JCTAX 52 (666) 1-96 (1980)

JULY 1980

jct JOURNAL OF COATINGS TECHNOLOGY

"Paint America Beautiful"

Uvinul®
UV ABSORBERS

Sun and plastics can be friends

In April of 1978 BASF Wyandotte took over the production facilities for Uvinul UV absorbers. These well known, widely accepted absorbers have been available for over 20 years. We have now assumed full responsibility for the product including sales and distribution as well as production, research and technical service.

Our line of Uvinul absorbers for plastics includes seven benzophenone types and two diphenyl acrylate types which are suitable for use with most commercially available plastics and some elastomerics.

Since last fall, we have been working to improve both the availability and the quality of our products. These improvements are now on-stream and working for you.

We have also placed technical sales representatives within easy reach and they will contact you shortly. BASF Wyandotte has the size and the resources not only to supply your needs, you can be secure in the knowledge that we are not only here to stay but to grow and to provide you with the best absorbers today and even better ones tomorrow.

In Europe contact:

BASF Aktiengesellschaft
D-6700 Ludwigshafen

BASF Farben + Fasern AG
Unternehmensbereich
Pigmente
D-7000 Stuttgart 30

BASF Wyandotte Corporation
Uvinul Department
100 Cherry Hill Road
P.O. Box 181
Parsippany, NJ 07054
Phone: (201) 263-0200

BASF

"Our new Fulflo® resin-bonded cartridge will filter more product than the one you're using. And we'll prove it."

Compare our new Fulflo resin-bonded cartridge to the resin-bonded cartridge you're now using. We developed a unique cartridge structure designed to last longer and provide faster throughput.

The result is lower filtration cost without sacrificing particle removal efficiency.

Our new cartridge is available in grooved and nongrooved models. Coreless design makes them compatible with a broad range of paints, inks, adhesives and other industrial chemicals.

Cartridges are available in all standard lengths and micrometer ratings to fit our line of Fulflo pressure vessels as well as conventional competitive models.

The simple fact is that we're so sure our new cartridge will perform better than the cartridge you're now using, we'll provide the cartridges required to conduct your test at one-half the price you're paying for competitive cartridges.

If our cartridge doesn't outperform yours, we'll refund your money. Send the coupon today.

Prove it!

Send the coupon today, or call Carney Likens, Product Manager, The Carborundum Company Filters Division, Lebanon, Ind. 46052 (317) 482-3900.

Make a believer of me. Please call me to arrange a Fulflo® resin-bonded cartridge field test as soon as possible.

Name _____

Title _____

Company _____

Address _____

City _____ State _____

Phone _____ Zip _____

CARBORUNDUM

A Kennecott Company

JULY 1980

JOURNAL OF COATINGS TECHNOLOGY

Volume 52 Number 666

Features

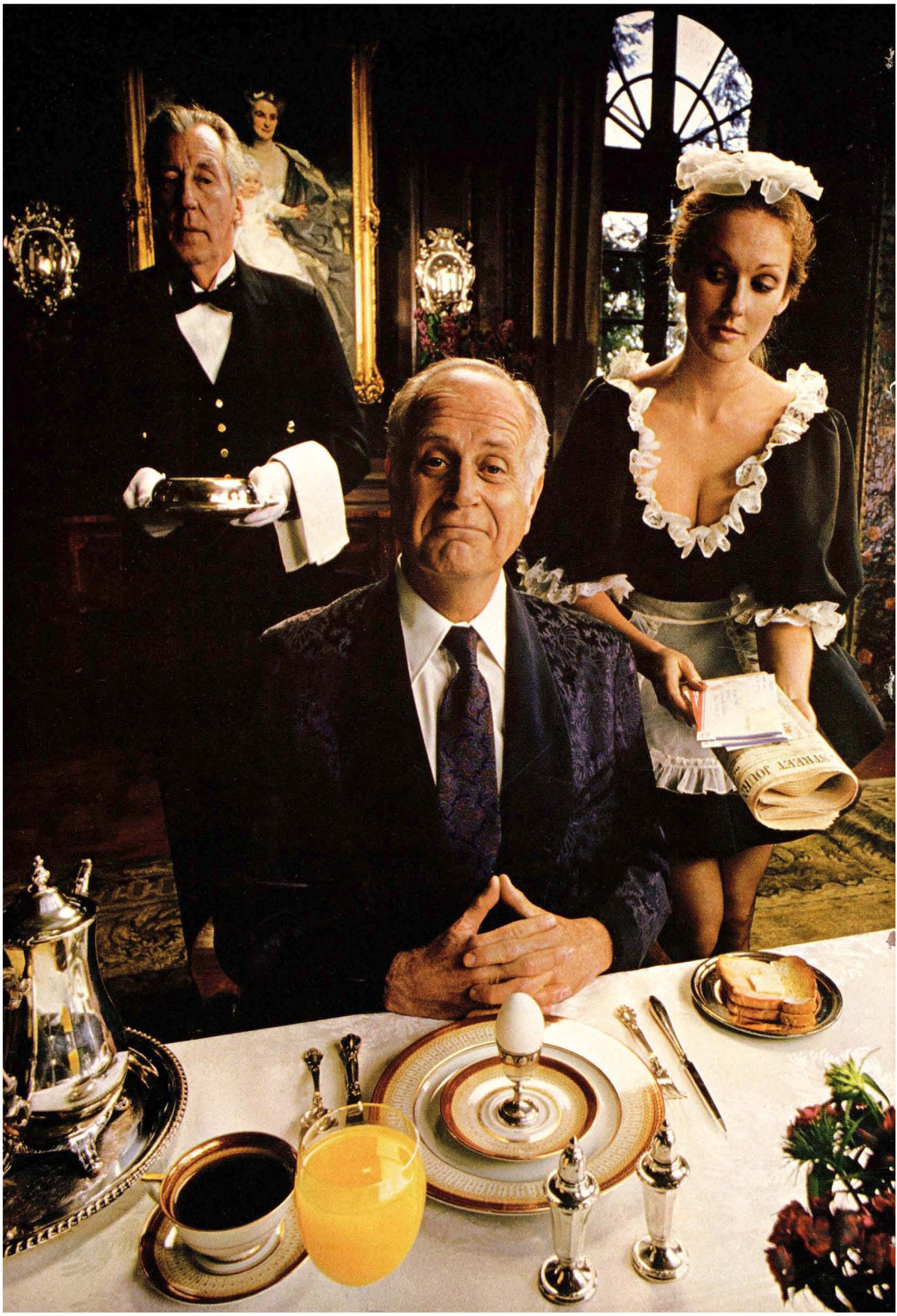
Federation Activities

Departments

THE JOURNAL OF COATINGS TECHNOLOGY (ISSN 0361-8773) is published monthly by the Federation of Societies for Coatings Technology, 1315 Walnut St., Philadelphia, Pa. 19107. Phone: (215) 545-1507.

Second class postage paid at Philadelphia, Pa. and at additional mailing offices. POSTMASTER: Send address changes to JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, Pa. 19107.

Subscriptions U.S. and Canada—1 year, $20; 2 years, $52. Europe (Air Mail)—1 year, $33; 2 years, $63; 3 years, $91. Other countries—1 year, $28; 2 years, $53; 3 years, $76.



I'M BASICALLY THE SAME GUY I WAS BEFORE UCAR ACRYLIC 503.

Sure, I've fixed the place up a little. And bought a few odds and ends.

But I haven't changed. I still draw my own bath.

I mean, what else could I do with the savings from UCAR Acrylic 503?

I save better than 25¢ a gallon over conventional acrylics on exterior paints. And that can add up.

Paints made with UCAR Acrylic 503 are as durable as any I've ever made. And they attract less dirt, too. They look as great on the walls of the east wing as they do on my summer place in Monaco.

And talk about versatility. Paints based on UCAR Acrylic 503 also provide unsurpassed alkali resistance for customers who want to use them on concrete.

Take my advice and contact your local Union Carbide representative. Or write them at Dept. JLS, 270 Park Avenue, New York, N.Y. 10017, for more information on UCAR Acrylic 503.

It may have an effect on your life. Though it hasn't changed mine all that much. Higgins. Have them bring around the blue Rolls.

PEOPLE PLANNING THE FUTURE.

UNION CARBIDE
Coatings Materials

jct JOURNAL OF COATINGS TECHNOLOGY

1315 Walnut St., Phila., Pa. 19107

THE JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology at 1315 Walnut St., Philadelphia, Pa. 19107. Phone: (215) 545-1507.

Annual dues for members of the Federation of Societies for Coatings Technology, $15.00, includes a subscription to this publication. Membership in the Federation is obtained through prior affiliation with, and payment of dues to, one of its 26 Constituent Societies. Non-member subscription rates are:

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$20.00	$33.00	$28.00
2 Years	$37.00	$63.00	$53.00
3 Years	$52.00	$91.00	$76.00

When available, single copies of back issues of the JOURNAL OF COATINGS TECHNOLOGY are priced as follows: $3.00 each for current calendar year issues; $4.00 each for all other issues.

The JOURNAL OF COATINGS TECHNOLOGY has first rights to the publication of papers presented at the Annual Meeting of the Federation and at local and regional meetings of the Federation's Constituent Societies.

A Guide for Authors is published in each January issue.

The JOURNAL OF COATINGS TECHNOLOGY is available on microfilm from University Microfilms, a Xerox Co., Ann Arbor, Mich. 48106.

The Federation of Societies for Coatings Technology assumes no responsibility for the opinions expressed by authors in this publication.

Comment

"Paint America Beautiful"

The Federation is pleased to join other organizations in commending the National Paint and Coatings Association for its campaign to stimulate growth of consumer products manufactured by the coatings industry.

The new Consumer Products Div. of NPCA will direct the program. All division staffers will concentrate their efforts in product promotions zeroed in on all media, all possible markets.

NPCA will fund the effort initially, then seek financial support from trade sales members and suppliers through a special promotional fee.

The former "Clean Up, Paint Up, Fix Up" national promotion of years ago did a good job of moving more trade sales products across the counter. We hope that "Paint America Beautiful"—the tentative theme for the 80's—attains even greater success.

Let's not only "Paint It Up" but "Talk It Up" as well.—FJB

For semi-gloss and eggshell with performance that inspires...

RHOPLEX® AC-417.

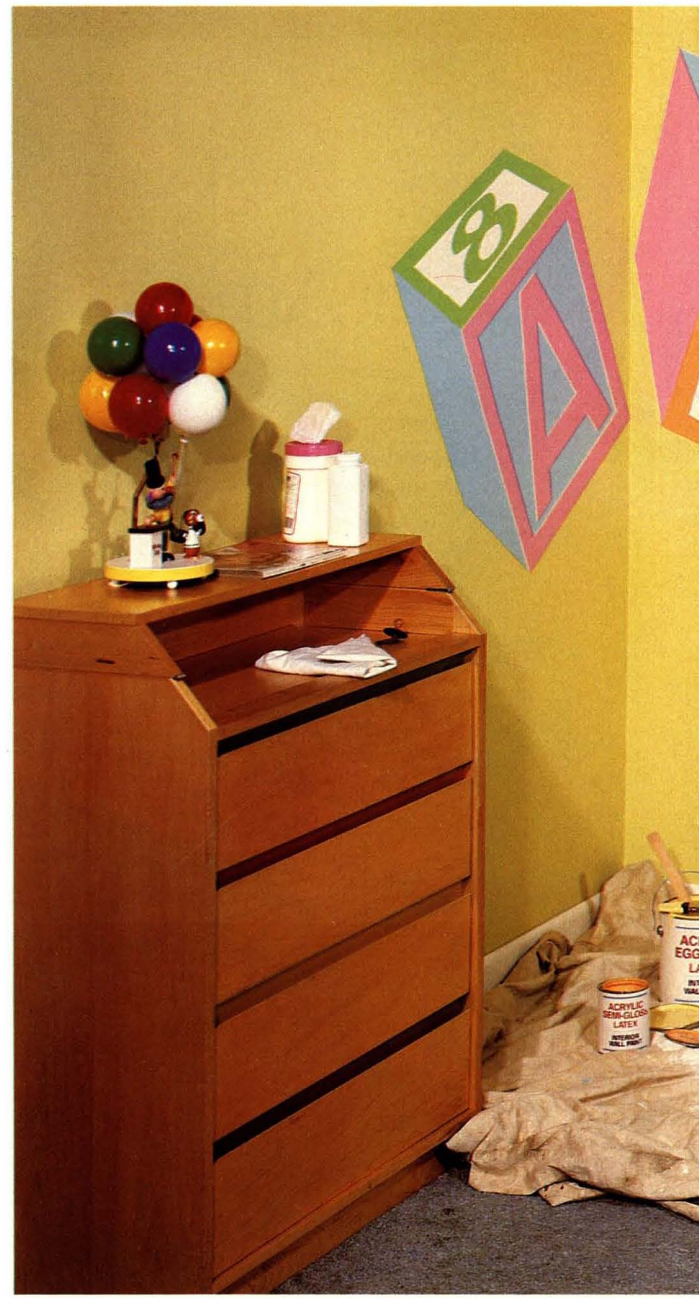
Satisfied customers mean repeat business.

Even customers who paint more conventionally are pleased by the performance of eggshell wall paints and semi-gloss enamels made with Rhoplex AC-417 100%-acrylic emulsion...and come back for repeat purchases.

How does Rhoplex AC-417 do it? By providing: (a) excellent application properties—flow, leveling, film build, and hiding, and (b) outstanding performance benefits—adhesion, water and alkali resistance, scrub resistance, and easy stain removal.

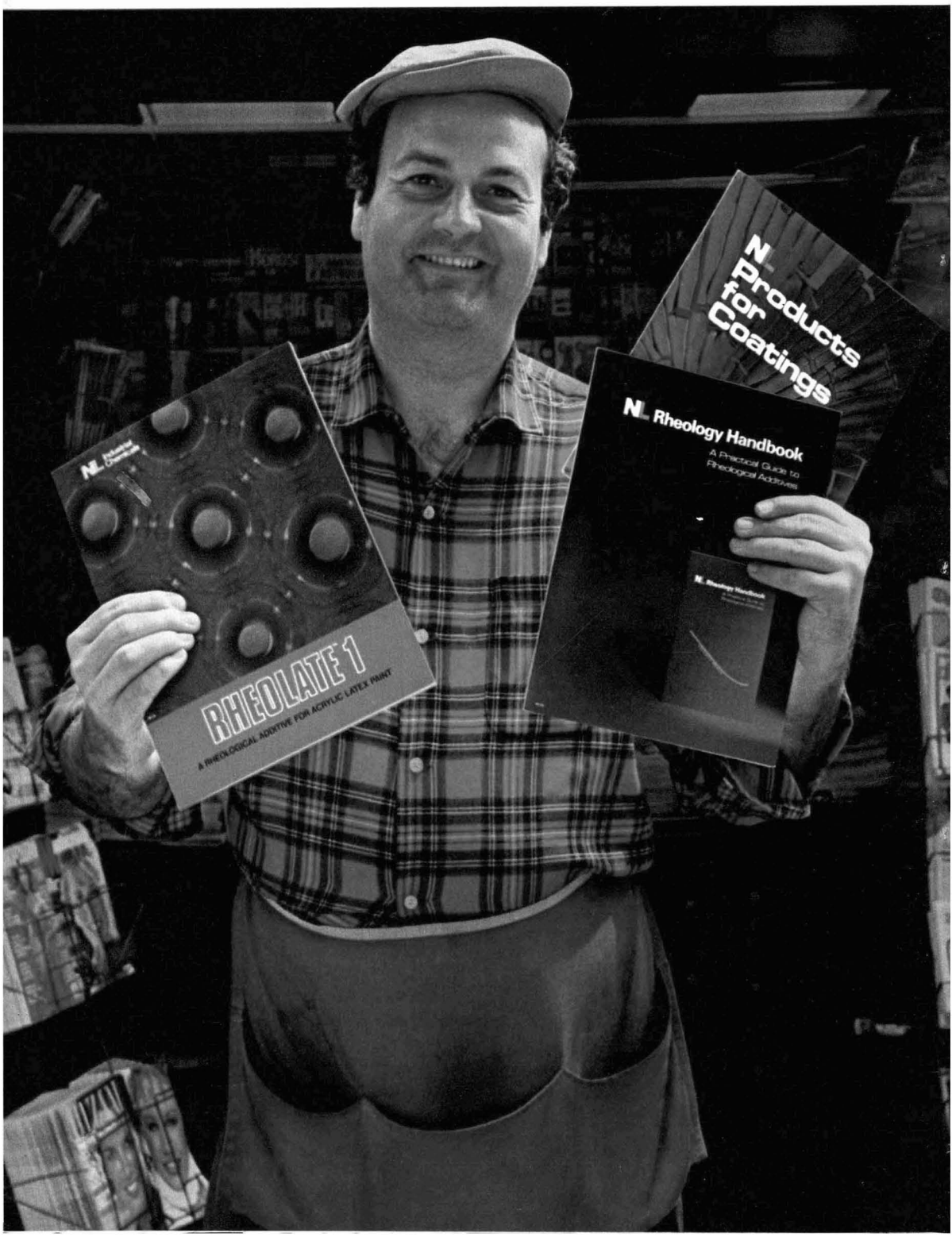
Rhoplex AC-417 offers paint formulators excellent cost/performance. Ask for a sample of this versatile polymer...and formulating information. Contact your Rohm and Haas technical representative or write our Marketing Services Dept., Philadelphia, PA 19105.

In Canada: West Hill, Ontario M1E 3T9



ROHM AND HAAS

Go by the books.



Now read everything you've always wanted to know about rheology and NL products for coatings.

These three authoritative books show you how NL products can help you solve your formulation problems.

The NL Rheology Handbook. Rheology is a complex subject. This handbook presents the basic concepts of flow and thickening and provides a practical guide to the selection and efficient use of NL rheological additives.

NL Products for Coatings. Describes one of industry's broadest range of both solvent and waterbase rheological additives and a unique line of anti-corrosive pigments, fire retardents, castor oils and derivatives, and exterior latex modifiers. The book includes typical properties of each product along with its principal uses.

