatings Technology and the New York Paint & Coatings Association is sponsoring two coatings courses this fall.

"Understanding the Basics of Coatings" is a two semester course in elementary coatings technology, designed for individuals with no previous chemistry experience who wish to gain a broader background in coatings fundamentals. The fall semester will introduce the raw materials employed in the coatings industry, while the second semester will emphasize dispersion techniques, application equipment, test methods, coatings calculations, and formulation. Instructor for the course is Don Brody, of Skeist Laboratories, Inc.

The second course is a laboratory course designed for technicians employed in the coatings industry. A combination of basic theory, demonstrations, and laboratory exercises is featured, along with a series of specific topics discussed by technical experts in the industry. Jeff Kaye, of Maas & Waldstein Co. is instructor for the course.

For further information, contact Don Brody, Skeist Laboratories, Inc., 112 Naylon Ave., Livingston, NJ 07039 or Jeff Kaye, Maas & Waldstein Co., 2121 McCarter Hwy., Newark, NJ 07104.

Detroit Society Officers for 1981–82. Seated left to right: President-Elect—Stephen J. Vargo; President—Gary Van De Streek; and Treasurer—Michael J. King. Standing: Council Representative—Harry B. Majcher; and Secretary—Sheila G. Drake.

People

Engelhard's Minerals & Chemicals Division has named **Cyrus H. Holley**, Executive Vice-President of Operations and **Fredric M. Guist**, Senior Vice-President and General Manager of the firm's Catalysts and Chemicals Group.

Mary Lu Hickey has been transferred to the Southern Region as the Technical Sales Representative for Water Soluble Polymers and Coatings for Hercules Incorporated.

Philip S. Hunter has assumed the office of President and Chief Executive Officer of Hunter Associates Laboratory. He was previously Chief Executive Officer. **Richard Hunter** remains Chairman of the Board for the firm.

Jack Dentler, of the Pfizer MPM Division, was named the 1981 Man of the Year by the Detroit Society. He has headed the group's Publicity Committee for several years and serves a similar function with the Detroit PCA.

Charles Ray Ledbetter has been appointed Southwest Regional Manager for Pearsall Chemical, a division of Witco Chemical Corp.

Wyandotte Paint Products Co. has acquired certain assets of the Pontiac Coating Division of Grow Group, Inc. **Ken Swint,** former Plant Manager of the Wyandotte, MI plant, was named General Manager of the newly acquired plant in Pontiac. He is a member of the Detroit Society.

Union Carbide Corp. has announced the appointment of **G.W. "Bill" Buttrick** as Regional Technical Manager in its Coatings Materials Division. In his position, Mr. Buttrick will manage laboratory and technical service activities at the firm's Tucker, GA latex plant, which serves the southeast region of the U.S.

Also announced by the firm was the appointment of **Roy H. Schaufelberger** as Sales Manager of coatings resins, in the Coatings Materials Division.

Joseph Vola, Technical Director and Vice-President of Dunne Quality Paints, Oakland, CA, retired this summer after 40 years in the paint manufacturing industry, 23 of them with Dunne. Mr. Vola is a member of the Golden Gate Society. He was succeeded by **Robert Miller**, Technical Director, who had been associated with Imperial Paint Co.


C.H. Holley


F.M. Guist


J.A. Trivisone


G. Doktorczyk

Reichhold Chemicals, Inc. has announced the restructuring of its Newport Division under **Joseph A. Trivisone,** who was named Vice-President and General Manager of the Division.

Albert C. Bean III has been elected to the office of President of Tnemec Co., Inc., and **Albert C. Bean** has become Chairman of the Board, having served as President since 1955. Also announced was the promotion of **William C. Hunt** to Vice-President, Operations. **Peter F. Cortelyou** was named Vice-President, Finance and **Gary M. Zinn** was appointed Vice-President, Sales and Marketing.

The Board of Directors of Jamestown Paint & Varnish Co. (Japco) has elected **Joseph P. Walton** to the position of Executive Vice-President. Mr. Walton most recently served as Assistant to the President.

Dr. James B. Lear has been named to the position of Scientist in the PPG Industries, Coatings & Resins Division, Research and Development Laboratory, Allison Park, PA. Dr. Lear had previously held the position of Senior Research Associate with the firm.

The appointments of **Samuel V. Militello** and **Richard K. Hong** to the positions of Product Development Managers have been announced by the Spencer Kellogg Division of Textron, Inc. Mr. Militello will have responsibility for the water-dispersible maintenance and trade sales resin systems, as well as the polyurethane and epoxy/polyester systems. Assuming responsibility for the high solids and industrial water reducible resins, will be Mr. Hong. He is a member of the Western New York Society.

Dr. Lawrence B. Nelson, Divisional Vice-President, was also appointed General Manager of the Sonneborn Division of Witco Chemical Corp.

The O'Brien Corp. has announced the following appointments. **George Doktorczyk** has been promoted to Vice-President of Operations. He is a member of the Golden State Society. **Russ Robison** was appointed Plant Manager for the Southeastern Region, headquartered in Brunswick, GA. Mr. Robison is a Chicago Society member. Named Quality Assurance Manager for the firm's Midwestern Region was **Michael McLaurin.** He is a member of the Baltimore Society.

The following appointments were announced by the Plastics and Coatings Division of Mobay Chemical Corp. **James N. McDerby, Jr.** was named Coatings Sales Supervisor of the Midwest district. He is a member of the St. Louis, Kansas City, and Louisville Societies. **Richard C. Dougan** was appointed Coatings Sales Supervisor for the Southern district, including the Houston, Los Angeles, and Atlanta areas.

Paul M. Bryant has been named Operations Manager for the Los Angeles plant of Ferro Corporation's Coatings Division. Mr. Bryant will be responsible for all facets of the Coatings Division's West Coast operations, including sales, administration, manufacturing, and research and development.