RHEOLATE™ 1. A Rheological Additive for Acrylic Latex Paint. Describes the properties of this unique thickener. It gives you detailed information on how to use RHEOLATE 1 in acrylic latex paints and includes typical formulations. It shows you how RHEOLATE 1 is easy to incorporate, how enzyme resistant it is and how remarkably cost effective it is when compared to other thickeners.

All three books were written by people deeply committed to the industry. For more than 100 years NL Industries has been developing the breadth of line and quality control necessary to help you with your manufacturing and formulation problems. The basics of what we have learned are in these three books. Combine this information with the well-known detailed help of NL's technical staff and you're on your way to coatings that will perform better.

Go by the books. The NL books. Order today. Just fill out and mail the coupon.

NL Chemicals

Mail this coupon to: NL Chemicals/NL Industries, Inc.,
P.O. Box 700, Hightstown, NJ 08520
Attn: Coatings Technical Service
Please send me a copy of ☐ The NL Rheology Handbook
☐ NL Products for Coatings
☐ RHEOLATE™ 1. A Rheological Additive for Acrylic Latex Paint.
Please have your representative contact me.

Name _____ Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Abstracts of Papers in This Issue

PIGMENT SYNERGISM AND PIGMENT ANTAGONISM IN AUTOMOTIVE PIGMENTATION—S. Panush

Journal of Coatings Technology, 52, No. 666, 50 (July 1980)

One hundred forty pigments of automotive potential were thoroughly evaluated in thermosetting acrylics, including 24 months of South Florida exposure, in over 4,000 colors to define specific areas of synergism and antagonism. The blending of unacceptable pigments to yield an acceptable system, or pigment synergism, is documented in detail across the color spectrum. The negative action of a blend of acceptable pigments which yield an unacceptable system, or pigment antagonism, is isolated and defined. Pigment antagonism is a term coined by the author to describe this unusual phenomenon.

Since the most expensive and chemically sophisticated pigments are required to meet the ultimate performance requirements of automotive pigmentation, the understanding of pigment synergism and pigment antagonism will yield rich rewards in both cost savings and aesthetic possibilities.

EVAPORATION OF SOLVENTS FROM WATER-BORNE SYSTEMS DURING BAKING—T. Imai and K. Tsubouchi

Journal of Coatings Technology, 52, No. 666, 71 (July 1980)

It is generally accepted that baking type water-borne formulations are inferior in application to conventional formulations. Aiming at the solution to these problems, the behavior of solvent evaporation from coated films during baking was investigated by using experimental techniques, such as: thermogravimetric analysis; differential scanning calorimeter; gas chromatographic analysis; and dynamic spring analysis.

As a result of these experiments, it was found that skinning is more readily developed at the surface of water-borne systems than in conventional systems, causing the occurrence of retardation of solvent diffusion which is reflected in film popping.

QUANTITATIVE CRYSTALLINE PIGMENT ANALYSIS BY X-RAY DIFFRACTION—P. Kamarchik, Jr.

Journal of Coatings Technology, 52, No. 666, 79 (July 1980)

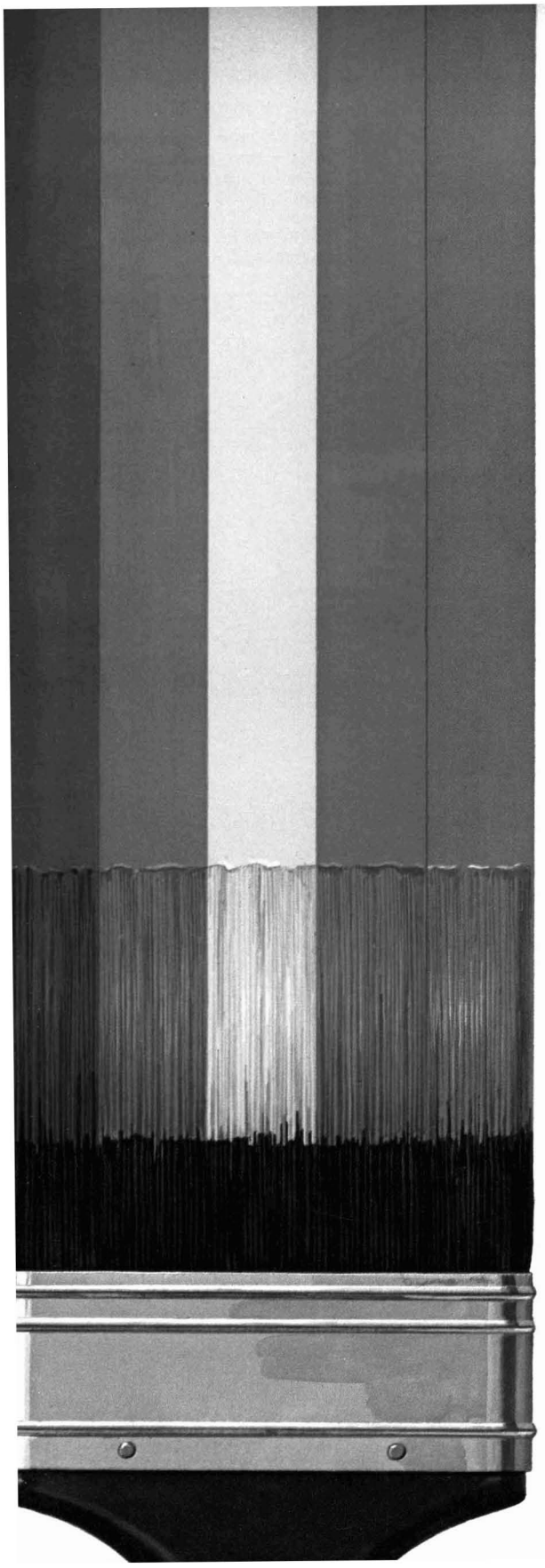
The technique of x-ray diffraction is described and shown to offer a direct and simple method for providing a definitive crystalline pigment analysis of paint films. The advantages of positive identification of silicate extenders and modifiers and speed of analysis are discussed. Precision and accuracy data for quantitative determinations for typical pigments are presented. A table of constants relating intensities with concentrations for 15 common pigments is included.

THREE UNSOLVED COLOR PERCEPTION PROBLEMS FUNDAMENTAL TO ACHIEVING BETTER RESULTS IN INDUSTRIAL APPLICATIONS OF COLOR SCIENCE—R. Kuehni

Journal of Coatings Technology, 52, No. 666, 83 (July 1980)

While applied color science as practiced in colorant producing and using industries has made much progress in the last decade in terms of instrumentation, a widening gap is perceived between what common color calculations are believed to deliver and what they can deliver on the basis of the known underlying principles of color perception. The three most pressing unsolved problems, color difference evaluation, color constancy or adaptation evaluation, and color depth and colorant strength evaluation, are discussed.

The extensiveness of the research necessary to solve these problems leads to the conclusion that a cooperative effort is required in order that results can be obtained in a reasonable period of time. It is suggested that what is needed is an industrially funded organization to work out the solutions.



Pfizer Pigments are Key Colorants in Matching the 1980 Recommendations of the Color Marketing Group.

A highly regarded panel of diverse authorities, the Color Marketing Group forecasts consumer color preferences. From among the colors it expects to have wide demand in paints this year, Pfizer tested its oxide pigments in matching 13 of them. This was done with our computer-controlled spectrophotometer system. Close matches were obtained using up to 95% Pfizer pigments. A technical report on this is yours for the asking.

Beyond such paint sales-making ability, Pfizer's pure synthetic pigments are outstanding in strength and hiding power, in wetting and suspension, in durability and brushability. And particularly important in these days of high energy costs, their easy dispersion is a cost-saving plus. Some grades, for example, will achieve 95% color development in just 15 minutes. All that and low prices too!

If you would like a sample to put to your laboratory tests, and copies of the above-mentioned technical data and our Products Brochure contact your nearest Pfizer sales office.

Pfizer

MINERALS, PIGMENTS & METALS DIVISION

Dept. OC-9 • 235 East 42nd Street, New York, New York 10017

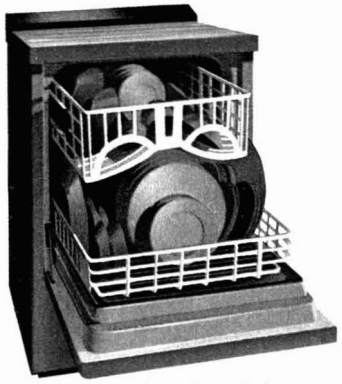
Second generation epoxies for

These special Ciba-Geigy epoxy resins have been used for years in the electronics and electrical industries. Their outstanding properties make them ideal for new high-performance coatings as well as for upgrading existing coatings systems. We have recently built new, larger manufacturing facilities, and these special epoxies are now available to the coatings industry. We believe the suggested applications illustrated are only a few of many possible uses. Details? Ciba-Geigy, Resins Department, Ardsley, New York 10502. Phone (914) 478-3131.

ECN 1299 resin improves chemical and corrosion resistance
Increases high temperature stability.

0500 resin increases heat tolerance
Allows easy formulation of multifunctionals due to low viscosity.

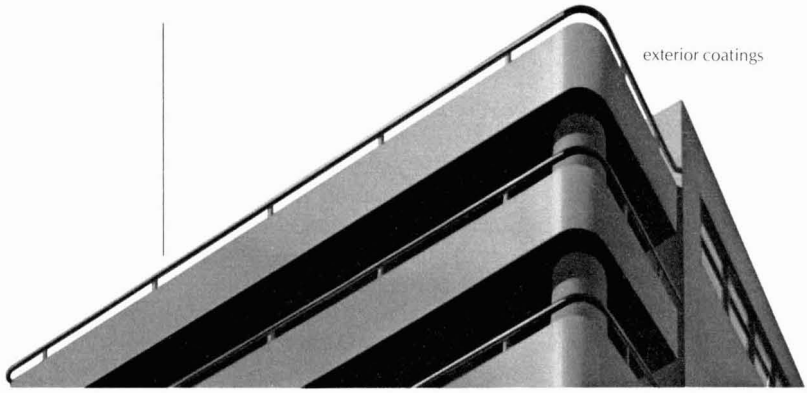
tanker linings



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.

high-performance coatings.



exterior coatings

EPN 1138 resin increases high temperature stability
Exhibits superior chemical and corrosion resistance.

Araldite® PT 810 resin crosslinks acrylic and polyester powders
Exhibits excellent weatherability (gloss retention and color stability).

coatings for storm windows

CIBA–GEIGY

Adding epoxy resin pre-reacts modified with Hycar® CTBN Reactive Liquid Polymer to coating formulas will make significant improvement in resistance to impact, thermal shock and chemicals. Also increased peel strength, flexibility and resistance to vibration and stress cracking. All this while maintaining typical epoxy resin adhesion, abrasion resistance and electrical properties.

Impact
By adding the pre-reacts containing Hycar® CTBN to an epoxy resin in laboratory tests, a 500% increase in impact resistance, as measured by Gardner impact methods, has been observed by formulators of corrosion resistant maintenance coatings. Recommended end uses include coatings for storage tanks, piping, flooring and electrical apparatus.

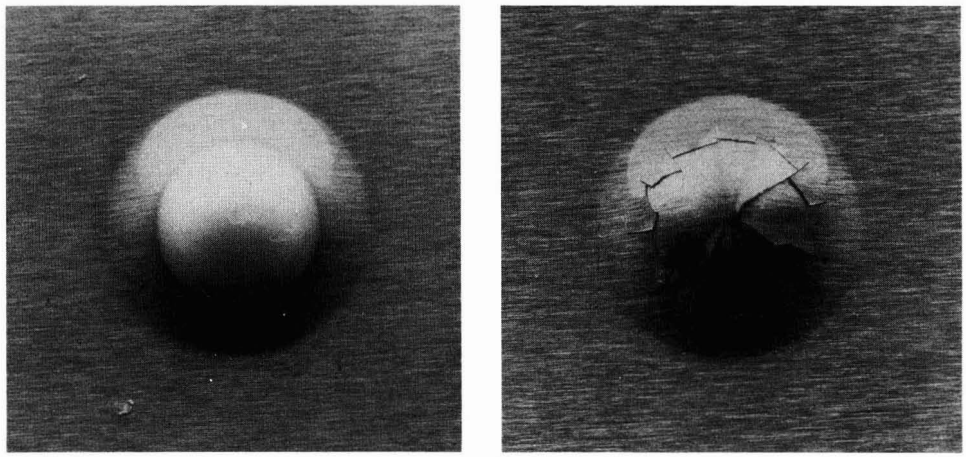
Conical Mandrel
Almost every coating formulation containing the pre-react modified with Hycar® CTBN passed the ⅛-inch conical mandrel test. Little if any effect on thermal-mechanical properties and corrosion resistance was experienced.

Salt Spray Resistance
In addition to impact and flexibility, epoxy pre-reacts containing Hycar® RLP improve salt spray resistance (ASTM D 610). Spot rusting was extensive (1-2) for an unmodified clear formulation after 200 hours; slight (8-9) for the same formulation modified.

For minimizing physical wear or chemical corrosion on flooring, piping, storage or other vulnerable equipment, consider adding pre-reacts containing Hycar® RLP to your epoxy coatings. For specific test results, specifications and samples, contact The BFGoodrich Company, Chemical Group, Dept. JP-36, 6100 Oak Tree Boulevard, Cleveland, Ohio 44131.

BFGoodrich
Chemical Group

Add our Hycar® RLP to your epoxy coatings and watch them stand the test.

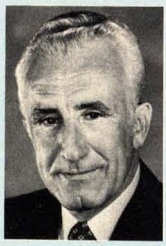


Modified epoxy coating (left) withstands reverse impact test with no rupture of coating. Unmodified control sample (right) displays extensive cracking, exposing base material to corrosive attack.

We're the Chemical Group of BFGoodrich.

Plant Safety Seminar to be Featured During Second Day of 1980 Annual Meeting

A Manufacturing Committee Seminar on "Safety in the Paint Plant" will highlight the second-day programming of the 1980 Federation Annual Meeting to be held in the Atlanta Civic Center, October 29–31.



G. E. Cain

Program Chairman Hugh W. Lowrey, of Indurall Coatings, Inc., Birmingham, AL, has announced that the three-hour seminar on Thursday morning, October 30, will be moderated by industry expert, Gilbert E. Cain, Director of Safety, Hercules, Incorporated, Wilmington, DE, and will feature the following topics:

"Materials Handling"—Gabe Malkin, Consulting Engineer, Westfield, NJ.

"In-Plant Safety"—Francis C. Gaugush, of The Sherwin-Williams Co., Cleveland, OH.

"Flammability"—Nelson W. Lamb, Manager, Safety and Loss Prevention Dept., Hercules, Incorporated, Wilmington, DE.

"Loss Control"—Speaker to be announced.

The panel of speakers and Mr. Cain will then assemble to lead an open discussion period and answer questions from the audience.

Other Program Highlights

The program, geared to the theme of "Three R's for the Eighties: Research, Resources, and Regulation," will also feature the following presentations:

Keynote Address, "The Challenges of the 80's in Coatings and Graphic Arts," by Harvey F. George, Research Director of Gravure Research Institute. (see March JCT).

Mattiello Lecture to be delivered by Dr. Percy Pierce, of PPG Industries, Inc. Dr. Pierce will speak on "The Physical Chemistry of Cathodic Electrodeposition." (see April JCT).

Symposium on Corrosion Control (see June JCT).

Paint Research Institute Seminar on current research projects.

Roon Awards Papers.

Constituent Society Papers.

Environmental Control Committee presentation, "Waste Management," to be moderated by S. Leonard Davidson, of NL Industries, Inc., Chairman of the Federation's Environmental Control Committee.

Educational Committee presentation, "Correspondence Course on Science and Technology of Surface Coatings."

Symposium on computer utilization, "Information: A Resource for the Eighties," sponsored by the Federation's Technical Information Systems Committee.

Papers presented on behalf of affiliated overseas organizations (FATIPEC, Oil & Colour Chemists' Association, and Scandinavian Paint and Varnish Federation).

These presentations will be supplemented by papers addressing the various aspects of the program theme.

Also featured will be a Gadgets and Gimmicks display—innovative devices and test methods for use in the laboratory or on the production floor.

Paint Industries' Show

To be held in conjunction with the Annual Meeting, the Paint Industries' Show is the only national exhibit of raw materials and equipment used in the formulation, testing, and manufacture of coatings. Top technical representatives from participating supplier companies will serve at the booths to discuss developments with personnel of the coatings manufacturing industry from around the world.

A total of 134 exhibitors will occupy 319 booth spaces in the 1980 Show, the largest in Federation history.

Show hours will be 12:30 p.m. to 5:30 p.m. on Wednesday, October 29; 9:30 a.m. to 5:00 p.m. on Thursday, October 30; and 9:30 a.m. to 4:00 p.m. on Friday, October 31.

Headquarters Hotel

The Atlanta Hilton will be headquarters hotel. Other hotels with blocks of rooms set aside for the Annual Meeting are the Marriott, Hyatt Regency, and Holiday Inn Downtown.

Room Reservations

All requests for rooms and suites must be sent to the Federation Housing Bureau on the official form which has been mailed to members, and is also included in this issue (pages 19–20). Forms are also available from the Federation headquarters office in Philadelphia.

Registration Fees

Regular "on-site" registration fees will be $45 for Federation members and $60 for nonmembers. Advance registration will be available for $40 for members and $55 for nonmembers.

There will be a special $20 advance registration fee each for retired Federation members and their spouses.

An advance registration form is included in this issue (see pages 22–23).

Luncheon

The Federation Luncheon will be held on Friday, October 31, at the Atlanta Hilton Hotel.

Presentations will be made to the recipients of the George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation), the Flynn Awards (firms judged to have the best exhibit booths in the 1980 Paint Industries' Show), and the Union Carbide Coatings Technology Award (for extraordinary achievement in coatings technology).

Featured speaker will be Dr. Kenneth McFarland, known as the "Dean of America's Public Speakers," and author of the bestseller, *Eloquence in Public Speaking*.

Spouses' Program

A schedule of activities has been planned each day for spouses attending the Annual Meeting, and a Hospitality Room will be maintained at the Atlanta Hilton Hotel.

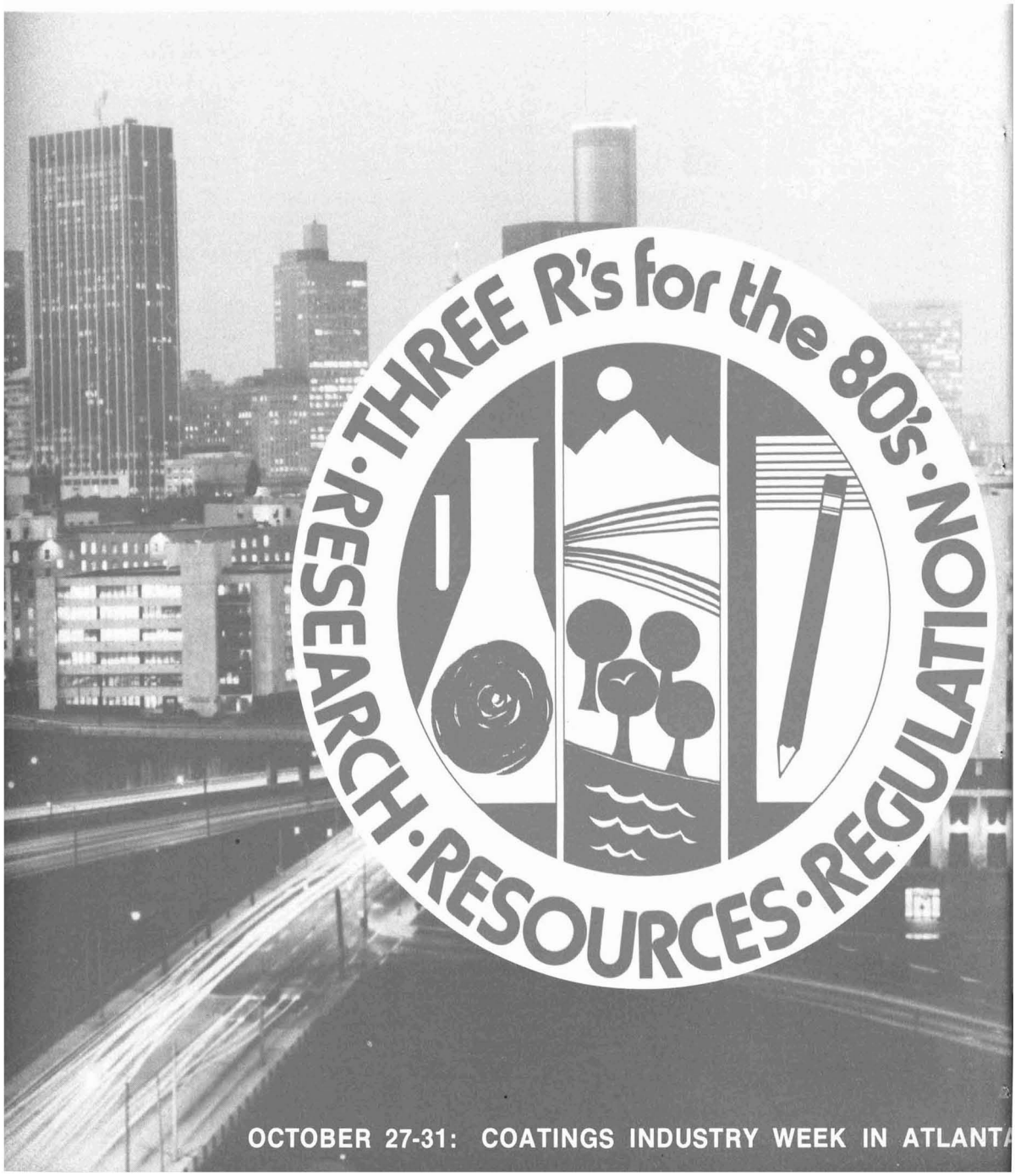
Registration fees for spouses' activities are $25 in advance and $30 on-site.

Included in the spouses' registration fee will be a get-acquainted social on Wednesday afternoon, continental breakfasts on Thursday and Friday in the hospitality headquarters; and a tour of Atlanta (including lunch) on Thursday.

NPCA Meets Same Week

NPCA registration badges will be honored for admission to the Federation Annual Meeting and Paint Industries' Show on Wednesday, October 29.

1980 Annual Meeting and Paint Industries' Show
October 29, 30, 31
Atlanta Civic Center
Atlanta, Georgia



FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1980 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
ATLANTA CIVIC CENTER, ATLANTA, GEORGIA
OCTOBER 29, 30, 31
(Wednesday, Thursday, Friday)

MAIL TO: Coatings Federation Housing Bureau
233 Peachtree St. N.W. #200
Atlanta, GA 30303

APPLICATION FOR ACCOMMODATIONS

Please indicate below the type of accommodations requested and your choice of hotels. Room reservations cannot be guaranteed unless this form is received by October 8. All reservation requests must be in writing and processed through the Housing Bureau: Phone requests are not accepted.

TYPE OF ACCOMMODATION	NUMBER	RATE REQUESTED
Single (1 person)		
Double (2 persons)		
Twin (2 persons)		
Suite (parlor and 1 bedroom)		
Suite (parlor and 2 bedrooms)		

CHOICE OF HOTELS:
(see notice below)
1st
2nd
3rd
4th

Hotel placement will be made in the order received. Your first choice will be assigned, if rooms are available. Otherwise, you will be assigned to hotels of your other choices. Confirmation will be sent to you directly by the hotel. Please make all changes with the Housing Bureau in writing only. All reservations will be held until 6:00 p.m., unless a later arrival time is indicated below.

Please fill in the names and addresses of all occupants of the rooms you have reserved. (Bracket those rooming together.) Incomplete information will delay assignment of rooms. Type additional names on the reverse side of this sheet. Please give accurate arrival and departure times and dates.

Type of Room	Name	Address	Dates of Arrival	Dates of Departure

SEND CONFIRMATION TO:

PLEASE PRINT
OR TYPE

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

IMPORTANT NOTICE

RESERVATIONS FOR THE ATLANTA HILTON WILL BE ACCEPTED FOR ARRIVAL BEGINNING WEDNESDAY, OCTOBER 29, ONLY. ANY RESERVATIONS REQUESTING HILTON ACCOMMODATIONS PRIOR TO WEDNESDAY, WILL BE ASSIGNED TO ANOTHER HOTEL.

HOTEL INFORMATION AND RATES

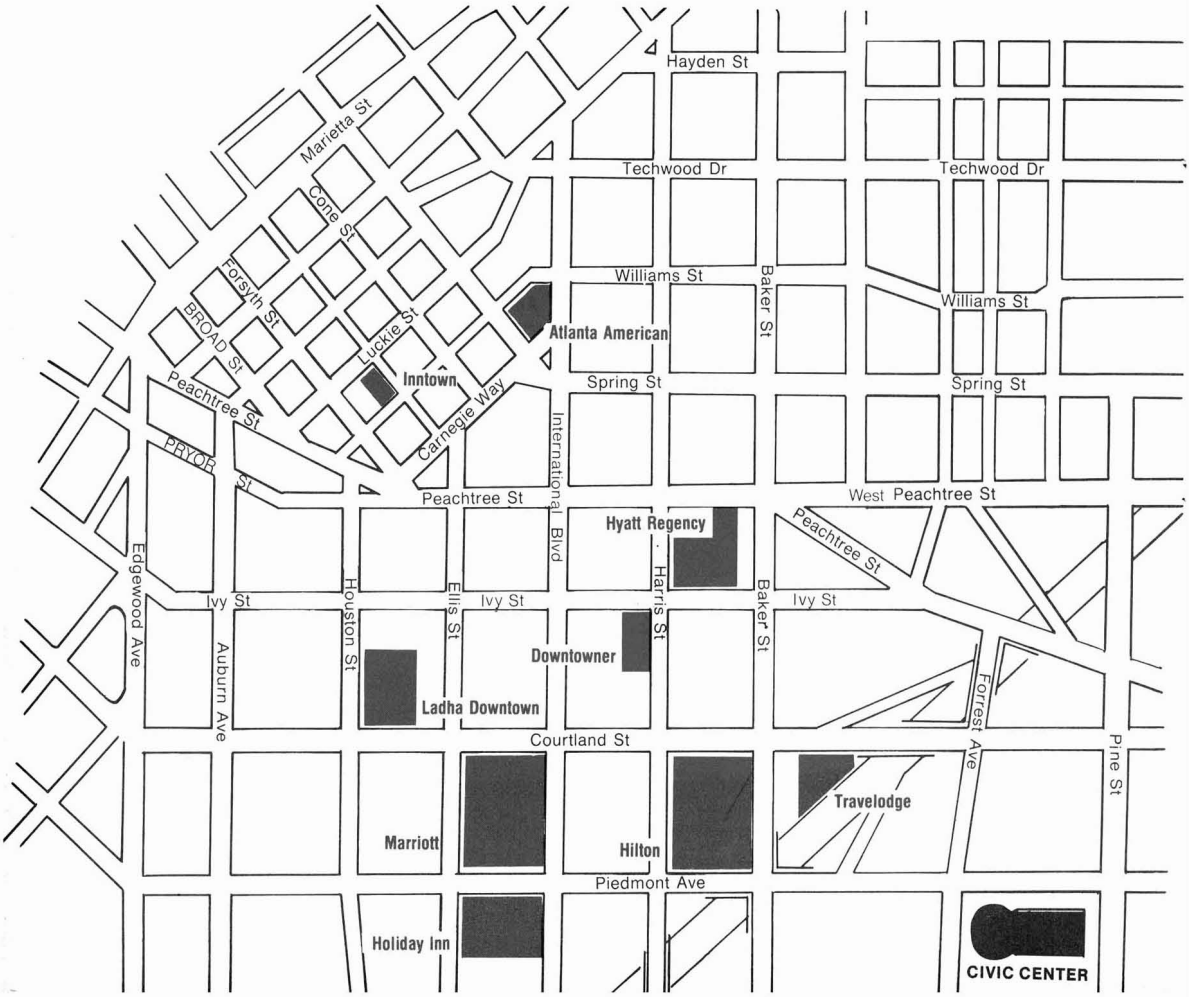
Nine hotels in Atlanta have reserved blocks of rooms for the 1980 Annual Meeting and Paint Industries' Show of the Federation. Please refer to map below.

All room rates are subject to an additional 7% charge—an Atlanta tax.

Confirmation will be sent to you directly by the hotel. Please make any changes with the Housing Bureau, in writing only.

IMPORTANT NOTICE: Reservations for the Atlanta Hilton will be accepted for arrival beginning Wednesday, October 29, only. Any reservations requesting Hilton accommodations prior to Wednesday, will be assigned to another hotel.

Hotel	Singles	Doubles/Twins	Parlor & 1 Bedroom	Parlor & 2 Bedrooms
ATLANTA HILTON (Headquarters)	$52–75	$68–91	$160 up	$230 up
HOLIDAY INN	35	39	56 up	112 up
HYATT REGENCY	46–66	58–76	145 up	225 up
MARRIOTT	45–62	57–74	130 up	190 up
ATLANTA AMERICAN (Quality Inn)	36	44	75 up	—
DOWNTOWNER MOTOR INN	37	47	150 up	—
INNTOWN MOTOR HOTEL	32	38–42	115 up	140 up
TRAVELODGE CENTRAL	30	35–40	—	—
LADHA DOWNTOWN HOTEL	36	42–46	125 up	167 up



GADGETS & GIMMICKS

AT THE 1980 ANNUAL MEETING

Do you have cost-cutting and/or labor-saving ideas that might be of interest to the coatings industry?

If so, here's your chance to put them on display and win a prize.

Gadgets and Gimmicks, a collection of innovative devices and test methods for use in the laboratory or on the production floor, will be a feature of the 1980 Federation Annual Meeting and Paint Industries' Show, to be held October 29-31 in Atlanta.

Winning entries will receive cash prizes ($100, first; $50, second; and $25, third) and a certificate. The entries will be grouped in two categories, Production and Laboratory, with three prize winners in each.

Descriptions and photos of the award-winning displays will be subsequently published in *Journal of Coatings Technology*.

If you wish to take part, submit your idea with a drawing, photograph, or other visual means of describing it to:

LABORATORY ENTRIES — Thad Broome
Precision Paint Corp.
5275 Peachtree Ind. Blvd.
Atlanta, Ga. 31341

PRODUCTION ENTRIES — Carroll Scholle
6530 N. Greenview Ave.
Chicago, Ill. 60626

Plan now to compete, your idea could be a winner!

Federation of Societies for Coatings Technology
1315 Walnut Street Philadelphia, Pa. 19107

PLEASE PRINT EXACTLY as you wish registration badge prepared

NICKNAME

FIRST NAME LAST NAME

BUSINESS AFFILIATION

STREET

CITY STATE *(U.S. only)*

ZIP (U.S. or CANADA) COUNTRY (OTHER THAN U.S.)

Name of the Federation Society
Of which you are a paid member _____

Hotel at which you are staying _____

PLEASE CHECK ONE BLOCK IN EACH CATEGORY

YOUR COMPANY *(Check One):*

- A ☐ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants, etc.
- B ☐ Manufacturers of Raw Materials
- C ☐ Manufacturers of Equipment and Containers
- D ☐ Sales Agent for Raw Materials and Equipment
- E ☐ Government Agency
- F ☐ Research/Testing/Consulting
- G ☐ Educational Institution/Library
- H ☐ Paint Consumer
- J ☐ Other

YOUR POSITION *(Check One):*

- A ☐ Management/Administration
- B ☐ Manufacturing and Engineering
- C ☐ Quality Control
- D ☐ Research and Development
- E ☐ Technical Sales Service
- F ☐ Sales and Marketing
- G ☐ Consultant
- H ☐ Educator/Student/Librarian
- J ☐ Other

***Special registration for Retired Federation Members and their spouses $20.00 each in advance only.**

***IMPORTANT:* REGISTRATION AND FULL PAYMENT MUST BE IN THE FEDERATION OFFICE NO LATER THAN WED., OCTOBER 1, 1980 TO QUALIFY FOR THIS OFFER.**

FSCT Annual Meeting and Paint Show Registration Fees

Federation Member	ADVANCE REGISTRATION ATLANTA, GA OCTOBER 29-31, 1980	Non-Member
$40.00		**$55.00**

MAIL TO: FSCT, 1315 WALNUT ST., PHILADELPHIA, PA 19107

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ANNUAL MEETING AND PAINT INDUSTRIES SHOW

REGISTRATION FEES

	Member	Non-Member	Spouses Activities
ADVANCE	$40.00	$55.00	$25.00
ON SITE (FULL TIME)	$45.00	$60.00	$30.00
ON SITE (ONE-DAY)	$25.00	$35.00	—

SPOUSES ACTIVITIES ▪ ADVANCE REGISTRATION

NICKNAME

$25.00

FIRST NAME LAST NAME

STREET

CITY STATE *(U.S. only)*

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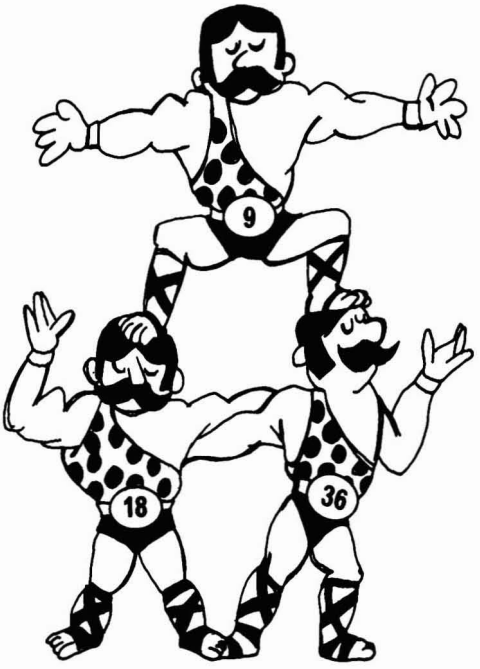

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- Active over a broad range of pH and solids content.

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C-Floc-9 – pH range 7.7-13

C-Floc-18 – pH range 6.3-9.5

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Federation Luncheon

Friday, October 31
Atlanta Hilton Hotel

DR. McFARLAND

Dr. Kenneth McFarland, a philanthropist and educator widely recognized as the "Dean of America's Public Speakers," will present his speech, "You *Can* Do Something About It!" at the Federation Annual Luncheon on Friday, October 31, at the Atlanta Hilton Hotel.

Dr. McFarland, whose past honors include the Freedom Foundation's National Freedom Leadership Award and the Los Angeles Philanthropic Foundation's Outstanding American Award, was the 1980 recipient of Toastmasters International's highest award, the Golden Gavel Award.

Two awards will be presented during the luncheon: The Heckel Award—for outstanding contributions to the Federation and the industry; and Flynn Awards—for the best six exhibits in the Paint Show.

Purchase of luncheon tickets is optional, and is not part of the Advance Registration fee. If you wish to attend, please fill in the Luncheon Ticket Order form below and include an additional $10.00 per person with your registration payment. Price of the luncheon ticket is NOT included in the Spouses' Registration fee.

Luncheon Ticket Order Form

Number of tickets ($10.00) required _____ Complete payment in amount of _____ is enclosed.