Also announced by the firm was the appointment of **Roger B. Peterson** as Director of Commercial Development. Headquartered in Bedford, OH, Mr. Peterson will be responsible for commercial appraisal of corporate research programs as well as overviewing the commercial development activities on new products within the operating division.

Edwin W. Jirousek has been promoted to National Sales Manager at Ferro Corporation's Chemical Division, Bedford, OH. In his new position, he will be responsible for the sales of all Chemical Division products.

Midland's R&D Center Dedicated to Milton A. Glaser

The Midland Division of The Dexter Corp. dedicated its new Research Center in Waukegan, IL on July 22 as the Milton A. Glaser Research Laboratories.

The new Research Center was dedicated to **Milton A. Glaser**, an employee of Dexter-Midland for 31 years. Mr. Glaser joined the firm as Technical Director and served as Vice-President of Research and Development for 29 years until his retirement in 1978.

Mr. Glaser is one of the most widely recognized research managers in the coatings industry. He has been honored with the Outstanding Service Award from the Chicago Society for Coatings Technology, the Federation's George Baugh Heckel Award, and the Distinguished Service Award from the Chicago Technical Society's Council, and Mattiello Lecture Award for "Distinguished Scientific Achievement". He is a member of fifteen renowned scientific organizations including the American Chemical Society, the American Institute of Chemical Engineers, the American Oil Chemists Society, the American Society for Testing Materials, the Federation of Societies for Coatings Technology, the Chicago Society for Coatings Technology, the Chicago Paint and Coatings Association, the Industrial Research Institute, the Institute of Food Technologists, International Union of Pure and Applied Chemistry, National Association of Corrosion Engineers and the New York Academy of Sciences. He is a Fellow of the American Institute of Chemists. He is a Past-President of the Federation and is a former president of the Paint Research Institute where he currently serves as an honorary trustee. He is also a registered professional engineer in the State of Illinois.

Mr. Glaser is the author of more than forty publications and several United States and foreign patents. He is currently serving as a consultant for many companies in the coatings industry throughout the United States specializing in innovation in research laboratories.

Mr. Glaser holds a Bachelor of Science Degree in Chemical Engineering, Magna Cum Laude, from Tufts University and has done graduate work at both the University of Chicago and Northwestern University.

Devoted exclusively to the development of high technology industrial coatings, the new research facilities were designed to accommodate scientific personnel in an open laboratory design concept to encourage communications and technological interchange. The laboratories have also been equipped with some of the most modern instrumentation and testing equipment available in the coatings industry.

The Midland Division is a major supplier of industrial coatings both domestically and internationally. The research efforts in Midland's new facilities include the areas of coatings for rigid and paperboard packaging, building products, and general industrial finishes.

George E. Batzel, President, Midland-Dexter (right) presents Certificate of Recognition to Milton A. Glaser, in front of the Milton A. Glaser Research Center

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Edward L. Hamilton has been promoted to Product Manager, Printing Ink Industry, in the Pigments Division of the Hilton-Davis Chemical Group. Mr. Hamilton is a member of the Rocky Mountain Society.

Also announced by the firm was the appointment of **Donna L. Batdorf** as Sales Representative in the Pigments Department for the Western Region. Ms. Batdorf is a Chicago Society member.

John D. Ignatius has been promoted to Technical Manager and **Floyd B. Morris** has been named Manufacturing Manager in the Hilton-Davis Chemical Group's Pigments Division.

Dr. Edward Stone has been named to the newly created position of Director of Polymer Research and Development and Analysis, of the Central Research Laboratory of United Technologies' Inmont Corp., Clifton, NJ. Most recently Manager of the firm's Polymer and Vehicle Laboratories and the Technology Development Program, Dr. Stone will continue these responsibilities while assuming full responsibility for direction of the analysis and testing laboratory.

McCloskey Varnish Co. has announced the promotion of **Jay L. Holmes** to the position of Executive Vice-President and General Manager of their Philadelphia, PA Division. Mr. Holmes is a member of the Philadelphia Society.

Midland Division, the Dexter Corp., has announced the following appointments. **Tom Daly**, who joined the firm in 1980 as Manager of Analytical Chemistry, has been promoted to the position of Manager, Research Services. In this capacity, he will continue to manage Analytical Services and assumes the responsibilities for Quality Assurance and Research and Development Administration Services. Mr. Daly is a member of the Chicago Society.

David R. Scheuing has joined the corporation as Senior Project Chemist, Analytical Services and **Larry L. Reasor** has been named Senior Project Chemist, Packaging Laboratory. Appointed Manager, Polymer Chemistry was **Dr. Louis J. Sharp IV**, while **Paul J. Timmerman** was named Manager, Building Products Laboratory. Mr. Timmerman is a member of C-D-I-C Society.

Bob English, a 48-year veteran of the paint manufacturing industry, retired from R.T. Hopkins Co., Atlanta, GA, on June 30. He joined Hopkins in 1953, after having been with Minnesota Paints, F.J. Cooledge & Sons, Leland Moore Paint & Oil Co., Southern Paint & Glass Co., and John R. Wald Co. He was President of the Southern Coatings Society in 1953.

G. Steve Hart, Senior Policy Advisor, Policy Branch Planning and Finance Service, Fisheries and Environment Canada, Ottawa, Canada, was elected President of the Air Pollution Control Association (APCA) at the association's 74th annual meeting and exhibition.

Elected to the Board of Directors were **Walter C. Barber**, U.S. Environmental Protection Agency; **William R. Meyer**, State Air Pollution Control Board; **William Reilly**, Air Management Services; **Richard C. Scherr**, Procter & Gamble Co.; and **Sara P. Siebert**, Public Service Electric & Gas.

Bernard Krantz, a long-time member of the New York and Los Angeles Societies, has formed Star Color & Chemical Co., a distributor and manufacturers' rep serving the coatings, plastics, and ink industries. He was formerly associated with BASF Wyandotte Corp. on the west coast.

Air Products and Chemicals, Inc., Allentown, PA, has named **Hugh P. Gallagher** General Manager of the firm's Performance Chemicals Division. Also announced by the company, was the appointment of **Richard Hedderick**, as Manager of Applications Development and Technical Services for the Polymer Chemicals Division.

Mooney Chemicals, Inc., Cleveland, OH has announced the appointment of **Dr. H. Burnham Tinker** as Technical Director.

Gaco Western Inc. has named **Rodney E. Bechtel** as Sales Manager in Seattle, WA.

Drew Chemical Corp., Boonton, NJ, has announced the following appointments. **Peter Bacinski** has been promoted to Manufacturing Quality Control Manager, Manufacturing Group, Kearny, NJ. Appointed Chemist in the Quality Control Department was **Christopher Jennings. Scott D. Tylicke** was named Laboratory Technician, Quality Control Laboratory.

The Resins Division of Henkel Corp. has announced the construction of new resins production facilities at the company's Kankakee, IL plant. Organizational changes have occurred within the division administrative group, at the Minneapolis, MN headquarters.

Richard A. Barry, formerly Product Manager, was promoted to Business Manager, Marketing. He is a member of the Northwestern Society. **R. Dale Baker**, a member of the Pittsburgh Society, has joined the division as a Product Manager.

Other appointments included: **John R. Yurchisin** and **Edward D. Smith**, Business Managers, Sales Development; **John D. Durig**, Marketing Specialist; **Judy Moss**, Marketing Assistant; and **John G. Raudsep** and **Wiliam H. Mann**, Western Regional Sales Manager and Eastern Regional Sales Manager, respectively.

Two grants have been awarded to Glidden Coatings and Resins by the National Science Foundation. The stipends went to two science faculty members for work in organic and organic physical chemistry at Glidden's Research Center, Strongsville, OH. The recipients are **Dr. Donald L. McClaugherty**, Assistant Professor and Chairman of the Department of Chemistry at the University of Texas at Tyler, and **Dr. John C. Weygandt**, Dean of the School of Sciences at Ashland College in Ohio.

Glidden Coatings and Resins, SCM Corp., has announced the retirement of long-time coatings veteran **Edwin G. Engelhardt** and the appointment of his successor, **Thomas R. McCarroll**, as Regional Director-Central region. Other changes in the organizational move were the appointment of **Roger H. Ahlers** as Regional Manager-Chemical Coatings and the promotion of **Scott M. Holt** to Regional Manager—Branch Operations.

The firm has also announced several management appointments at its Huron, OH facility. **Bruce M. Cohen** was named Resin Plant Manager and **Ronald F. Dieckman** was appointed Resin Materials Manager. Appointed Manager of Quality and Process Engineering was **James C. Pecchio**, while **Eleanor A. Hahn** was named Manager of Chemical Coatings Inventory Control.

Other appointments for Glidden Coatings and Resins include the following. **Roger P. Hall** was named Manager of Technology, Strongsville, OH. **Peter J. Rocco** was appointed Plant Superintendent, Reading, PA. Named Plant Manager for the Southwest region, headquartered in Carrollton, TX, was **Kennedy O. Quick. William E. Whitmire** was named Field Sales Manager—Chemical Coatings, Southeast region, located in Atlanta, GA.

Two appointments have been made by Glidden Coatings & Resins. **Gregory J. McGill** was named Manager—Personnel Development and **James Fluker** was appointed Manager—Physical Distribution for Glidden's Western Region, headquartered in San Francisco, CA.

Glidden Midwest Chemical Coatings has announced three promotions. **H. Thomas Tonkin** was named Manager—Chemical Coatings Sales and **Richard D. Lane** was appointed Field Sales Manager. Both are headquartered in Chicago, IL. **Robert D. Nicholas** was promoted to Manager—Chemical Coatings Zone, based in Minneapolis, MN.

Colloids, Inc., Newark, NJ, has appointed **Stanley D. Schwartz** as Vice-President for Industrial Sales. Mr. Schwartz is a member of the Baltimore Society.

The retirement of **Vincent Ward** as Chairman of the Board and President of Hanley Paint Co. was recently announced. He is succeeded by **William Tunno**, previously Vice-President and General Manager.

Mr. Ward joined the company in 1944 and became President in 1964. A 44-year veteran in the paint industry, Mr. Ward became owner of the firm in 1970.

Neville Chemical Co. has announced the appointment of **Robert W. Halley** as District Sales Manager, based in Cincinnati, OH.

Donald K. Lutes, Sr., retired in July from the Sherwin-Williams Co. after 36 years of service with the firm. Mr. Lutes began his career with Sherwin-Williams as a Development Chemist in 1945, and held several supervisory positions, with his most recent position being Director of Technical Services, Coil Coatings, International Division.

Hercules Incorporated has named five technical representatives in its Midwestern Region. Joining the Oak Brook, IL headquarters are **Glenn S. Barone** for Water Soluble Polymers & Coatings; **Nancy J. Ferrari** for Organic Resins; and **Thomas A. Augustyn** for Plastic Resins. At the Akron, OH operations, **Mildred A. McCrary** and **David W. Stiff** assume positions with Elastomers & Specialty Products.

Richard Oudersluys, of Ferro Corp., **Marv Gallisdorfer**, of Ridgway Color Co., and **Ted Potter**, of Shepherd Chemical Co. were elected to three-year terms on the Board of Governors of the Dry Color Manufacturers' Association at the association's 51st annual meeting.