NAME _____

COMPANY _____

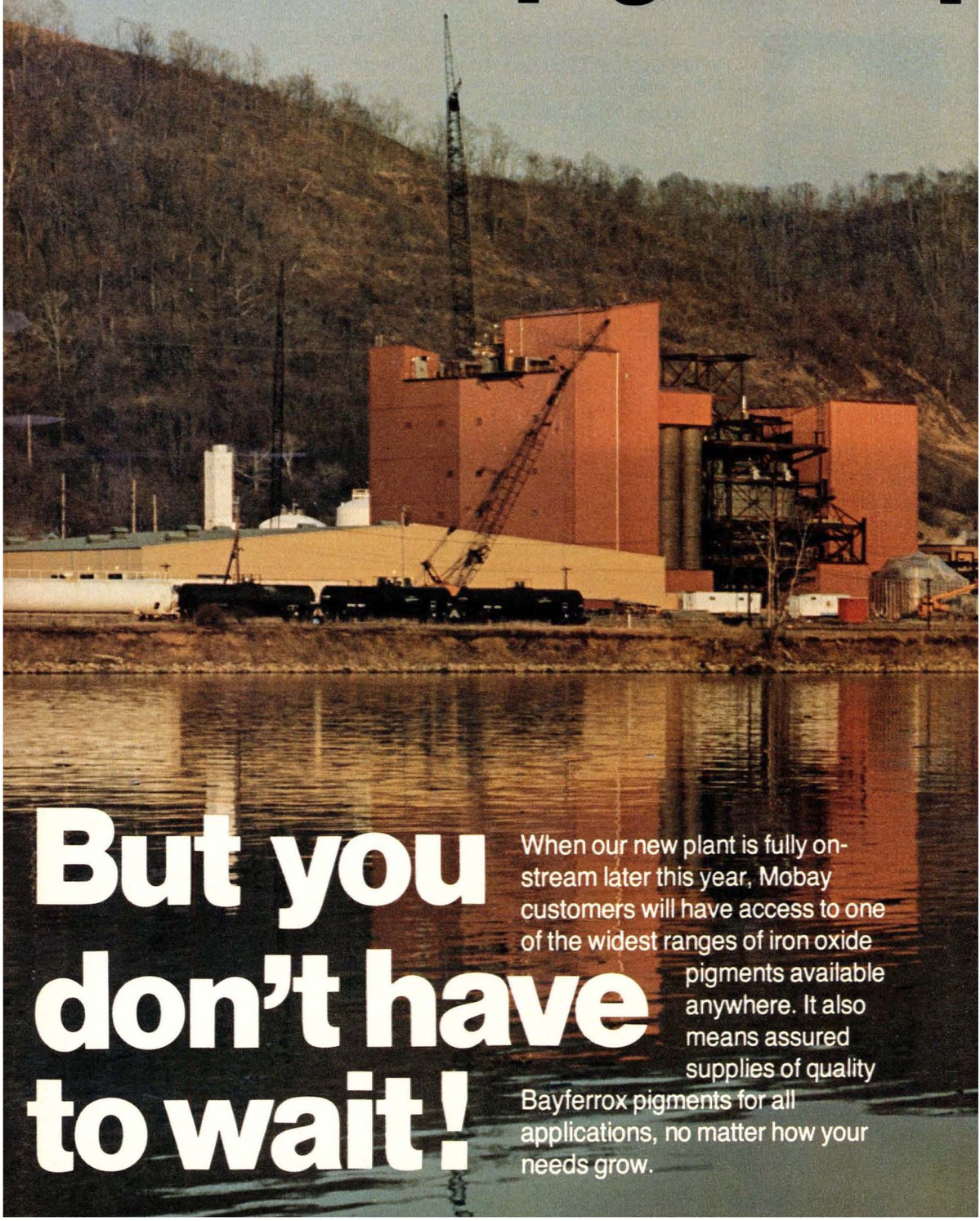
ADDRESS _____

CITY & STATE _____ ZIP

NOTE: Tickets may be picked up with your badge during Paint Show registration hours at advance registration desk in the Atlanta Civic Center.

MAIL TO: FSCT, 1315 WALNUT ST., PHILADELPHIA, PA 19107

We're coming on-str
iron oxide pigment p



But you don't have to wait!

When our new plant is fully on-stream later this year, Mobay customers will have access to one of the widest ranges of iron oxide pigments available anywhere. It also means assured supplies of quality Bayferrox pigments for all applications, no matter how your needs grow.

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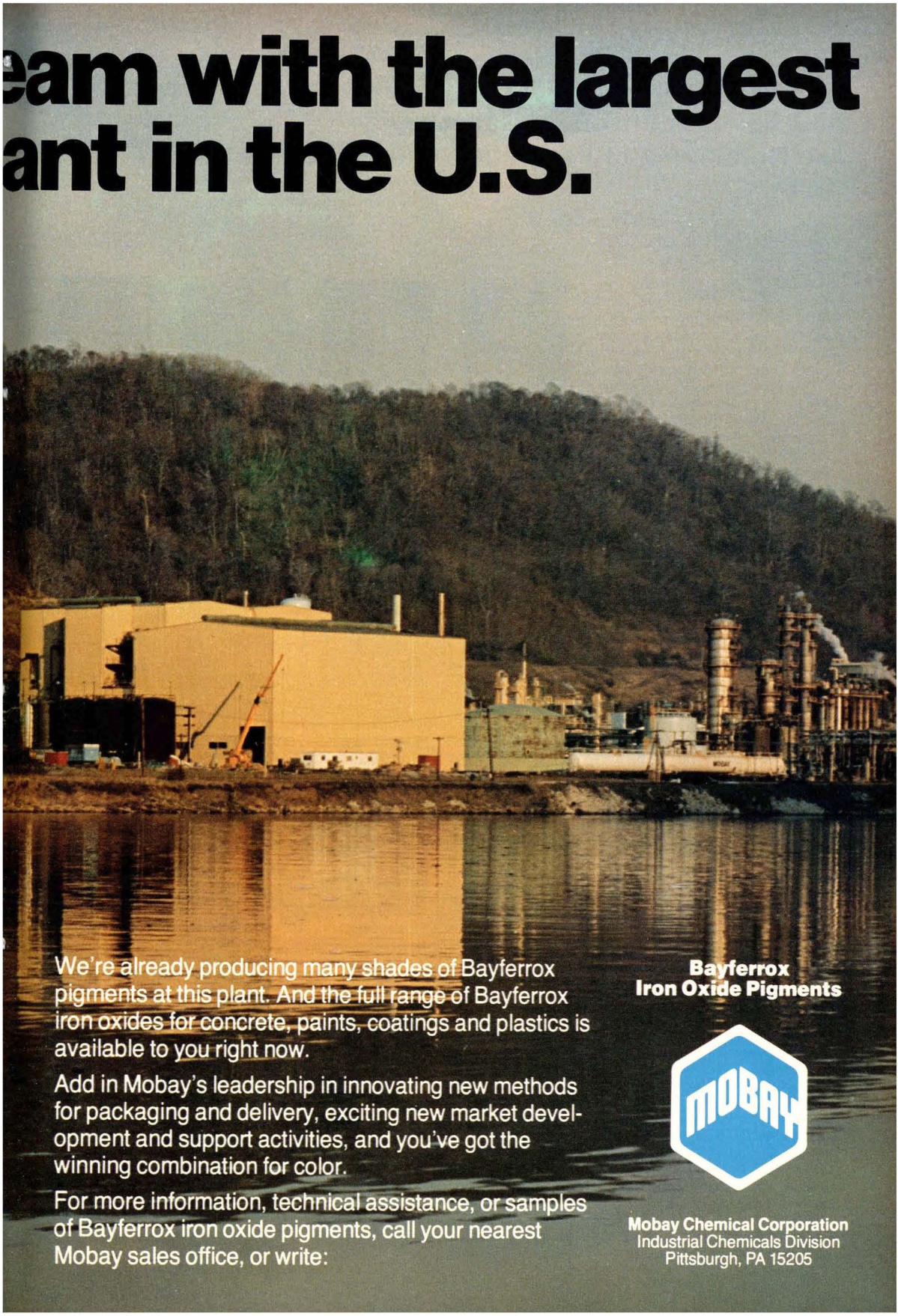


We're already producing many shades of Bayferrox pigments at this plant. And the full range of Bayferrox iron oxides for concrete, paints, coatings and plastics is available to you right now.

Add in Mobay's leadership in innovating new methods for packaging and delivery, exciting new market development and support activities, and you've got the winning combination for color.

For more information, technical assistance, or samples of Bayferrox iron oxide pigments, call your nearest Mobay sales office, or write:

Bayferrox
Iron Oxide Pigments

MOBAY

Mobay Chemical Corporation
Industrial Chemicals Division
Pittsburgh, PA 15205

Howard Jerome, of St. Louis; Clarke Boyce, of Toronto; And Terryl Johnson, of Kansas City Are Nominated to Federation Officer Positions

Howard Jerome, of Spatz/Vane-Calvert, St. Louis, MO, has been nominated to be President-Elect of the Federation of Societies for Coatings Technology. Mr. Jerome, currently Treasurer, is a Past-President and Honorary Member of the New England Society and has served the St. Louis Society as a member of the Executive Committee and as its Representative on the Federation Board of Directors. He was Chairman of the Federation By-Laws and Annual Meeting Host Committees.

A. Clarke Boyce of Nacan Products Ltd., Toronto, Canada, and Terryl F. Johnson, of Cook Paint & Varnish Co., Kansas City, MO, have been nominated to the post of Treasurer.

Mr. Boyce is Technical Service Manager of the Resin Div. of Nacan, which he joined in 1962. Previously, he had been Chief Chemist of Langmuir Paint and British Paints. A Past-President of the Toronto Society, he is currently the Society Representative to the Federation Board of Directors and a member of the Federation Executive Committee.

Mr. Johnson has been with Cook since 1947 and is Manager of the Quality Control Dept. He is a Past-President of both the Kansas City Society and Kansas City PCA. He is the Society Representative to the Federation Board of Directors and a past member of the Federation Executive Committee.

The Nominating Committee also submitted the names of candidates for Board of Directors/Executive Committee positions:

Board of Directors as Members-at-Large—(two-year term; two to be elected):

William F. Holmes, of DeSoto, Inc., Garland, TX. Formerly the Dallas Society Representative on the Board, he is currently Chairman of the Federation Membership Committee and President of the Dallas Society.

John Emmerling, of Lenmar Lacquers, Inc., Baltimore, MD. He has served as Baltimore Society Representative to the Federation Board and as Chairman of the Federation Technical Advisory Committee. He is a Past-President of the Baltimore Society and PCA.

Hugh W. Lowrey, of Indurall Coatings, Inc., Birmingham, AL. He has served on the Federation Board of Directors and is currently Program Committee Chairman for the 1980 Annual Meeting. He is a Past-President of the Southern Society.

H. Jerome

A.C. Boyce

T.F. Johnson

W.F. Holmes

J. Emmerling

H.W. Lowrey

J.A. Gordon, Jr.

H.L. Fenburr

J.J. Oates

F.G. Schwab

J.A. Bauer

John A. Gordon, Jr., of the University of Missouri-Rolla, Rolla, MO. He is currently Chairman of the Federation's Educational Committee and a member of the Publications Committee. He is a Past-President of the Los Angeles Society.

Board of Directors as Past-President Member—(two-year term; one to be elected):

Herbert L. Fenburr, Retired, Columbus, OH. He served as President of the Federation in 1967–68. He is a Past-President of the Paint Research Institute and is currently Chairman of the Federation Investment Committee.

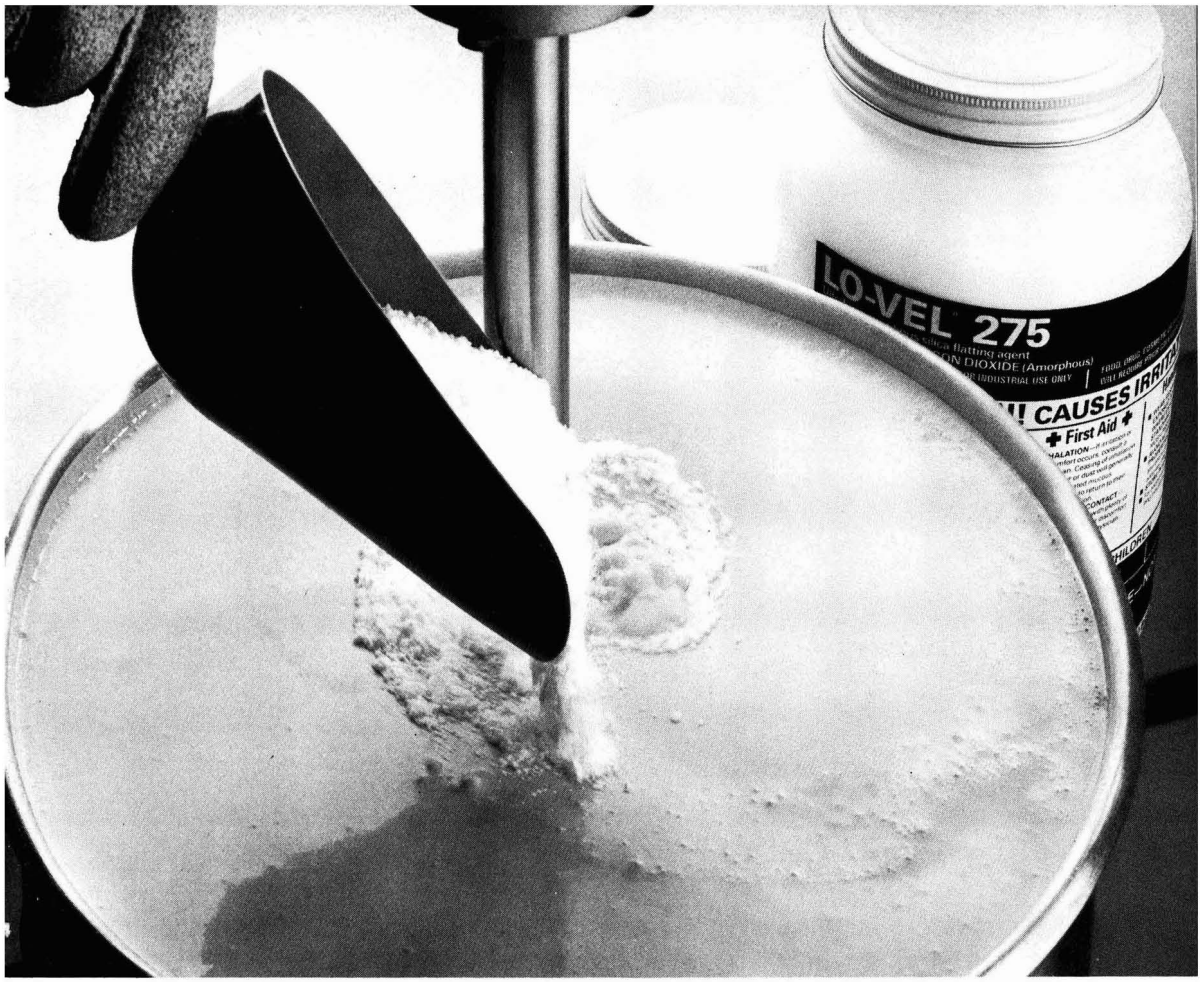
John J. Oates, of Troy Chemical Corp., Newark, NJ. He served as President of the Federation in 1977–78 and is currently Chairman of the Federation Liaison Committee.

Society Representative to the Executive Committee—(three-year term; one to be elected):

Fred G. Schwab, of Coatings Research Group, Inc., Cleveland, OH. He has chaired the Federation Program and Memorial Committees and is currently Chairman of the By-Laws Committee. He is a Past-President of the Cleveland Society.

Joseph A. Bauer, of Porter Paint Co., Louisville, KY. He is Louisville Society Representative on the Federation Board and a Past-President of the Louisville Society.

Voting will take place on October 28 during the 1980 Federation Annual Meeting in Atlanta, GA.



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And, it resists overdispersion, too.

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Chemicals Group
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Please send me a free sample of Lo-Vel 275 silica flatting agent, along with your literature.

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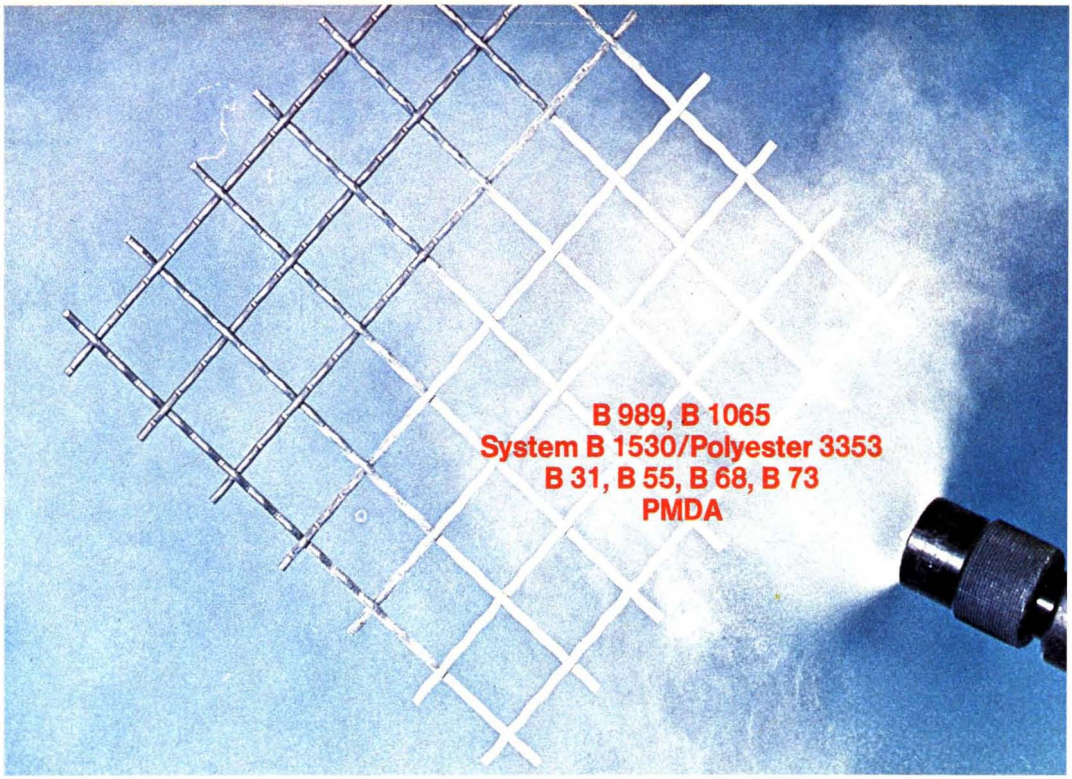

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NPCA Launches "Paint America Beautiful!" Campaign

The National Paint and Coatings Association has just launched the first phase of a three-year national public relations/promotion campaign to stimulate growth in the consumer products segment of the industry.

Following a unanimous vote of support by the NPCA Board of Directors, the Executive Committee approved initial funding from NPCA resources to begin the campaign. NPCA is now calling on its trade sales and supplier members to continue the funding and participate in this landmark program.

The campaign signals the beginning of an era in which product promotion will play a major role in NPCA activities.

The first step in implementing the campaign will be the development of an "umbrella" theme which individual companies and local associations can coordinate with their own promotions. The proposed theme is "Paint America Beautiful!"

Special promotional projects will be featured in women's and shelter magazines. One of these projects will be a "House of Ideas." The house will be a showcase for the decorating versatility of paint and will be featured in a large circulation women's magazine. Another project under consideration is a consumer contest to encourage imaginative decorating with paint.

One of the most important elements of the campaign is an annual "Paint America Beautiful!" month, tentatively scheduled for May 1981. During this period, a heavy volume of consumer publicity will be scheduled and manufacturers will be provided with appropriate point-of-purchase and advertising materials for their retailers. Individual companies will be encouraged to develop their own marketing programs to tie in with the national campaign. In time, this special focus period for paint is expected to make a dramatic impact on consumer paint sales. It is also a flexible promotional vehicle that any manufacturing company can use to its own advantage.

NPCA will provide $151,000 to carry the campaign through December 1980. Beginning in January, 1981 trade sales members and suppliers will pay a Special Promotional Fee which will accrue to a fund maintained exclusively to implement this program. The Special Promotional Fee will be paid each year the program is in effect. Funding details will be outlined in a letter to official member representatives.

The "Paint America Beautiful!" campaign is the result of many months of study, planning and hard work on the part of the Association's Board, Executive Committee, Trade Sales Steering Committee, and staff. It is the first step in a comprehensive plan to stimulate trade sales growth now being developed by NPCA's newly formed Consumer Products Division.

The campaign will be implemented by Henry J. Kaufman & Associates, a Washington, D.C.-based advertising/public relations agency. HJK&A was selected after reviewing proposals by several other top agencies.

Chemicals Lead All U.S. Industries In Pollution Control Investments

One out of every four dollars invested by U.S. industry to control pollution is spent by chemical companies, making them No. 1 in this crucial field, according to the U.S. Department of Commerce.

Chemical companies, Commerce Department figures show, spent about $1.5 billion on pollution control during 1978, the latest year of record. This includes $700 million in operating expenses and about $800 million in capital expenditures for new equipment.

Updating these statistics, an industry report published recently by the Chemical Manufacturers Association shows that by the end of 1979 U.S. chemical companies had invested about $7 billion for pollution control facilities. The industry expects to spend an additional $7 billion between 1981 and 1985 on pollution control equipment and maintenance, the report notes.

And since 1961, CMA reported, the number of people employed by the chemical industry on environmental problems has more than tripled, to over 10,000.

The chemical industry's sizable efforts at controlling and reducing pollution are paying off in measurable improvements in air and water quality. For example, today nearly all of the plants operated by members of CMA meet or exceed federal requirements for air and water quality.

In addition, the industry has accelerated its efforts in the area of waste management.

In 1979, CMA established a Hazardous Waste Response Center whose teams of experts go into the field to assist government officials in coping with failing "orphan" waste disposal sites—those which have no viable or identifiable owners and which may pose hazards to people or the environment. Additionally, the center also has conducted seminars for engineers and others on the latest technological developments of hazardous waste disposal.

The industry's approach to environmental protection includes such specific measures as: Carbon absorption equipment to eliminate odors from chemical plants; Secure landfills to keep hazardous wastes from damaging groundwater supplies; Sophisticated scrubbers, precipitators, incinerators and water treatment systems.

The chemical industry also has altered production processes to reduce pollution. The CMA report points out that process redesign usually requires new technology, which can be a slow, expensive, and frequently frustrating effort. And even with new processing methods, the report says, the industry frequently has had to add equipment which captures potential pollutants generated by the process. Such add-on equipment also is required for older, less-efficient plants.

Chemical companies have all but eliminated so-called "gross-contaminants," large-quantity particles from air discharges, according to the CMA report. They now are aiming at more subtle problems—those that relate to the release of small, sometimes minute, amounts of potentially toxic substances.

Here, too, progress is cited. For example, the chemical industry uses special strains of bacteria to digest hazardous liquid wastes, converting them into harmless water, carbon dioxide and organic sludge.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Spring 1980 Board of Directors Meeting

Thirty-three members attended the Spring Meeting of the Board of Directors of the Federation of Societies for Coatings Technology on May 16-17, 1980, in Minneapolis, Minn.

The following were present:

Officers

President	Elder C. Larson
President-Elect	William H. Ellis
Treasurer	Howard Jerome

Society Representatives

Baltimore	Alex Chasan
Birmingham	David Lovegrove
Chicago	John Petty
C-D-I-C	William Mirick
Cleveland	Fred Schwab
Dallas	Carlos E. Dorris
Detroit	Harry Majcher
Golden Gate	A. Gordon Rook
Houston	Willy C.P. Busch
Kansas City	Terryl F. Johnson
Los Angeles	Gerald L. West
Louisville	Joseph A. Bauer
Mexico	Tony Pina Arce
Montreal	Horace Philipp
New England	Charles Aronson
New York	S. Leonard Davidson
Northwestern	Lowell Wood
Pacific Northwest	John A.J. Filchak
Philadelphia	John Stigile
Piedmont	Gary Marshall
Pittsburgh	Edward Vandevort
Rocky Mountain	James E. Peterson
St. Louis	Herman Lanson
Southern	J. Tommy Robertson
Toronto	A. Clarke Boyce
Western New York	Eugene LeVea

Other Members

Neil S. Estrada	Golden Gate
Ruth Johnston-Feller	Pittsburgh
James A. McCormick	Baltimore
Colin Penny	Baltimore

Guests

Larry Thomas, Executive Director of the National Paint and Coatings Association.

W. Doug Wood, President of the Canadian Paint and Coatings Association.

Martin Gonzales Raab, President of the Mexico Paint and Ink Manufacturers Association.

Dr. Orin Keplinger and Dr. Raymond R. Myers, President and Research Director, respectively, of the Paint Research Institute.

Dr. Herbert L. Fenburr, Chairman of the Federation's Investment Committee; John Fitzwater, Secretary of the New England Society; and Lee Sveum, Membership Chairman of the Northwestern Society.

The following Society officers who attended the orientation meeting the previous day: Mike Bauer, of Kansas City; Paul Christensen, of Golden Gate; Paul Cooper, of Toronto; Steve Crouse, of Rocky Mountain; Mitchell Dudnikov, of Baltimore; Dale Ernst, of Northwestern; John Kemper, of St. Louis; Ray Marett, of Dallas; Robert Miller, of Pacific Northwest; Robert Modrak, of New England; Robert Thomas, of C-D-I-C; Thomas Tuckerman, of Cleveland; Sharon Vadnais, of Golden Gate; and Jan Van Zelm, of Los Angeles.

Staff

Frank J. Borrelle, Executive Vice-President; Thomas A. Kocis, Director of Communications and Field Services; and Rosemary Falvey, Director of Administration.

Mr. Borrelle called the roll of members and reported all present except: John Ballard, of Louisville; Milton A. Glaser, of Chicago; and Thomas J. Miranda, of Chicago.

The report of the Fall 1979 Board of Directors meeting was approved as published in the January 1980 JOURNAL OF COATINGS TECHNOLOGY.

Reports of Officers And Staff

PRESIDENT LARSON

This has been a busy season of travel to many of the Constituent Societies and to other areas to conduct Federation-affiliated business. Chronologically speaking, I have visited the following since taking office: annual meeting of Mexico Paint and Ink Manufacturers Association; PRI Trustees meeting; Houston and St. Louis Societies; meeting of the Editorial Review Board for the Correspondence Course at the University of Southern Mississippi; Finance and Executive Committee meetings; Chicago, Northwestern, New England, New York, and Southern Societies; Joint Paint Industry Coordinating Committee meeting; Technical Advisory Committee meeting; Pittsburgh and Kansas City Societies; Southwestern Paint Convention; NPCA Board of Directors meeting; and Pacific Northwest Symposium.

As I review all of the activities of the FSCT and Constituent Societies I see a very healthy condition throughout the coatings industry. We are bullish about the future of the Federation and the Societies in spite of the slight downturn in prosperity in certain areas during the past month or so. Sixteen of the Societies are already in their Golden Years, i.e., over 50 years old, and others will soon join this group.

The FSCT continues to be a most worthwhile umbrella for the Societies as it encourages INNOVATION in technology, leadership, and programming. We must continue to provide assistance in the development of technical INFORMATION for the industry; this will materialize in improved coatings and ways to meet and/or challenge restrictions made by the Government(s). The Paint Research Institute is in an enviable position to furnish leadership in developing new technical information.

Significant strides have been made by the local Societies and the FSCT in the area of EDUCATION of the membership. Examples are: the Coatings Dictionary, Infrared Atlas, Coatings Technology booklets, and now the forthcoming two-part Correspondence Course, "Science and Technology of Coatings," that is being developed by FSCT and the Polymers Dept. at the University of Southern Mississippi. Also, excellent symposia and seminars have been held in various locations during the past few months.

Congratulations are extended to all of those dedicated and motivated persons who are already functioning in high gear in local and Federation capacities as members and Chairmen of committees, projects, etc. There is still need for more MOTIVATION of membership at the local level. This may be fostered by our own enthusiasm and a one-on-one request for participation in project work.

Involvement in Federation and Society activities is made productive and enjoyable by the capable assistance of the staff in Philadelphia. We are operating on a balanced budget and look forward to another outstanding Annual Meeting and Paint Show in Atlanta.

ELDER C. LARSON,
President

PRESIDENT-ELECT ELLIS

In addition to participating in the ongoing guidance and administration of the Federation, the President-Elect has two major responsibilities—visits to local Societies and selection of 1980–1981 Committee Chairmen. Both of these activities are rewarding and reassuring because they reveal the many competent, dedicated members working in and for the Federation and the many worthwhile activities underway.

At three meetings—Detroit, Baltimore, and Louisville—Frank Borrelle and I talked about Federation activities and presented the slide show. It is apparent that individual Societies have both common and unique problems. Hospitality is gracious at all Society meetings. The concerns and questions are sometimes challenging and always help keep the Federation on the right track.

Together with staff and other officers, I also attended a meeting of the Joint Paint Industry Coordinating Council and the Southwestern Paint Convention.

Recruitment of 1980–81 Federation Committee Chairpersons is progressing well. I have confidence that the capable persons who have accepted this responsibility will make next year a vintage year for the Federation. I also plan to dedicate a significant amount of my own effort toward that goal.

WILLIAM H. ELLIS
President-Elect

TREASURER JEROME

Your Treasurer's activities since last November have been minimal. Visits, in conjunction with staff and other officers, have been made to Western New York and Kansas City Society meetings. I anticipate a stepped-up travel schedule in the months ahead. Visiting with Federation members is not only a pleasant way to renew acquaintances, but also to make new friends. Having the opportunity to observe the inner workings of Constituent Societies will be valuable to me as the time approaches to make committee appointments.

I have been an active participant in the affairs of PRI in my role as Trustee and Treasurer. PRI is laboring to develop new approaches to problem-solving and new approaches to fund-raising. Hopefully, the future will see these efforts bear fruit.

Our staff in Philadelphia is composed of a group of hard-working, dedicated individuals. I spent a day with these people recently and I am proud to be associated with them.

The first quarter report on our finances indicates that we are operating within budget. We expect to continue within budget for the balance of the year.

HOWARD JEROME,
Treasurer

EXECUTIVE VICE-PRESIDENT BORRELLE

The previous year was a good one for the Federation, and 1980, so far, looks to be just as successful. This report will reflect Federation and staff activities since the 1979 Annual Meeting.

PUBLICATIONS

JCT: Advertising page sales in 1979 were 9% over the previous year. Technical papers continue to be in plentiful supply. Because of skyrocketing costs of paper and printing, total pages published during the year were 90 less than in 1978.

Year Book: The 1980 edition (302 pages—largest ever) was released on March 3, six weeks earlier than in 1979. This achievement is due to the good work of Rosemary Falvey, Editor, Lorraine Ledford, and Pat Viola, of staff—and—the Society Treasurers who submitted the membership rosters within the deadline.

Federation Series: No new booklets were published in 1979. We expect to receive manuscripts of "Statistics for the Coatings Industry" and "Color and Appearance" later this year.

Newsletter: This bi-monthly publication continues to be direct-mailed to key Federation and Society personnel in advance of its insertion into the JCT.

Handbook: The compilation of Federation/Society officers, committee chairmen, etc., is now a "standard" publication and will be released annually in the fall.

Paint/Coatings Dictionary: Sales are going well—about 2,100 copies sold to date.

Infrared Spectroscopy: This greatly expanded and magnificent piece of work by the Chicago Society was published in January. About 310 copies have been sold. President Elder Larson, Lorraine Ledford (staff Editor of the IR Book), and I attended the Chicago Society meeting in February and presented specially-bound and personalized copies of the IR Book to the members (and their wives) of the Society's IR Committee. Special engraved and mounted reproductions of the February JCT "Comment Page" on the IR Book were also presented to the committee at the April meeting.

Activities Booklet: A new 12-page booklet on Federation Activities and Services has been prepared and will be mailed to members this summer. Copies, in quantity, will be mailed to the Societies for their distribution to new and prospective members.

Pictorial Standards of Coatings Defects: Introduced last year, this handy photographic reference binder is another popular Federation publication. 110 copies have been sold.

Annual Meeting and Paint Show

Registered attendance at the 1979 AM & PS was 4,760 (regular—2,547, exhibitors—1,774, and spouses—469). Paid exhibit space in the Show, 32,900 net square feet, was a new high.

The 1980 Show in Atlanta has already surpassed 1979 with 34,350 net square feet of paid space.

Hugh W. Lowrey and his Program Committee are preparing a most informative program geared to the theme "Three R's (Research, Resources, Regulations) for the 80's." Most encouraging this year is the number (14) of papers entered in the Roon Awards competition.

Color-Matching Aptitude Test Set

Of the 300 sets produced in May 1978, 180 have been sold.

Paint Research Institute

Staff has again prepared the letters soliciting contributions for 1980, from previous donors. We also attend PRI Trustee meetings and submit reports to the Executive Committee.

FSCT Exhibits

At the invitation of the Baltimore Society, staff (Rosemary Falvey and Dick Gross) prepared and manned a Federation booth at the Baltimore "Coatings Show" in March.

Officer/Staff Visits to Societies

In the company of a Federation officer, Tom Kocis or I met with the Executive Committees and attended monthly meetings of: the four Southern Sections, Houston, St. Louis, Baltimore, Chicago, Northwestern, New England, Detroit, New York, Western New York, Pittsburgh, Kansas City, and Louisville.

We also attended the Southern Annual Meeting and the Southwestern Paint Convention in Dallas.

To follow are visits to: the Pacific Northwest Symposium, the Winnipeg Section of Northwestern Society, the joint Kansas City-St. Louis meeting, and the Birmingham Club 50th anniversary meeting. The Winnipeg monthly meeting in May will be the first time for me and I am pleased to represent the Federation, accompanied by Lowell Wood, Society Representative of Northwestern.

Committees

Educational, Manufacturing, Technical Advisory: Tom Kocis, Director of Field Services, has worked closely with these committees and the Review Board for the Correspondence Course at USM. He has prepared his own report.

Publications: Staff hosted a joint meeting of the Publications Committee and the JCT Editorial Review Board on March 18. It was such a productive meeting that it will probably be held every other year. The committee reaffirmed its policy regarding papers submitted for publication: All (regardless of source) must conform to the technical and editorial standards of the JCT. Those that do not will be returned to the author with the reviewers' report requesting revision, or a statement of rejection. Although the Editorial Review Board will try to be of some assistance when possible, authors must assume responsibility for revising their manuscripts.

JPICC

The Federation hosted the meeting of the Joint Paint Industry Coordinating Committee in March. JPICC is composed of officers and staff of the Federation, National Paint and Coatings Association, National Decorating Products Association, and Painting Decorating Contractors of America.

The first joint project of JPICC was the four-pager on "℞ for Winter Storm Damaged Homes." It was included in the March JCT. The credit for this booklet belongs to NPCA for the preparation of the copy and to NDPA for the layout and printing. The next booklet to be produced will be on "Water Damage."

Future AM&PS

Future sites of the Annual Meeting and Paint Show are: 1981—Detroit; 1982—Washington, D.C.; 1983—Montreal; and 1984—Chicago. All but Montreal are in conjunction with the NPCA annual meeting.

Other cities being considered for 1985 and beyond are Chicago, Dallas, Kansas City, Louisville, Miami Beach, New Orleans, St. Louis, and Washington.

As the exhibit and hotel requirements of the AM&PS increase yearly (presently at 75-100,000 square feet of exhibit space and 3,000 hotel rooms) it becomes increasingly difficult to find a city which can provide adequate first class facilities for both the NPCA and the Federation.

A separate headquarters hotel (1,000 rooms) for each group is preferred but unfortunately, available only in a few cities. Therefore, in order to continue the practice of meeting back-to-back three out of every four years, it is necessary for the NPCA and the Federation to compromise and share the same headquarters hotel, as we will this year and next.

This works to the disadvantage of both organizations, particularly the Federation as we are "second in."

INDEMNIFICATION

At the request of the Executive Committee I contacted insurance brokers regarding indemnification insurance policies for Federation officers and staff. The attorneys are evaluating four proposals. At the request of the Board of Directors, I also inquired into a blanket indemnification policy that would cover both the Federation and the Societies. Because the Federation exercises no control of the Societies, such a blanket policy is not available. Societies can obtain individual policies.

OTHER ACTIVITIES

Paint Short Course: Bob Ziegler, Managing Editor of the JCT, attended the Paint Short Course at the University of Missouri-Rolla in March. It was a very worthwhile experience for him.

Headquarters Office: Your staff office in Philadelphia has just undergone a "Clean Up, Paint Up, and Fix Up" and we invite members to visit us when they are in our city.

I extend my sincere thanks to the eleven members of the staff for their good work, dedication, and team effort: Tom Kocis, Rosemary Falvey, Dick Gross, Kathryn Ferko, Bob Ziegler, Ronna Righter, Lorraine Ledford, Mary Sorbello, Dottie Robinson, Pat Viola, and Linda Hanratty.