William A. Bours III, Vice-President of Fabrics and Finishes of the Du Pont Co., has retired after 40 years of service to the company. **Dr. Nicholas Pappas,** General Manager of Fabrics and Finishes Department, will succeed Mr. Bours. Succeeding Dr. Pappas will be **Bruce A. Beardwood,** Director of the Industrial Films Division in the Polymer Products Department.

CIBA-GEIGY has announced the sale of its Radiant Color pigments business, located in Richmond, CA, to Bayou State Enterprises, Inc. The three principals of Bayou State are **John Mone, William Tichenor**, and **Denis O'Connell.**

The Valspar Corp. has announced the election of **Robert E. Pajor** to the position of President and Chief Operating Officer by the Board of Directors. Mr. Pajor previously served as Executive Vice-President.

Beckman Instruments, Inc., Fullerton, CA, has promoted **William F. Fuller** to the position of Marketing Development Manager, Process Instruments Division.

James Ignatow has been appointed Manufacturing Manager for the Southwestern Region of The O'Brien Corp. In his new position, Mr. Ignatow will be responsible for the firm's manufacturing facilities in Houston, TX.

Obituary

Carl L. Schwenk, 49, Product Manager for the Spencer Kellogg Division of Textron, Inc., died on July 24.

Mr. Schwenk began his coatings career with service to Allied Chemical Corp., Hooker Chemical Co., and Amercoat, Inc. In 1962, he joined Spencer Kellogg as an Applications Chemist at the Research Center and became Manager of the Technical Service Laboratory in 1973. He was promoted to the Sales Department in 1976, and was appointed Product Manager of Chemical Products the following year. Mr. Schwenk was a member of the Western New York Society and served as Chairman of the Drying Oils Subcommittee for ASTM.

Literature

Aqueous Dispersion

Literature is available announcing a new high jetness black aqueous compound, which offers excellent blackness, rheology, stability, and compatibility characteristics in a variety of applications. Write CDI Dispersions, 27 Haynes Ave., Newark, NJ 07114.

Software Package

Literature is available featuring a new purity analysis software package, offering complete automation of the technique. For more information, contact the Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

Laser System

Literature has been published featuring a laser inspection system with a dynamic position tracking feature which pinpoints the crossweb location of defects such as holes, streaks, and contaminants to within one mm on moving webs. Described are the advantages of using the laser inspection system with this added feature, such as enabling manufacturers of pulp and paper, plastics and coated products, nonwovens, metals, and photographic materials to reduce scrap, save raw material, and optimize slitting/sheeting operations. For additional information, write, Robert L. Yeager, Senior Vice-President Marketing, Intec Corp., One Trefoil Dr., Trumbull, CT 06611.

Chromatography Column

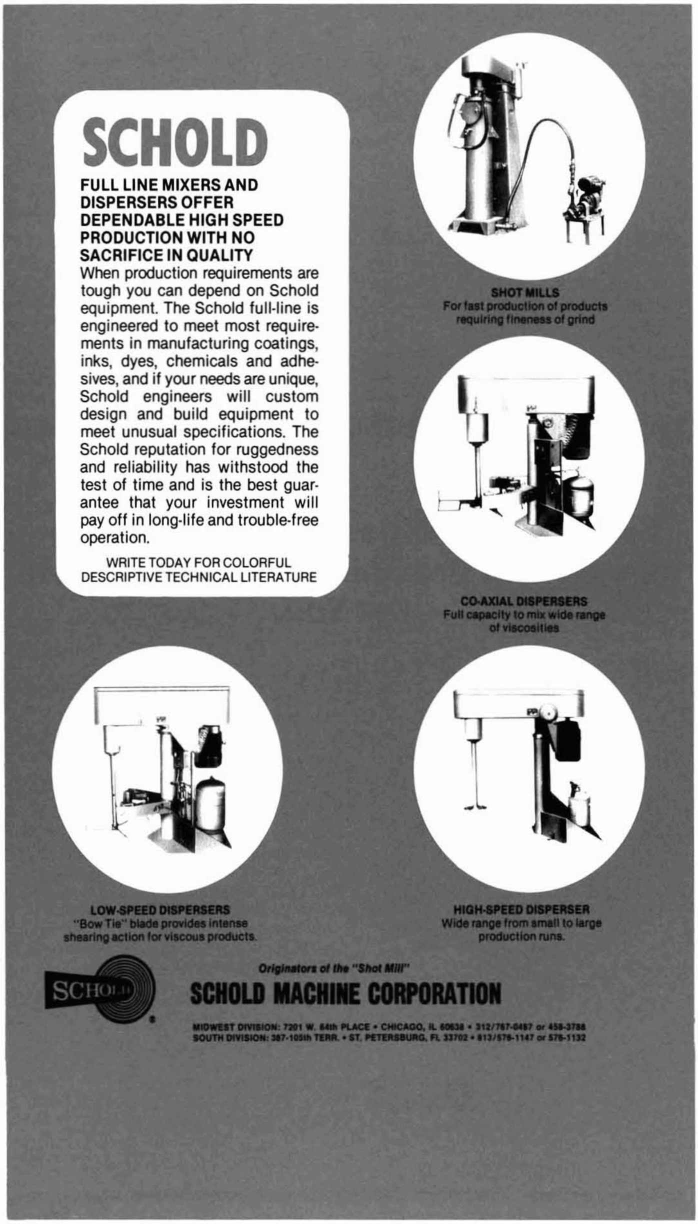
Literature describing a mobile phase conditioner accessory and a newly designed column end fitting, both designed to significantly extend the life and utility of liquid chromatography columns, has been published. The mobile phase conditioner accessory is a sacrificial column that eliminates the possibility of dissolving silica from an expensive analytical or preparative column when mobile phase conditions of basic pH or high aqueous concentration are used. The newly designed column end fitting provides up to 15% more efficiency per column. For information, write the Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

High-Speed LC Package

Literature has been published introducing a high-speed LC package that is factory tested, specified, and guaranteed. High-speed liquid chromatography permits most analyses to be completed in under two minutes while maintaining high resolution. For more information, contact the Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

Isoprene

Literature is available featuring a highly refined isoprene, used for long service life in passenger, truck, bus, and airplane tires. Isoprene is described as a basic building block for synthetic used in tires. For more information, write Goodyear News Bureau, Akron, OH 44316.



Spray Painting Robot

Literature is available introducing a robot designed and manufactured in the U.S. specifically for spray painting. Features of the robot are described, as well as its flexibility, ease of operation, and reasonable cost. For further information, contact Marketing Communications Dept., Binks Manufacturing Co., 9201 W. Belmont Ave., Franklin Park, IL 61031.

Exterior Coatings

A new line of exterior coatings including a semi-transparent stain, a solid color stain, and a solid color coating, is featured in recent literature. All three coatings are detailed according to specifications and applications. For information, write Premier Coatings, Inc., 2250 Arthur Ave., Elk Grove Village, IL 60007.

Light/Sightglass

Literature is available introducing a combination light/sightglass equipped with a threaded collar nut that permits easy opening and easy cleaning of the inside glass port. It combines glare-free illumination and viewing, allowing plant personnel to observe the contents inside of a processing vessel, tank, reactor, storage silo, etc. Additional information may be obtained from J.G. Papailias Co., Inc., 136 E. 57th St., New York, NY 10022.

Elastomeric Coatings

Literature is available featuring elastomeric coatings used for the protection of sprayed-in-place exterior urethane foam insulation. For more information, write Gaco Western, Inc., P.O. Box 88698, Seattle, WA 98188.

Light/Heat Stabilization

A new, four-color brochure on light stabilizers and their role in impeding the harmful effects of ultraviolet radiation on coatings is now available. The publication details the mechanism of photodegradation and explains how the different types of stabilizers counter this destructive process. The brochure is both a technical and working guide to the subject, and includes stabilizer performance data, recommended concentration ranges, product descriptions, and solubility data for a variety of coatings. Color photographs dramatically depict the value of light stabilizers in coating systems and extensive data provide supporting evidence. For a free copy of "Light and Heat Stabilization of Coatings," write Coatings, Inks and Photography Business Center, Additives Dept., CIBA-Geigy Corp., Ardsley, NY 10502.

Chromatography Software

Literature is available featuring a gel permeation chromatography (GPC) system, with both analytical equipment and GPC calculation software. It provides full distribution analyses complete with Mw, Mn, Mz and viscosity averages, polydispersity and normalized plots. The literature describes how the software is designed for use by noncomputer-trained operators, and yet allows full intervention or modification to provide data specific to a particular user's analytical needs. For information, write the Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

Specialty Silicones

Literature describing specialty silicones used in coating and finish formulations is now available. Included are silicones used in addition and condensation resins, while epoxy, vinyl and acrylic functional silicone prepolymers are described. A complete chemical description including molecular weights, comonomer content and termination provide data for development of high performance resins and encapsulants. This 48-page booklet, entitled "Silicones", is available from Petrarch Systems, Inc., 2731 Bartram Rd., Bristol, PA 19007.

Flash Point Testers

An updated descriptive brochure on the latest models of flash point testers is now available. The literature lists current costs for the instrument models and all available accessories. A free copy can be obtained from Paul N. Gardner Co., Inc., 218 Commercial Blvd., Suite 205, Lauderdale By-the-Sea, FL 33308.

Lighting Fixtures

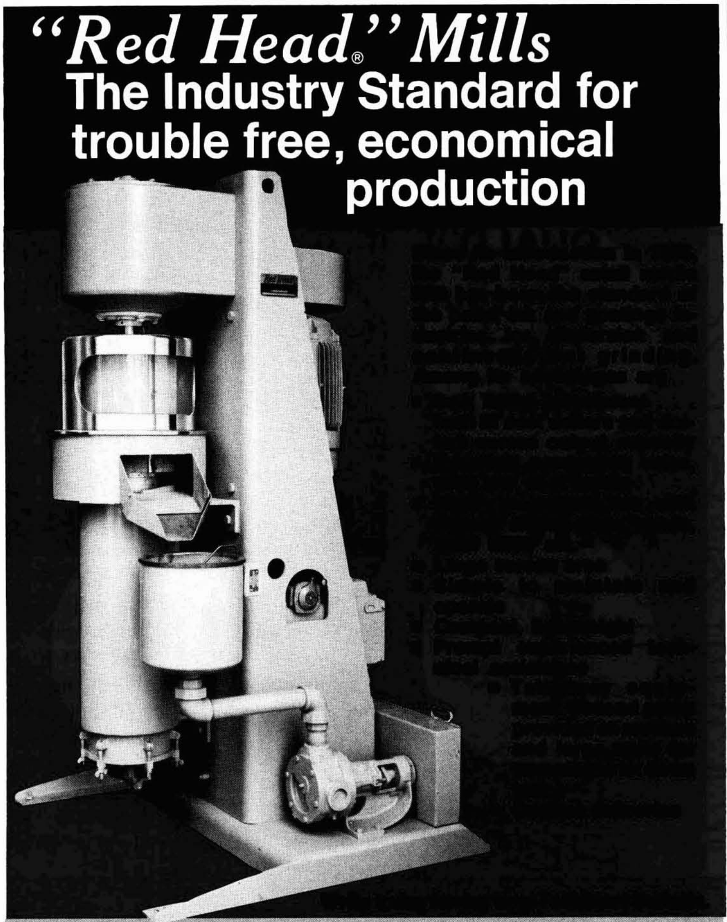
Literature introducing explosion-proof lighting fixtures, used for illuminating paint spray areas safely, brightly, and economically, has been recently published. For additional information, write ITT Weaver, 8676 Pennell Dr., St. Louis, MO 63114.