FRANK J. BORRELLE
Executive Vice-President

DIRECTOR OF FIELD SERVICES KOCIS

As has been the case in the last several reports, major involvement continues to be in committee liaison and, as noted in the following, there has been much activity on this front in recent months.

COMMITTEE LIAISON

Educational—Development of Correspondence Course in conjunction with University of Southern Mississippi is major current activity. Editorial Review Board (which includes Committee Chairman John A. Gordon, Jr., and Vice-Chairman Jim Hoeck) is working with USM staff in developing course textbooks. Board responsibility is to critique material written by USM staff members to assure that technical and practical considerations are properly accommodated. Board members met with USM staff personnel in January to discuss their cooperative efforts; subsequently, detailed chapter outlines were distributed and critiqued. Initial chapter texts are being readied for distribution, and will be reviewed and discussed at the next meeting of Board/USM, with expectation that continued good progress can be made, and current timetable to have the course available by September 1981 can be maintained. (Educational session at 1980 Annual Meeting will feature presentation on the Correspondence Course.)

Annual update of "Guide to Coatings Courses, Symposia, and Seminars" was published and distributed in January; reports on Society educational activities are currently being compiled and will be published in JCT.

Society Educational Committee Chairmen met with FSCT Educational Steering Committee on April 16, and a prime topic of discussion was promoting career opportunities in coatings industry. Development of literature and slides underway to assist presentations by Society personnel at local high schools.

Manufacturing—Manufacturing Steering Committee met January 23 and April 29 to discuss current and proposed programs.

Slide/tape presentations on "Cartridge Straining" (Houston) and "Sand Mill Operation" (Kansas City), produced several years ago, are being revised and updated and will be resubmitted to Federation for subsequent reproduction and addition to A/V library.

The committee will sponsor a Safety Seminar at the 1980 Annual Meeting in Atlanta (to be moderated by Gil Cain, of Hercules), which will feature individual speakers, panel discussions, and an open forum for audience participation.

An "In-Plant Materials Handling Data Sheet," being developed by the Pacific Northwest Society for use by floor operators, for which Federation funding has been requested, was reviewed by the committee. Revisions in the format and content were recommended and the committee's assistance was offered as needed and requested.

Maintaining and improving Society manufacturing programs is of prime concern. A compilation of such activities will be published and distributed to help stimulate interest.

Technical Advisory—Committee met in December to continue efforts to develop project suggestions for Society Technical Committee undertaking.

A follow-up meeting of the TAC with Society Technical Committee Chairmen was held March 27-28, at which the suggested projects were discussed; these included mildew and fungicidal studies (based on work being done by PRI); corrosion control; washability/scrubbability standards; and minicomputer programs for paint formulation. The mildew project, which was initially recommended at a similar meeting last year, drew the most interest; implementation awaits notification from PRI of availability of satisfactory copolymers for use in the project.

Another project recommendation was to select one of the booklets from the Federation Series on Coatings Technology which require revision/updating. Three booklets were selected: Northwestern, #4 - "Modern Varnish Technology"; C-D-I-C, #6 - "Solvents"; and Chicago, #17 - "Acrylic Resins."

Six Societies (Chicago, Golden Gate, Louisville, Montreal, New England, and Toronto) advised they plan to present papers at the 1980 Annual Meeting; 10 Societies said they were planning to have papers ready for presentation at the 1981 Annual Meeting.

Reports of Society Technical Committee activity were submitted to the Federation office and will be published in a forthcoming issue of JCT.

Program—Initial work on the 1980 programming effort began at the organizational meeting last September; follow-up discussions were held at the Annual Meeting in St. Louis.

The schedule of presentations for Atlanta will offer a full three days of programming keyed to the theme, "Three R's for the Eighties: Research, Resources, and Regulations."

Special features this year will include sessions on corrosion control, safety, and waste disposal along with a Gadgets and Gimmicks display—collection of innovative devices and test methods for use in the laboratory and on the production floor.

Again this year, the committee is having prospective speakers submit manuscript drafts prior to granting acceptance for presentation to assure high quality papers.

Environmental Control—Newsletter has been issued (published in May issue of JCT and distributed to key Federation personnel), featuring info on RCRA "final rule" regulations on hazardous wastes and timetable for implementation, guide to hazardous waste disposal facilities, and NPCA comments on EPA effluent guidelines.

Corrosion—Initial meeting of reorganized committee was held May 8, to discuss areas of activity.

AUDIO/VISUAL PROGRAMS

Work on Toronto Society program on "Introduction to Resin Operations" has been completed and it will be available shortly.

Production work is underway on Birmingham Club's four-part presentation on "The Setaflash Tester," and it is anticipated this will be available for distribution in the Fall.

Review of script on "Impact Resistance of Organic Coatings by the Fall and Weight Method" (Western New York Society) has been completed. Meanwhile, Kansas City has advised they are nearing completion of program on "Hiding" and will forward to headquarters for critiquing.

PRI LIAISON

Assistance was provided in the writing and distribution of letters of solicitation for contributions to the Paint Research Institute, as well as in making arrangements for and attending Trustees meeting in March. Arrangements have been completed for July meeting of Trustees.

SYMPOSIUM ON COLOR AND APPEARANCE INSTRUMENTATION

Initial arrangements have been completed for this event, to be held March 24-26, 1981, in Louisville under the co-sponsorship of the Federation, Manufacturers Council on Color and Appearance, and the Inter-Society Color Council. Previously held in 1978, it will feature paper presentations, workshops, and "hands-on" displays of color instrumentation equipment.

THOMAS A. KOCIS
Director of Field Services

At the meeting, Mr. Kocis reported that—as directed by the Executive Committee—he represented the Federation at the May meeting of the NPCA Scientific Committee.

When queried about the "In-Plant Materials Handling Data Sheet" proposed by the Pacific Northwest Society, Mr. LeVea, a current member and former Chairman of the Manufacturing Committee, said that—because of the legal implications and liabilities involved—the Federation is in no position to become engaged in such a program. He added that this is his personal opinion and not the official opinion of the Manufacturing Committee.

Paint Research Institute

PRESIDENT KEPLINGER

At meetings on December 7, and March 13 and 14, the Trustees of the Paint Research Institute reviewed the progress of our several active grants and selected grants which will be funded in 1980. Disbursements totalling $98,825 have been approved against a budget of $110,000.

Dr. C. Malcolm Hendry was appointed to replace L. Afremow, who resigned from the Board of Trustees. Dr. Peter Robinson was elected Vice-President for the remainder of this year.

GRANTS IN PROGRESS

Aqueous Systems: Problems of high viscosity, sensitivity to humidity and thermal effects, application difficulties, cosolvent interaction, hardness vs. flexibility, low molecular weight and slow dry were identified by the monitors. During the remainder of 1980 an Aqueous Consortium proposal will be put together.

Viscosity Control in Water-Borne Coatings (#68, NDSU)—Four standard acrylic copolymers at acid numbers 35 and 70 and molecular weights 20,000 and 8,000 at various degrees of neutralization demonstrated an independence of viscosity to molecular weight but inverse dependence on acid number. Standard polymers were prepared and distributed to Drs. Myers and Schreiber in March.

Film Formation and Polymer Transitions (#13, Kent State)—Studies of several standard water-soluble polymers at various degrees of neutralization with a variety of amines have been made on dielectric behavior, torsional braid viscosity, the vibrating quartz substrate (impedometer) and ^{13}CNMR. Evidence of a t butanol adduct, polymer sidegroup transitions, delocalized dipoles, several degrees of water swelling, yield values related to degree of neutralizations, film shrinkage stresses, ion cluster formation, and humectant properties related to consecutive incorporation of several acrylic acid molecules in the polymer were uncovered. Studies of drying at various levels of humidity have begun. The drying behavior of water-based coatings is infinitely more complex than predicted and much more work will be required.

(#67-Ecole Polytechnique)—Critical surface tension changes in some aged films was related to migration of some polymer components or to surface oxidation. Aging in the presence of some atmospheric contaminants will be studied. Cosolvent and plasticizer migration studies might also be possible.

MILDEW CONSORTIUM

Preparation of Mildew Metabolites and their Degradation of Paints. Preparation of a Paint Polymer which Fights Back (#57-Alabama)—Industry members of the consortium and Dr. Zabel are devising field tests for the pentachlorophenol acrylic polymer. Efforts to make this at greater volume are underway. Other esterified toxicants were found to be ineffective because of hydrolysis. Current research is aimed at ether linkages to provide longer effective life.

The Role of Aureobasidium Pullulans in the Deterioration and Disfigurement of Paint Films (#61, State Univ. New York)—It is now evident that A-p in pure cultures can grow on adventitious carbon and not carbon from the film (SEM). Glucosamine assay is quantitative for A-p growth (this is relevant!). Humidity levels for optimum growth were verified.

Control of Cell-Wall Biosynthesis of A. Pullulans (#64, Univ. Missouri-Rolla)—The objective is biosynthesis of H.p cell walls so that a rational attack on this organism can be mounted. This group is now growing protoplasts in radioactive glucose.

OLIGOMERS

Methacrylate Oligomers (#69, NDSU)—Monomer and chainstop alcohol $\xrightarrow[\text{metal oxide}]{}$ Oligomer (DP 17). These will be evaluated for high solids after technique has been mastered.

"Stability and Stabilization of Coatings Systems" will be the subject of the 1981 Symposium of PRI.

ORIN KEPLINGER
President, PRI

RESEARCH DIRECTOR MYERS

The Paint Research Institute operates with a $110,000–$120,000 budget, within which two programs are supported and a third is beginning.

MILDEW-INDUCED DEFACEMENT OF COATINGS

This effort is a self-supporting consortium. The selection of the general area of activity was made by the Trustees. I then held an encounter session to learn from experts what were considered to be significant problems needing solution.

Four problem areas were identified. The first one (mildew microecology) concerned the factors involved in mold growth. At first there was great excitement about mildew-bacteria symbiosis and about the succession of organisms that grows on a surface and culminates in a ubiquitous species called *Aureobasidium pullulans;* later this phase of the work settled down to the more prosaic study of nutritional and humidity requirements of that organism.

A second problem area concerned mildew physiology. Here is where alternatives to fungicides are studied. Fundamental research is underway on the building of cell walls, their inhibition by agents not likely to be toxic to humans, and the parallel inhibition of black pigmentation.

A third area of study incorporates fungicides into polymers in bound form by means of copolymerization. We have learned that fungicides remain active when bound; we have not yet proven that they can be bound in a form that permits them to display activity and also remain in a viable form on test fences. This is our present aim.

Principal scientists involved in this effort are Dr. Charles Yeager (the program manager), and three academics: Robert Zabel, of New York State College of Forestry and Environmental Science at Syracuse, on the nutritional requirements; Donald Siehr, of University of Missouri at Rolla, on the cell wall synthesis; and Charles Pittman, of University of Alabama, on the fungicidal copolymer. We expect to use a laboratory assay developed by Dr. Zabel in evaluating Dr. Pittman's polymers.

WATER-BORNE COATINGS

PRI's interest in compliance coatings was narrowed to the class known as water dispersible. At one time four grants were in force; emphasis was then placed on the rheology, surface chemistry, and drying behavior of acrylic acid copolymers and the survivors dropped to two:

Film-forming properties, in which the neutralizers and the degree of neutralization exerted profound effects on the drying behavior. Water retention depended on both of these variables and underwent a drastic change at half neutralization. These findings were interpreted as evidence of water clustering when neighboring acid groups were deprotonated. Since random copolymerization produces neighboring acid groups and copolymerization of monomers with different reactivity ratios produces even more, the synthesizers of copolymers should heed this finding.

Critical surface tensions of cast films have shown which molecular segments that make up copolymers are concentrated on the surface. The measurement also shows whether migration or segregation occurs on aging, although early evidence that the more energetic parts of the molecule moved to the surface may be an artifact resulting from oxidation.

I directed the film formation research and Dr. Henry Schreiber, of Ecole Polytechnique in Montreal, did the surface tension research.

OLIGOMERS

After the Workshop on the Science of Organic Coatings held in 1978, our report on the meeting stated that oligomers need characterization by scientists in the same manner that polymers and small molecules have been characterized. Oligomers constitute the main ingredient in high-solids coatings, and indications are that control of their rheology will become the dominant feature in formulating a practical coating.

Our intent was to select a composition which could be made at a controlled low degree of polymerization and one which had functional groups. After contacting a half dozen academic people for proposals, we placed a grant with Dr. Zeno Wicks at NDSU for synthesis of acrylate oligomers. Characterization of these oligomers would then take various forms, both at NDSU and elsewhere. The NDSU group likes to measure viscosity and its concentration dependence, leading to concepts of free volume and monomeric friction coefficients. They also have capabilities for determining MW and MWD.

Other properties of oligomers that could be studied, listed in nonranked order are:

- Methods for molecular weight control.
- Viscosity of the neat oligomers as a function of temperature and molecular weight.
- Distribution of functional groups on the molecule, and methods to guarantee their placement.
- Transitions; specific volume as a function of temperature; effects of MWD on the location of meeting, gloss, and other transitions.
- Thermodynamic properties; evaluation of shift factors in time-temperature superposition.
- Curing behavior; methods, rates of cure, and behavior of coatings on curing; adhesion.
- Structure/property correlations in general.
- The presence or absence of directional effects; molecular alignment.

Numerous other fundamental questions could be posed; but PRI has been criticized for taking pioneering approaches to problems rather than backing off from some applied problem and providing background information as needed. Perhaps this is why the oligomer program has not yet been funded by outside subscribers. Ideas on how to get to the bankers will be most welcome.

RAYMOND R. MYERS
Research Director, PRI

Amendments To By-Laws

The following amendment to the By-Laws was passed for first reading at the Board of Directors Meeting on October 2, 1979, and adopted at the May 16, 1980 meeting.

ARTICLE III—ORGANIZATION

WHEREAS counsel has recommended that a By-Law be adopted authorizing the Federation to indemnify its officers and directors, and

WHEREAS the Board of Directors at its January 28, 1978 meeting requested the By-Laws Committee to offer a resolution which would provide such a statement, be it

RESOLVED that a new section "F" be added to Article III of the By-Laws which shall read as follows:

"F. INDEMNIFICATION OF DIRECTORS, OFFICERS AND OTHERS

The Federation shall indemnify, to the extent determined by the Board of Directors, any person who, by reason of serving as a director, officer, employee, or agent of the Federation is made a party to any legal, administrative, investigative or similar proceeding. Indemnification may be against all or a portion of any amounts such person is required to pay (including expenses) as a result of such a proceeding. This right of indemnification shall not deprive such person of any other rights of indemnification to which a person may be entitled and shall inure to the benefit of such person's heirs, executors and administrators."

* * * * * * * *

The following amendment to the By-Laws was passed for first reading at the May 16, 1980 meeting and will be presented for adoption at the October 28, 1980 meeting.

WHEREAS the Federation's Executive Committee passed the following action on October 6, 1979:

"That the President, or duly appointed representative, and the Research Director of PRI submit progress reports to and attend the two meetings of the Board of Directors and further that this statement be made a provision of the Standing Rules and be referred to the By-Laws Committee for preparation of the proper resolutions," be it

RESOLVED that By-Laws Article III, Section B, Sub-Paragraph n, be revised as follows [additions in *italic*, deletions in parenthesis ( )]:

(n) Receive written reports on their activities from the Federation officers, (and) Committee Chairmen, *and both the President, or duly appointed representative, of the Paint Research Institute and its Research Director* semiannually; and from Constituent Societies annually.

* * * * * * * *

The following revision of the Standing Rules has been submitted by the By-Laws Committee. Since this change is dependent upon the proposed previous amendment to By-Laws Article III, Section B, Sub-Paragraph n, and since Standing Rules require only one reading before being voted upon for approval, this amendment will be presented for adoption at the October 28, 1980 meeting.

WHEREAS the Federation's Executive Committee passed the following action on October 6, 1979:

"That the President, or duly appointed representative, and the Research Director of PRI submit progress reports to and attend the two meetings of the Board of Directors and further that this statement be made a provision of the Standing Rules and be referred to the By-Laws Committee for preparation of the proper resolutions," be it

RESOLVED that Standing Rules Article SR VII, Section A, Sub-Paragraph (2) be revised as follows [additions in *italic*, deletions in parenthesis ()]:

(2) The President of the Federation shall extend an invitation to appropriate officers of the Canadian Paint & Coatings Association, the Mexican Association of Paint & Ink Manufacturers, the National Paint & Coatings Association, (and the Paint Research Institute) *and both the President of the Paint Research Institute and its Research Director* to attend meetings of the Board. The President may also invite officers of other organizations which he deems to be appropriate.

* * * * * * * * *

The following proposed change to the By-Laws will be presented for first reading at the October 28, 1980 meeting.

WHEREAS an important annual duty of the President is to nominate the Trustees of the Paint Research Institute for election by its Members, who are the Federation Board of Directors, and

WHEREAS this duty is not currently included in the Federation By-Laws, be it

RESOLVED that By-Laws Article III, Section C, Paragraph (1) be amended by adding new sub-section e., as follows:

"e. Nominate annually the Trustees of the Paint Research Institute for election by its Members (Federation Board of Directors)."

FRED G. SCHWAB, *Chairman*
By-Laws Committee

Nominations

The Nominating Committee presents the following slate of candidates for Federation Office, 1980–81:

President-Elect—Howard Jerome, of the St. Louis Society (Spatz/Vane-Calvert). He is currently Treasurer.

Treasurer (one to be elected)—A. Clarke Boyce, of the Toronto Society (Nacan Products Ltd.) and Terryl Johnson, of the Kansas City Society (Cook Paint & Varnish Co.). Both are Society Representatives.

Society Representative to the Executive Committee (three-year term, one to be elected)—Joseph Bauer, of the Louisville Society (Porter Paint Co.) and Fred Schwab, of the Cleveland Society (Coatings Research Group, Inc.).

Member-at-Large on the Board of Directors (two-year term, *two to be elected*)—John Emmerling, of the Baltimore Society (Lenmar Lacquers, Inc.); John A. Gordon, Jr., of the St. Louis Society (University of Missouri-Rolla); William Holmes, of the Dallas Society (DeSoto, Inc.); and Hugh W. Lowrey, of the Southern Society (Indurall Coatings, Inc.).