Primer Coating

Literature is available introducing a primer coating for steel surfaces which works well on rusty surfaces where only wire brushing or hand cleaning may be permitted. For Technical Bulletin UR-6, contact Steelcote Manufacturing Co., 3418 Gratiot, St. Louis, MO 63103.

Sponge Tester

A new, thin film wet sponge tester, designed to detect pinholes and holidays in nonconductive protective coatings applied to conductive substrates, is featured in new literature. Contact KTA-Tator Associates, Inc., 2020 Montour St., Coraopolis, PA 15108.



Directory

The latest annual Directory of Chemical Producers—United States has just been released. This comprehensive sourcebook provides current information about chemical producers and the products they manufacture. Featured are detailed descriptions of the 1,300 companies, and a revised regional index. The directory, of interest to chemical industry technical personnel, purchasing agents, planners, financial analysts, and marketing researchers, is available by subscription only. An inquiry service is included at no extra charge. For further information, contact Elaine Klapproth, Program Director of the Directory of Chemical Producers, SRI International, 333 Ravenswood Ave., Menlo Park, CA 94025.

Compound

Loop encapsulating compound, a self-leveling sealant used to encapsulate and seal traffic vehicle loop detector wire embedded in asphaltic concrete or portland cement concrete, is the subject of new literature. This epoxy sealant will adhere to clean surfaces and cure to a tough resilient material. Uses and applications are featured in Technical Bulletin LEC-1, obtainable from Steelcote Manufacturing Co., 3418 Gratiot, St. Louis, MO 63103.

Waterproofing

A new type of waterproofing specifically for wood construction is featured in recently published literature. Complete details, specifications, and applications are described in the brochure. To obtain a copy, write Chemstop Manufacturing & Sales Corp., 1222 Ardmore Ave., Itasca, IL 60143.

Coating

A heavy duty coating, combining a series of 100% solids (solventless), two component epoxy formulations compounded with pure resins, used for tank linings when storing either edible or corrosive commodities, is the subject of recent literature. For Bulletein ELI-TL-4, write Steelcote Manufacturing Co., 3418 Gratiot, St. Louis, MO 63103.

Specialty Monomers

"Specialty Monomers", a multi-client, techno-economic marketing study has recently been completed by Skeist Laboratories, Inc., Livingston, NJ, consultants to the polymer industries. The subscription fee is $9500.00. A free brochure, with Table of Contents, is available from Skeist Laboratories, Inc., 112 Naylon Ave., Livingston, NJ 07039.

Polyvinyl Alcohol

The latest grade of polyvinyl alcohol for use in textiles, adhesives, and paper applications is described in recent literature. Information on typical properties and unique characteristics of polyvinyl alcohol are featured along with descriptions of various applications. For copies, contact Air Products and Chemicals, Inc., Polymer Chemicals Div., P.O. Box 538, Allentown, PA 18105.

Surfactant

Literature introducing a surfactant recently sanctioned by the U.S. Food and Drug Administration as a safe, acceptable ingredient in coatings of articles which come into contact with food, is now available. The brochure features the various uses of the surfactant in food packaging. For information, contact Air Products and Chemicals, Inc., Allentown, PA 18105.

Reusable Plastic Pails

Literature featuring extra texture paints in handy, reusable two-gallon plastic pails is now available. For more information, contact Enterprise Paint Co., 1191 S. Wheeling Rd., Wheeling, IL 60090.

Diamines

New data sheets describing the physical properties and product specifications of orthotoluenediamine (OTD) and metatoluenediamine (MTD) are now available. The literature provides information on product quality, pertinent properties, and special handling requirements and uses. For copies of the data sheets, contact Air Products and Chemicals, Inc., Industrial Chemicals Div., P.O. Box 538, Allentown, PA 18105.

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PAINT CHEMIST—Color Tile Manufacturing will be opening a new plant in West Chicago and has an immediate opening for a paint chemist.

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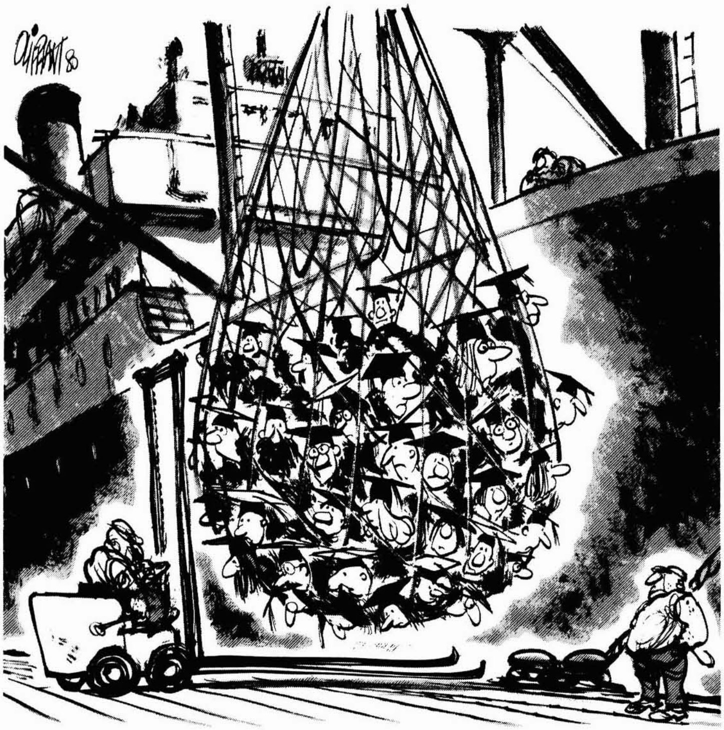
For additional information send complete resume and salary history to: Mr. Jim Burnett, P.O. Box 100, Melbourne, AR 72556.



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Coming Events

FEDERATION MEETINGS

(Oct. 28–30)—59th Annual Meeting and 46th Paint Industries' Show. Cobo Hall, Detroit, MI. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

1982

(Apr. 29–30)—Spring Meetings. Society Officers on 29th; Board of Directors on 30th. Lenox Hotel, Boston, MA. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Nov. 3–5)—60th Annual Meeting and 47th Paint Industries' Show. Sheraton Washington Hotel, Washington, D.C. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

1983

(Oct. 12–14)—61st Annual Meeting and 48th Paint Industries Show. Queen Elizabeth Hotel, Montreal, Quebec, Canada. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

SPECIAL SOCIETY MEETINGS

(Feb. 17–19)—Water-Borne and Higher-Solids Coatings Symposium sponsored by Southern Society for Coatings Technology and University of Southern Mississippi—Department of Polymer Science. New Orleans, LA. (Mr. Fred M. Ball, Eastman Chemical Products, Inc., P.O. Box 431, Kingsport, TN 37662).

(Mar. 10–12)—Southern Society Annual Meeting. Hyatt Regency, Savannah, Ga. (Dan Dixon, Freeport Kaolin Co., P.O. Box 337, Gordon, GA 31031).

(Mar. 23–24)—25th Annual Technical Conference of the Cleveland Society for Coatings Technology. Baldwin-Wallace College, Berea, OH.

(Apr. 21–23)—Southwestern Paint Convention. Shamrock Hilton Hotel, Houston, TX.

(May 6–8)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C.

1983

(Feb. 23–25)—16th Biennial Western Coatings Societies' Symposium and Show. Hyatt Regency, San Francisco, CA.

OTHER ORGANIZATIONS

(Oct. 13–15)—Association for Finishing Processes of the Society of Manufacturing Engineers. "Finishing '81" Conference and Exposition, "Economics, Compliance, and Energy." Cobo Hall, Detroit, MI. (William J. Yeates, Executive Director AFP/SME, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Oct. 13–16)—"Formula 81". RAI Exhibition Centre, Amsterdam, Holland.

(Oct. 19–23)—"Scanning Electron Microscopy and X-Ray Microanalysis: Theory and Practice in Materials Science" Course. State University of New York, Institute In Science and Technology, New Paltz, NY. (Dr. Angelos V. Patsis, State University of New York, New Paltz, NY).

(Oct. 25–27)—"Women in Coatings—Meeting the Challenges" Short Course. Detroit, MI (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Oct. 26-28)—National Paint and Coatings Association Annual Meeting. Detroit Plaza Hotel, Detroit, MI. (Karen Bradley-Welch, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Oct. 26–29)—"Scanning Electon Microscopy and X-Ray Microanalysis: Theory and Practice in Biology and Medicine" Course. State University of New York, Institute In Science and Technology, New Paltz, NY.

(Nov. 2–4)—American Society for Testing and Materials Committee D-33 on Protective Coating and Lining Work for Power Generation Facilities Meeting. Monteleone Hotel, New Orleans, LA. (ASTM, 1916 Race St., Phila., PA 19103).

(Nov. 2–4)—"Water Soluble Polymers: Synthesis, Structure and Applications" Course. State University of New York, Institute In Science and Technology, New Paltz, NY.

(Nov. 3–4)—Decorating Plastic RETEC, 5th Annual Regional Technical Conference, Society of Plastic Engineers, Decorating Division. Louisville, KY. (Edward S. Stumpek, General Electric, One Plastics Ave., Pittsfield, MA 01201).

(Nov. 3–4)—First World Congress on Protective Coatings Systems for Bridges and Structures. Holiday Inn, La Guardia Airport, New York, NY. (Norma R. Fleming, Arts and Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Nov. 4–5)—Fourth Resins & Pigments Exhibition. Hotel Principe & Savoia, Milan, Italy. (Mike Tarrant, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 4–6)—American Society for Testing and Materials Committee, Utilities Nuclear Coating Work Committee Meeting. Monteleone Hotel, New Orleans, LA. (ASTM, 1916 Race St., Phila., PA 19103).

(Nov. 10–12)—"Refresher for Painting Contractors, Maintenance Engineers and Inspectors" Short Course. Hilton Plaza Inn, Kansas City, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Nov. 13–15)—34th Annual National Decorating Products Show sponsored by the National Decorating Products Association. McCormick Place, Chicago, IL.

(Nov. 16–18)—"Powder Coatings Technology" Short Course. Center for Professional Advancement, East Brunswick, NJ. (Center for Professional Advancement, Dept. NR, P.O. Box H, East Brunswick, NJ 08816).

(Nov. 17–19)—"Job Estimating Workshop for Painting Contractors." Granada Royale, Kansas City, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Nov. 30–Dec. 4)—"Principles of Industrial Coatings" Short Course. University of Missouri-Rolla, Rolla, MO. (Norma R. Fleming, University of Missouri-Rolla, Rolla, MO 65401).

(Dec. 7–9)—"Waterborne Industrial Coatings—Chemistry & Formulation" Short Course. Chicago. (Center for Professional Advancement, Dept. NR, P.O. Box H, East Brunswick, NJ 08816).

(Dec. 9)—American Society for Testing and Materials Symposium on Selection and Use of Wear Tests for Coatings. Phoenix, AZ. (ASTM, 1916 Race St., Philadelphia, PA 19103.)

(Dec. 10-11)—"Waterborne Industrial Coatings—Application" Short Course. Chicago. (Center for Professional Advancement, Dept. NR, P.O. Box H, East Brunswick, NJ 08816).

1982

(Feb. 7–10)—Inter-Society Color Council. Williamsburg Conference, Williamsburg, VA.