Past-President on the Board of Directors (*two-year term, one to be elected*)—Herbert L. Fenburr, of the CDIC Society (retired); and John J. Oates, of the New York Society (Troy Chemical Corp.).

Elections will take place at the Board of Directors meeting on October 28, 1980.

The members of the Nominating Committee are: Joseph Bauer, Willy C.P. Busch, Neil S. Estrada, John A.J. Filchak, and your Chairman.

JAMES A. MCCORMICK
Chairman

Review of Actions Of Executive Committee

One of the duties of the Board of Directors is to approve or disapprove all actions of the Executive Committee.

The actions of the Executive Committee (at meetings of October 2 and 6, 1979, and January 26, 1980) were included with the minutes mailed previously to the Board of Directors. The actions of the May 16, 1980 meeting were presented to the Board the same day.

The actions are as follows:

October 2 and 6, 1979

That the Philadelphia Society be named the recipient of the Union Carbide Award for extraordinary achievement in coatings technology for its preparation of the "Paint/Coatings Dictionary."

That Dr. Thomas Miranda be reappointed Technical Editor of the JCT for 1979–80.

That in keeping with the year-end change, the Trustees of the Federation Pension Plan for the coming year be President-Elect Ellis, Treasurer Jerome, and Executive Vice-President Borrelle.

That the First-Quarter budget for 1980 be set at one-quarter of the 1979 budget for operational purposes only.

That the Federation continue to pay transportation expenses for the Board, Executive Committee, committee members, and Federation Past-Presidents in accordance with conditions specified in the minutes.

That the Federation continue to pay complete travel expenses (within the budget) of Federation officers and Immediate Past-President on matters of official Federation business, and that spouses accompany the officers on certain travel at Federation expense.

That the 1979-80 Executive Committee approve the actions of the 1978-79 Executive Committee.

That appropriations for 1979-80 Federation committees be approved by the Executive Committee as recorded in the minutes.

That Mr. Gordon, Chairman of the Educational Committee, be requested to review the scholarships at NDSU, USM, UD, KSU, and UMR and advise the Executive Committee of the number of graduates who have become employed in the coatings industry.

That the policy stated in E-0042: "That the author of any paper—approved by the Federation for presentation on its behalf at a conference of members of the International Coordinating Committee, be given an honorarium of $250."—be amended so that it applies to one paper per year per conference.

That the price of the "Infrared Spectroscopy Atlas for the Coatings Industry" be set at $75.00 for members and $100.00 for nonmembers subject to the review of the situation by the Federation attorneys.

That the Pacific Northwest Society's Project on "In-Plant Materials Handling Data Sheet" be referred to the Manufacturing Committee provided that the committee consult with NPCA and also review what else may have already been done in this area.

That Mr. Kocis be assigned the responsibility of seeing that the terms of the agreement with USM concerning the Correspondence Course are adhered to.

That the President, or duly appointed representative, and the Research Director of PRI submit progress reports to and attend the two meetings of the Board of Directors and further that this statement be made a provision of the Standing Rules and be referred to the By-Laws Committee for preparation of the proper resolutions.

That the Federation's Technical Information Services Committee be assigned to search the literature for all available information on "The Technical Uses of Computers in the Coatings Industry" and that the estimated cost of preparing the bibliography—for distribution within the International Coordinating Committee—be submitted for approval.

That staff salaries be increased in 1980.

January 26, 1980

That the estimated report of income ($960,300) and expense ($936,700) for 1979 be accepted.

That the selling price of the "Infrared Spectroscopy Atlas for the Coatings Industry" be $75.00 for members, and $100.00 for nonmembers. (This affirmed the mail ballot of November 1979).

That the Technical Advisory Committee be requested to undertake the revision of the Units in the Federation Series on Coatings Technology (as required).

That the registration fees for the 1980 Annual Meeting be increased $5.00 across the board.

That the Executive Vice-President and his wife attend the Fiftieth Anniversary meeting of the Birmingham Club in June.

That a letter be written to those who travel at Federation expense, advising them to hold down expenses by taking advantage of the various fare discounts offered by airlines.

That the Executive Committee continue to endorse the advertising policy of the Paint Show Program Book. (Advertising accepted from Paint Show exhibitors only).

That the Federation Director of Field Services attend meetings of the NPCA Scientific Committee.

That the PRI Trustees establish a strategy for soliciting funds and an effective follow-up procedure.

That the 1980 budget of income ($1,048,000) and expense ($1,044,600) be approved.

That the Executive Committee thank the Kansas City Society for the invitation to hold an Annual Meeting and Paint Show in that city. The invitation will be given consideration.

That the 1986 Annual Meeting and Paint Show be held in Washington, D.C., in conjunction with the NPCA.

That the 1988 Annual Meeting and Paint Show be held in Chicago, Ill., in conjunction with the NPCA.

That an announcement and introduction of winners of Federation Awards be made at the Annual Meeting Luncheon, but that the actual presentation of the awards (except Heckel and Union Carbide) be made at the Annual Business Meeting.

That the Federation accept, with thanks, the Badge of Office for the Federation President designed and made by the Birmingham Club and that it be worn at appropriate times by the Federation President.

That a new committee—Future Planning—be established and composed of Federation Past-Presidents.

That the Federation's investment trust fund be transferred from the Pittsburgh National Bank to the Girard Bank of Philadelphia. [*Please see "New Business."*]

MAY 16, 1980

That, at the request of the Inter-Society Color Council Committee, the Federation publish a separate booklet of color and optics terms from the "Paint/Coatings Dictionary." (The print order will be 2,000 copies. The ISCC Committee has already projected immediate sales of half of these.)

That the Executive Committee thank the St. Louis Society for the invitation to hold the 1987 Annual Meeting and Paint Show in that city. The invitation will be given consideration.

That the 1981 Federation President and his wife (M/M William H. Ellis) represent the Federation at a meeting of the Birmingham Club and also at the Biennial OCCA Conference, in England, June 1981.

That the schedule of Flynn Awards for the best exhibits in the Paint Industries' Show be changed, as recommended by the Paint Show Committee. (Presently, there are a total of six awards: first and second prize each for a single, double, and three-or-more booth exhibits. Effective 1980, the six awards will be presented as follows: *Raw Material Suppliers*—first prize each to a single, double, three-to-five, and six-or-more booth exhibits; *Equipment Manufacturers*—one first prize; *Service Industry*—one first prize.)

That the schedule of the Spring meetings in Denver, 1981, be as follows: Executive Committee—May 13; Society Officers—May 14; Board of Directors—May 15.

That the Executive Vice-President meet with staff of the National Paint and Coatings Association to convey the Executive Committee's desire that it is in the best interests of both organizations that the annual conventions of FSCT and NPCA be split at some agreeable and practicable point in the future. [*Please see "New Business."*]

[*All of the actions of the Executive Committee were approved by the Board of Directors.*]

Society Business

BALTIMORE

Mr. Chasan reported that, effective this year, the Baltimore Society will withhold financial support from the Paint Research Institute because of dissatisfaction with results and accomplishments of PRI research. He also stated that the Society is considering granting full voting and office-holding privileges to Associate members.

NEW ENGLAND

Mr. Aronson, referring to a recent survey regarding the travel expenses of Society Representatives to the two meetings of the Board of Directors each year [*the Federation reimburses air coach transportation to the Spring meeting*] noted the following results: seven Societies pay the full expenses to both meetings; eleven pay partial expenses; and eight pay none. In the case of "some" or "none," the representative's employer usually covers the expenses. Mr. Aronson, speaking for the New England Society, stated that the attendance of Society Representatives to Board meetings is an obligation of the Societies and each Society should cover the complete expenses to both meetings (except for the transportation to the Spring meeting which is paid by the Federation).

Mr. Aronson reported on the first "Coatings & Ink Expo" sponsored by the New England Society on May 13-14. He said that although it is too early to report final results, all indications are that the event was successful.

NEW YORK

Mr. Davidson commented that the Society Representatives should meet privately prior to the Board meeting for the purpose of airing Society problems and presenting constructive recommendations to the Board. He therefore moved that provision be made for such a meeting at future Board meetings. After the second, the motion was put to a vote and was defeated. There were only two affirmative votes.

From this discussion came the suggestion that Society Representatives be requested to submit written reports for each meeting of the Board. The reports should be directed to the Board of Directors and be concerned only with the presentation of current Society problems and constructive suggestions for the improvement of Federation services/activities. Mr. Borrelle stated that the letters to the Society Representatives would be so worded.

MONTREAL

Mr. Philipp presented the Society's $400 contribution to the Paint Research Institute. It was accepted, with thanks, by President Larson.

PHILADELPHIA

Mr. Stigile displayed the new membership roster of the Society prepared in loose-leaf binder form.

PITTSBURGH

Mr. Vandevort presented the following written request:

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"The Pittsburgh Society has most recently revised its By-Laws to extend voting and office-holding privileges to its Associate as well as Active Members. As the Pittsburgh representative to the Federation Board of Directors, I have been unanimously directed by my membership to propose to the Federation By-Laws Committee a like change in the Federation By-Laws.

"In view of recent Federation surveys which show over 50% of our local Societies doing likewise, it is our feeling that now is the time for the Federation to act in accordance with the majority of the Societies. So, in conclusion, I am taking this opportunity to present to the By-Laws Committee our written proposal for their earnest review. We look forward to an official first reading at our Fall 1980 Board Meeting in Atlanta."

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It was referred to the By-Laws Committee for editing, clarification, and preparation of the enabling resolutions.

Old Business

NEW PRI TRUSTEE

Dr. C. Malcolm Hendry, of The O'Brien Corp., Houston, was nominated (by President Elder C. Larson) to the PRI

Board of Trustees, succeeding Leonard C. Afremow who resigned January 17, 1980. By mail ballot, the Federation's Board of Directors then unanimously elected Dr. Hendry as a Trustee for the remainder of this year. At the May 16th meeting, the mail ballot was reaffirmed for the record.

New Business

TRANSFER OF INVESTMENT TRUST TO GIRARD BANK IN PHILADELPHIA

Dr. Herbert L. Fenburr, Chairman of the Investment Committee, submitted a report which indicated committee dissatisfaction with the Federation's investment trust performance at Pittsburgh National Bank, since 1965.

He stated that he, James A. McCormick (Chairman of the Finance Committee), and Mr. Borrelle had met with investment trust officers of the Girard Bank, Philadelphia, in December and were favorably impressed with both the personnel and the flexibility of the investment programs available.

Dr. Fenburr said that the easy in-and-out of investments into short-term securities and the location of the investment trust in the same city as the headquarters office are other factors which favor a change.

He answered several questions from the floor about the Federation's investments and cited results over the years.

The Board of Directors thereupon approved the recommendation of the Executive Committee that the Federation's portfolio be moved from Pittsburgh National Bank to the Girard Bank in Philadelphia. And further, by Board action, that the Executive Committee be empowered to decide on the division of the investment funds in Girard, subject to the opinions of the Federation counsel.

INVESTMENT CHAIRMAN ON FINANCE COMMITTEE

While presenting the report of the Investment Committee, Dr. Fenburr requested that, as a matter of policy, the Chairman of the Investment Committee be a member of the Finance Committee. This was approved by the Board and recommended for implementation to the Executive Committee.

SEPARATION OF ANNUAL CONVENTIONS OF FSCT AND NPCA

Mr. Borrelle reported a long discussion at the Executive Committee Meeting about the difficulties the Federation is facing with the current back-to-back annual convention arrangement with the National Paint and Coatings Association. As stated in his written report to the Board, being "second in" the headquarters hotel works to the disadvantage of the Federation. The Federation needs 3,000 hotel rooms and about 130 suites. To find this number in a center-city location, which is at the Federation's complete disposal, is almost impossible. As a result, the NPCA and FSCT are forced to share a headquarters hotel. NPCA closes on Wednesday at about the same time that the Federation AM&PS begins. The overlapping situation causes severe inconveniences regarding sleeping rooms, suites, and the use of hotel function space. Other problems concern programming and Paint Show hours.

Since the AM&PS represents 42% of Federation income, it behooves the Federation to provide exhibitors and attendees the best and most convenient hotel and exhibit package available. The Federation can only do this when it exercises complete control over its own convention. This it cannot do under the present FSCT/NPCA arrangement, except every fourth year when NPCA meets in California.

After much discussion and a review of the future schedule of the AM&PS, the Board of Directors approved the Executive Committee action that the Executive Vice-President meet with staff of the NPCA to convey the Executive Committee's and Board of Directors' desire that it is in the best interests of both organizations that the annual conventions of FSCT and NPCA be split at some agreeable and practical point in the future.

FEDERATION HONORARY MEMBERSHIP FOR PAST-PRESIDENT CARROLL M. SCHOLLE

Carroll M. Scholle, a Past-President of the Federation (1965-66) and the Chicago Society, has been proposed by the Society for Federation Honorary Membership. As specified in Standing Rules II, the Secretaries of each Society and the Board of Directors were advised of the nomination on January 10, 1980. By unanimous vote, the Board of Directors elected Mr. Scholle a Federation Honorary Member.

At time of retirement in 1979, Mr. Scholle had been associated with the coatings industry for 43 years—38 with Jewel Paint & Varnish Co. and the last five with the Sherwin-Williams Co. He received the Chicago Society's Outstanding Service Award in 1963. Mr. Scholle continues to serve the Federation as Chairman of the Memorial Committee and a member of the Manufacturing Committee.

STUDY GROUP FOR PAINT RESEARCH INSTITUTE

Mr. West commented that although there is dissatisfaction with the operation of the Paint Research Institute, there appears also to be disinterest in doing something about it. He said that it is incumbent upon the Board of Directors to make PRI function more effectively.

President Larson then announced that, at the Executive Committee meeting that morning, he had appointed the new Future-Planning Committee (composed of James A. McCormick, Chairman, Newell P. Beckwith, Neil S. Estrada, Milton A. Glaser, and John J. Oates—all Federation Past-Presidents) to undertake an in-depth study of PRI.

President Larson said that PRI deserves recognition as a most significant arm of the coatings industry and the Federation should do everything possible to see that PRI attains this status. The study of PRI, to be undertaken by the ad hoc committee, will need to address several areas: Programming; Funding; Administration; and Location.

The committee will be so charged, President Larson concluded, and a preliminary report may be expected by the next Board meeting.

Committee Reports

A. F. VOSS/AMERICAN PAINT JOURNAL AWARDS

Six Societies have reported their intent to present papers:

Chicago —"Renewable Resources for the Coatings Industry: Part I, What and Where"

Golden Gate —No official title. Paper will report on an evaluation of exposure performance of commercially available, nontoxic, water-borne, corrosion-inhibitive primers that conform to CARB regulations for 1984.

Louisville —"Extender Pigments in Latex Wall Paints"

Montreal —"Factors Influencing Freeze-Thaw Stability in Flat Latex Paints"

New England—"Flash Rust Inhibitors: An Evaluation of Some Amines and Organic Salts in An Aqueous Acrylic Coating"

Toronto —"Parameters Affecting Wear Rate in Small Media Mills"

From the composition of committee members, it will again be necessary to set up a mathematical modulus for judging the papers, since members from Societies with papers automatically disqualify themselves in judging their own Society presentations.

HORACE S. PHILIPP
Chairman

CORROSION

The Corrosion Committee met at the Annual Meeting in St. Louis, in October 1979. The results and status of the work being performed by the Steel Structures Painting Council were discussed. A progress report on this work is available from SSPC [and was published in the June 1980 JCT].

The meeting then concerned itself with a discussion of what future goals and directions the committee should take. To date, the efforts of the committee have been centered, for the most part, around work done by the Steel Structures Painting Council. These efforts, and the support provided, including both financial support by the Federation as well as technical guidance and input by the committee, have contributed significantly to the many achievements made by SSPC in the field of corrosion of large steel structures. This valuable work should continue, as should the support and input thereto.

However, it was agreed that the efforts of the committee should not be limited to the corrosion of large steel structures. Corrosion is a problem in other areas (e.g., auto, marine, chemical facilities, etc.) and as a committee serving the entire Federation, it is our responsibility to reflect this in the work done. Further, the duties of the Corrosion Committee are numerous, as printed in the Federation Year Book. Therefore, it was recommended to expand the base of the committee's efforts.

Areas considered included providing guidance to Society Technical Committees working on corrosion projects and/or the development of a procedure whereby the committee reviews and reports on pertinent technical articles on corrosion published by other groups, e.g., Society of Naval Architects and Marine Engineers, Society of Automotive Engineers, Zinc Institute, etc., as well as expansion of the committee to include delegate representation from other groups in addition to NACE, ASTM, and SSPC to expand involvement in other areas of corrosion technology.

Therefore, in order to provide the time for the committee to discuss these goals in depth, a special meeting has been scheduled for early May. At this time it is anticipated that the membership will begin to focus on new and expanded activities.

SAUL SPINDEL
Chairman

DEFINITIONS

There are three phases of the second edition of the *Paint/Coatings Dictionary* that are active: expanding the present definitions to be more encyclopedic; defining more terms; and updating the bibliography.

We have had a welcome, albeit limited, response from various individuals who responded to our request to submit terms and definitions. Most of these have been excellent.

We have been listing all new pertinent books since the dictionary was published. These will be included in the new bibliography.

Our committee is still looking for volunteers to be sub-editors for our various categories. Their job would be to edit the definitions and bibliography for their categories. We are particularly looking for a good organic chemist who will review the nomenclature and definitions of all our chemical terms. Please write to me or the Federation if you are interested.

STANLEY LESOTA
Chairman

ENVIRONMENTAL CONTROL

The Environmental Control Committee has continued to meet the aims it adopted at its organization meeting. That is, "to disseminate information to the members of the Federation on matters of government regulatory actions as they apply to environmental control impacting on the coatings industry."

At the present time, the regulations that deal with disposal of waste are of paramount importance to the industry. The Environmental Protection Agency has issued some of the Final Regulations that have been mandated by the Resource Conservation and Recovery Act of 1976. In order to make the industry aware of the impact of these regulations, an Environmental Control Committee Newsletter will be published in the JOURNAL OF COATINGS TECHNOLOGY (May issue) and will also be distributed to the FSCT mailing list.