(Mar. 3–5)—"The Versatile Thermosets" RETEC, Society of Plastics Engineers, Inc. and the Thermoset Division. Marriott Oakbrook Motor Hotel, Oakbrook, IL. (Paul Fina, College of DuPage, Box P, Riverside, IL 60546).

(Mar. 8–10)—National Paint and Coatings Association's Marine and Offshore Coatings Conference. Grand Hotel, Point Clear, AL. (Armand P. Herreras, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Apr. 21–28)—Hanover Fair '82 for Surface Treatment and Coatings Technology Equipment and Materials. Hanover, West Germany. (The Hanover Fairs Information Center, P.O. Box 338, Whitehouse, NJ 08888).

(Apr. 27–29)—Oil & Colour Chemists' Association's 34th Annual Exhibition, "International Forum for the Surface Coatings Industries." Cunard International Hotel, Hammersmith, London, England. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HA0 2SF).

Advertisers Index

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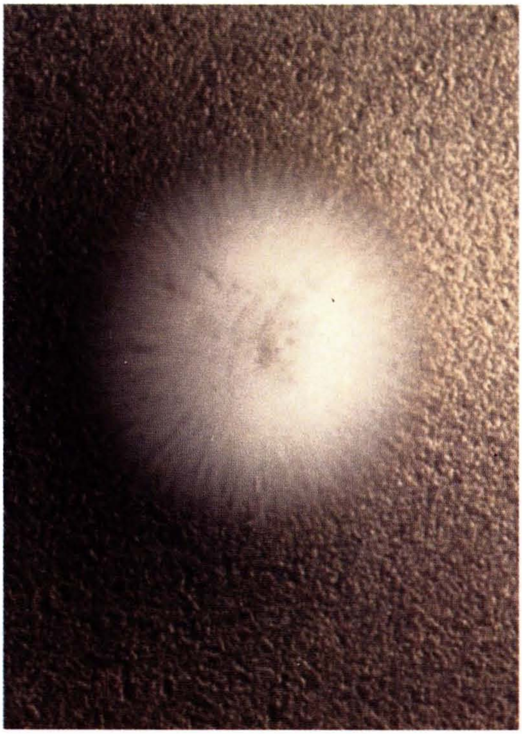

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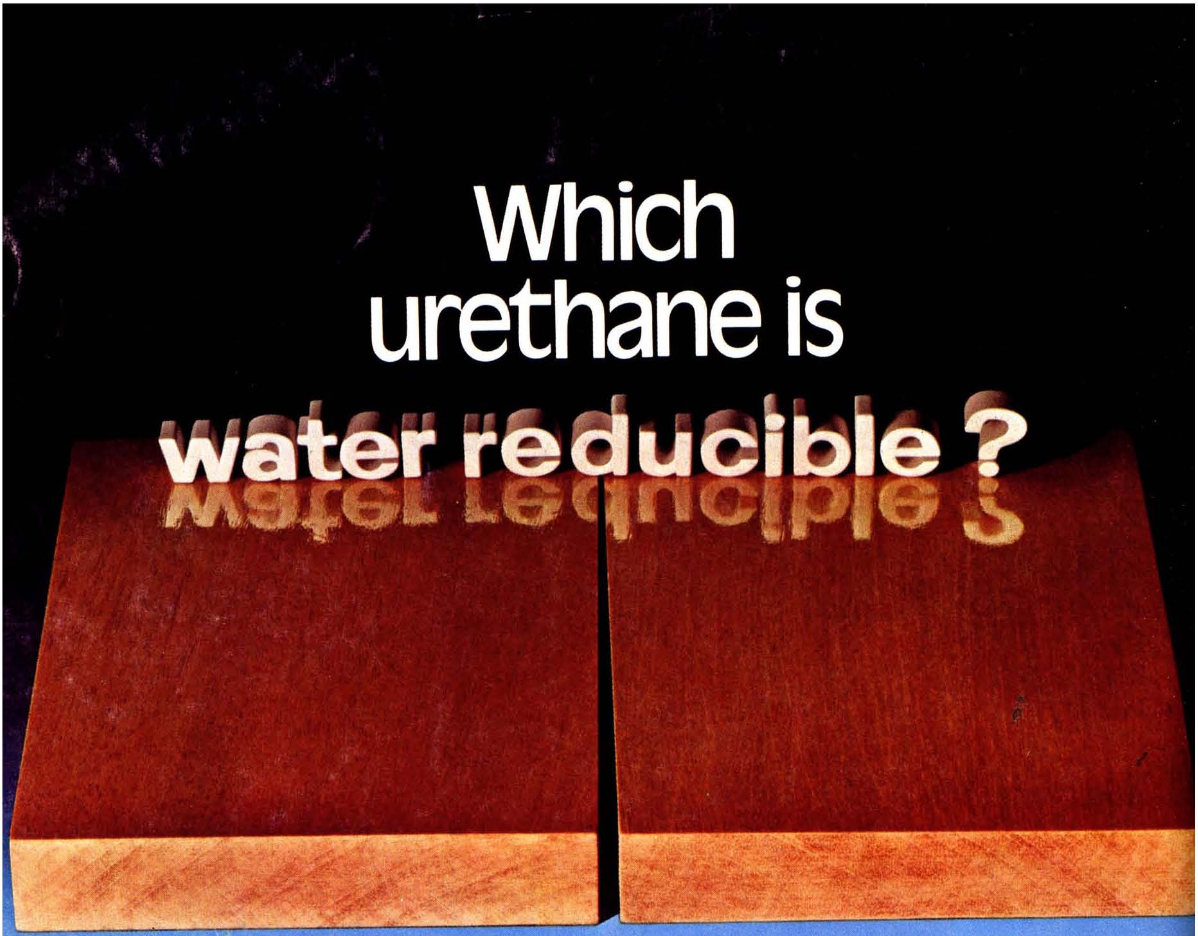

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