The Environmental Protection Agency has proposed regulations that require that waste water discharged into publicly operated sewage plants must meet "zero discharge" requirements. This problem is also covered in the Newsletter.

Time has been set aside during the Annual Meeting for a two-hour program to be presented by this committee. It will cover the regulations dealing with the disposal of toxic waste and waste water. It is expected that, by the time of the Annual Meeting, more regulations covering these materials will have been issued. Until then, this program is still in a fluid state.

The committee is still available to answer inquiries from our members or the public as they relate to the coatings industry. We ask only that we be asked.

S. LEONARD DAVIDSON
Chairman

INTER-SOCIETY COLOR COUNCIL

Since the last Council Meeting, the Inter-Society Color Council (ISCC) held two important functions: The Helson Memorial Symposium on Chromatic Adaptation on February 3–6, and the ISCC Annual Meeting on April 21–22.

Papers from the Helson Symposium should eventually be published in *Color Research and Application*. A report in the January–February 1980 ISCC News by Peter Kaiser briefly

describes the gist of the ten invited and six contributed papers. If any Board Members would like to see this summary, I will gladly supply them with a copy. Chromatic adaptation is an important tool used for the purpose of studying color vision, and may eventually provide clues for developing the ultimate in color difference equations.

As in the past, the ISCC Annual Meeting was a two-day affair. Project Committee 10 on the Color-matching Aptitude Test, which is marketed by the Federation, will probably be put on stand-by status until the time that we exhaust our present inventory of tests and must decide about whether or not to put together another group. The Project Committee (34) on Color Differences will require a new chairman. An experimental program set up by that committee is floundering after having discovered that the samples scheduled for use were unusable. In the "Determination of the Strengths of Colorants: Pigment Section" Project Committee (25P), the results, to date, of a round robin indicated that the standard errors in determining tint strength (expressed in percentages of tint strength) were: instrument 0.65% tint strength; spray 1.0%; grind 1.96%; and a between laboratories error of 4.4%. There was an indication that specular excluded measurements were more accurate than those made with the specular component of reflection included. This first study was conducted with nonmetameric green pigments and is expected to be expanded in the future to other color families and possibly metameric pigments. Project Committee (37) on "Artists Materials" is quite concerned over the mislabeling of artists pigments and, also, is looking for quick methods of determining the tinting strength of artists pigments.

With the election of R. Marcus to the ISCC Board of Directors, three members of the Federation will be either Officers (F. W. Billmeyer, Jr., Secretary) or Directors (Bender, Marcus) of the ISCC for 1980.

Planning for the 1981 Louisville Symposium on Color Appearance and Instrumentation (SCAI) is going strong. Dr. David Wright will be one of the speakers. He will talk about the origins of the 1931 CIE system of color specifications, which he helped develop. All but two papers are firmly committed, and we are awaiting information from the Manufacturer's Council on Color and Appearance (MCCA) on the workshops. We hope to finalize the remaining papers within a couple of weeks. The ISCC Committee would also like to reactivate an earlier proposal to separate the color and optics terms from the Coatings Dictionary.

A meeting of the ISCC Committee was held during the ISCC Annual Convention, at which the status of the SCAI was discussed, in addition to possible nominations for the ISCC Macbeth and Godlove awards. Jim Cave was added to the DCMA Award Subcommittee, as Dennis Osmer resigned from that subcommittee. The ISCC Committee will also continue to compare the 1978 version of the Color-matching Aptitude Test with the 1964 version. A meeting of the ISCC Committee is planned at the Annual Meeting of the Federation in Atlanta.

R. T. MARCUS
Chairman

MANUFACTURING

The Federation Manufacturing Steering Committee met January 23, in Chicago. Five of the seven members were in attendance. Also attending was the Manufacturing Committee Chairman of the Kansas City Society.

A presentation on "Safety" is being arranged for the Annual Meeting in Atlanta. The Steering Committee will meet again to finalize details for the session. Gil Cain, of Hercules, has agreed to be a participant.

The Pacific Northwest Society has been designing an "In-Plant Materials Handling Data Sheet." This item was reviewed by the Steering Committee and Dick Stewart, of PNW Society, so further details can be discussed.

Work is proceeding on slide/tape programs. The presentation of the Toronto Society. "Introduction to Resin Operations" should be available in the next few months. Three other programs were previewed and critiqued at the Chicago meeting: "Sand Mill Operation" (Kansas City), "Cartridge Straining" (Houston), and "MSM Filling Machine" (New York). The committee agreed that all three were worthwhile and the Societies are being encouraged to revise and update the programs as soon as possible.

Two other projects were considered: (1) Computers in the paint plant, and (2) Waste water and solvent reclamation and re-use. Definitive proposals will be considered by the Steering Committee.

Two new members have joined the Steering Committee this year and their efforts have been highly commendable: John Wood (Detroit) and Richard Max (New York).

D J. FRITZ
Chairman

MATTIELLO LECTURE

The Mattiello Lecturer for 1980 is Dr. Percy E. Pierce, of PPG Industries.

An updated list of potential lecturers has been prepared and all files have been transferred to the next Chairman, Felix Liberti.

The philosophy and intent of the lecture was reviewed again to assure conformity with the scope of this important Federation function.

THOMAS J. MIRANDA
Chairman

METRIC SYSTEMS

Communications with the United States Metric Board (USMB) have been established and maintained.

Direct activities have been confined, currently, to assembling an updated table of recommended, industry-related, metric units with a view toward publishing them in the JCT to provide a uniform guide. The committee is also reviewing our 1974 recommendations on "how to convert a paint plant to metric." The object is to revise it, where necessary, in the light of experience. This work is expected to be completed by early summer.

Continued inaction by NPCA's "Metric Task Force" has delayed the industry's move toward implementation and impedes more direct and fruitful work by our committee. It is hoped that this inaction will not continue much longer, so that a proper conversion plan for our industry can be developed and submitted at a reasonable date.

Close liaison has also been maintained with the Canadian Metric Commission, where conversion is considerably further advanced.

E. L. HUMBURGER
Chairman

PROGRAM

The 1980 Program Committee, comprised of eight members, was organized during the summer of 1979. The committee has held two meetings, in September and October 1979. The program theme selected by the committee is "Three R's for the Eighties: Research, Resources, Regulations." Papers address-

ing this theme have been invited from sources inside and outside of the Federation, in North America and overseas.

Tentatively, the 1980 program is full, with some attractive papers available over and above what we can schedule. The remaining uncertainties exist because Constituent Society and Roon Awards deadlines are still in the future, because of lack of confirmation on two invited overseas papers, and because we have requested informal manuscripts from several speakers as prerequisite to final acceptance.

Six symposia on specific topics are planned, in addition to the Constituent Society, Roon, overseas, and general "theme" papers. These symposia are:

(1) Corrosion Control.
(2) Safety (Manufacturing Committee).
(3) Federation Correspondence Course (Education Committee).
(4) "Information: A Resource for the Eighties" on computer utilization (Technical Information Systems Committee).
(5) Waste Disposal (Environmental Control Committee).
(6) Present and Future PRI Research Programs.

In addition to the conventional program sessions, the Program Committee is organizing a Gadgets and Gimmicks competition and display.

HUGH W. LOWREY
Chairman

PUBLICATIONS

The Publications Committee held its annual meeting in Philadelphia on March 18. This year, for the first time, members of the Editorial Review Board were invited to attend.

The following topics were reviewed:

Technical paper supply is excellent. Supply occurs through voluntary submission of authors and by pursuit of ACS and other society meetings and symposia.

Publication costs are increasing, requiring careful selection of manuscripts and urging authors to reduce the number of pages through condensation and the use of references.

Journal features involved some discussion. We need more information related to environment issues. Input is to be obtained from the Environmental Control Committee, NPCA, and by soliciting someone to write a column to apprise readers of urgent regulatory issues.

Federation booklets which are outdated will be revised. The Technical Advisory Committee should follow up after the Federation Staff and review board members recommend units to be revised and will recommend authors. Sales of the booklets are excellent. Other excellent sellers include the "Infrared Atlas," "Pictorial Standard of Coatings Defects," and "Paint/Coatings Dictionary."

JCT content. There was some discussion on the balance of content in JCT. In some issues, too many theoretical papers are published, restricting readership interest. Efforts will be made to strike a better balance. An editorial comment will be prepared to solicit manuscripts from authors who may not now be using JCT as a publishing medium. Several other techniques for obtaining manuscripts will be pursued.

There is still a need to improve Society Papers to accommodate the effort put forth by Technical Committee members. Authors should be encouraged to follow the "Guide for Authors," and Societies must critique their own papers before submission.

The mechanics of review procedures was reviewed, and constructive criticism presented to improve assignment and to provide feedback to reviewers. A "Guideline for Reviewers" will be prepared by the Chairman and submitted to the Vice Chairman for refinement.

We shall attempt to include other features as time and resources permit.

The joint meeting was a success and will be repeated every other year.

THOMAS J. MIRANDA
Chairman

ROON AWARDS

The Roon Awards Competition seems in good shape this year. Fourteen people indicated that they intend to write papers. This represents a 40% increase over the number of entries in the last two years.

Ten entries are from industry or government agencies, while four are from universities.

Hopefully, most of these expressions will soon be translated into actual papers. The Program Chairman will be advised as soon as possible of the papers qualifying for presentation.

UMBERTO ANCONA
Chairman

TECHNICAL ADVISORY

As chairman of the Technical Advisory Committee, I have focused the Federation's program around the annual meeting of the Society Technical Chairmen. This year was the second such meeting under my direction. In 1979 we had representatives from 22 Societies and this year from 21 Societies.

A number of goals were established and I believe many of them were achieved.

(1) To build enthusiasm with the chairman of the respective Society, to try to achieve greater involvement by the membership.

We opened by reminding the participants that the Federation is a technical body. The role of the Technical Committee Chairman within the Society is undoubtedly the most important chairmanship in the Society, ranking in significance (if not in prestige) with that of the Society President.

We pointed out that one of the first duties of the job is to instill enthusiasm in the membership for participation in Society projects. We suggested that there are many benefits to working on technical projects that should be emphasized to the membership. The educational aspect of involvement is a theme that should be strongly stressed. The excuse offered by many members, of knowing nothing about the subject of a particular project, is the very reason that members should become involved. We found strong support for the idea of providing a certificate identifying participants who work through the completion of a project. (The Philadelphia Society has used this practice for some time.) Such certification is a means for the Society to acknowledge the members' contribution. Another factor worthy of consideration is that it provides some substantive proof of an individual's experience in a specific subject.

(2) Provide an environment where we could develop an interchange of ideas.

To this end we commenced our meeting in the early afternoon and concluded in mid-afternoon of the following day. We planned a luncheon, dinner, and evening

mixer in order to achieve maximum exposure for each participant.

(3) Provide a forum where each chairman could both report on the activities of his Society, as well as answer questions from other participants.

(4) Provide new ideas for Society projects.

In 1979, we developed a variety of ideas which were presented by members of the Technical Advisory Committee.

In 1980, we reduced the number of subjects under discussion in order to provide greater time to discuss each in detail. Subjects discussed were as follows:

(A) For the second year, we discussed the role that the Society could play in evaluating new "mildew-resistant" polymers. Attention has been focused on the work that Dr. Pittman is doing in this area under the aegis of PRI. It is felt that the Societies could collectively provide the considerable power needed to evaluate the many variables that such a project demands.

(B) Corrosion Studies. Within this extensive subject, we have focused attention in the area of anti-corrosive pigments in water-borne systems. It is generally acknowledged that the subject has a huge number of ramifications. Therefore, there is not likely to be extensive duplication even if a large number of Societies develop projects on the subject.

(C) The consumers' need for meaningful product identification. We have long recognized the need for retail products to be identified in a manner which can be easily comprehended by the consumer. The industry as a whole has only just begun to address the issue.

The basis on which any system must work has to relate to product performance. The challenge which we present is to establish meaningful, reproducible test methods which can be translated into an alpha-numeric grading system.

(D) Use and Application of the Micro-Computer. We invited, as guest speaker, a computer expert and programmer. He presented an overview of the state of the art, together with an account of an actual program detailing the capabilities of the Micro-Computer. A Radio Shack unit, TRS80, was available for demonstration as a typical piece of equipment.

To measure the effectiveness of this meeting, we subsequently circulated a questionnaire. The questions and answers are summarized below. (Total of 16 responses.)

(1) Was your attendance at this meeting beneficial to you as a Society Technical Committee member?

Yes - 16 No - 0

(3) Meeting subject content (topics presented including informational material sent to you prior to the meeting).

Very good - 7 Good - 7 Fair - 1

(4) Meeting organization (agenda, time periods, staffing, etc).

Very good - 13 Good - 2 Fair - 0
(One respondant wrote in "Excellent")

(5) Physical arrangements (meeting site, rooms, room arrangements, materials, etc.).

Very good - 13 Good - 3 Fair - 0

Questions 2, 6, and 7 called for subjective answers.

(2) If yes, (answer to question 1.), please list specific benefits. Fifteen replies cited comments, which may be generalized as follows:

1. Interaction with other Technical Chairmen.
2. Exposure to the problems of other Societies.
3. New project ideas.

(6) Suggestions for improving this meeting. (Twelve responses.)

Most of the answers to this question indicated that the participants wanted more time to discuss topics of specific interest to them.

(7) Other comments. (Nine responses.)

Comments generally specified certain topics which participants would like to see included on the agenda of future meetings.

Overall, the meeting objectives were achieved. Considering the distance that some participants traveled, I believe that we made full use of our limited time. The response and enthusiasm of the Society Chairmen was very gratifying and I am recommending to the Board of Directors that this type of meeting be continued and endorsed.

One other comment should be brought to the attention of the Board of Directors. It is my opinion that an area of communication that has been neglected is the one between the Technical Advisory Committee and PRI. The Technical Committees which exist within the Federation represent a substantial resource of talent and ability. Use of this resource in any kind of cooperative project such as the work which Dr. Pittman is doing will provide an immense improvement in the image of PRI at the grass roots level of our industry.

We believe that a workable forum needs to be created to provide an interaction of ideas between the Society Technical Committee and PRI. Surely the Technical Advisory Committee should be a prime candidate when considering the media for this objective!

COLIN D. PENNY
Chairman

TECHNICAL INFORMATION SYSTEMS

The Technical Information Systems Committee has engaged in, or is currently engaged in, the following activities:

(1) The preparation of the Subject/Keyword Index to the JOURNAL OF COATINGS TECHNOLOGY (JCT) for 1979;

(2) The submission of contents of leading coatings journals to the JCT for its "Technical Articles in Other Publications" department.

(3) The compilation of a bibliography on the "Technical Uses of Computers in the Coatings Industry" as the Federation's project for the International Committee for Coordinating Activities of Technical Groups in the Coatings Industry (ICC);

(4) The planning of a session on uses of computers in the coatings industry, as part of the program at the Annual Meeting in Atlanta.

HELEN SKOWRONSKA
Chairman

DELEGATE TO NATIONAL ASSOCIATION OF CORROSION ENGINEERS

This delegate attended the 1980 Annual Meeting of the National Association of Corrosion Engineers, in Chicago, Illinois, March 3-7.

This year's meeting program listed over 270 papers; to accommodate these in the five days of the meeting, there were at any one time up to 28 simultaneous technical sessions from which to choose. Add to this the meetings of over 70 Technical Committees (which are open to anyone interested), three courses on various aspects of corrosion, and a Show with exhibits by over 95 companies. There were also dozens of hospitality suites where ideas could be exchanged in a more informal setting with others involved in similar fields of interest.

Corrosion protection by coatings is only one of the many interests of NACE. This year, however, coatings were highlighted at the plenary lecture, which is roughly NACE's equivalent of our Mattiello Lecture. The title of this year's lecture was "Can Coatings Protect Steel Successfully? What Are the Ingredients of Success?," and was authored by the well-known Archie N. McKelvie, of the British Paint Research Association. Mr. McKelvie discussed the various factors that make up a successful paint job, ranging from proper formulation to surface preparation, application, and inspection.

The main group of papers dealing specifically with coatings were assembled in a Symposium sponsored by Group Committee T-6, and entitled "Pollution-Permeation-Protection." The papers were, in general, interesting and of good quality. However, they had only a marginal, and sometimes forced, connection to the publicized title of the Symposium. The papers covered the subjects of analysis of successful and unsuccessful case histories, coal-tar epoxies, coatings and cathodic protection, system design, urethanes, coatings for process industries, zinc-rich coatings, accelerated testing, and surface profile and adhesion.

Another coatings-related symposium, this one on quality assurance, sponsored by Committee T-6Q, was closer to target, with papers on quality control, quality assurance, inspection and instruments for it, and failure analysis.

Among the committee meetings, Group T-6A, on Coatings and Linings for Immersion Service, reviewed the activities of its many task groups, including thermosetting linings, theoretical coverage of zinc-rich coatings, electrical testing, repair and maintenance, cathodic protection, water extraction, and review of numerous publications.

Surface Preparation is the subject of Group Committee T-6G; activities reviewed at its meeting included inspection aids, wet blasting, chemical cleaning, field measurement, contaminated steel and concrete, galvanized steel, surface profile, and performance of coatings on wet-blasted surfaces.

Group Committee T-6H, on Coatings Materials for Atmospheric Service, issued a Report on its comprehensive 10-year test on "The Effect of Surface Preparation on the Service Life of Protective Coatings," which comprised over 2000 panels and computerized data handling. This is one of the most complete and thorough studies on the subject ever made anywhere, and copies of the Report are available at a modest fee from NACE headquarters.

In all, it was an exciting and exhausting week, which reaffirmed once more the tremendous vitality of the corrosion community.

THOMAS GINSBERG
Delegate

DELEGATE TO SSPC

The Steel Structures Painting Council (SSPC) holds two meetings per year, usually during the Spring and Fall. These meetings usually last three days in order to allow adequate time for all "Advisory" Committees to complete their activities. The last meeting was held in Pittsburgh, Pa., November 27–29, 1979.

This meeting was attended by 138 representatives of paint manufacturers, raw material suppliers, and users of coatings for steel, e.g., steel fabricators. Of those attending, 45 are members of the Federation.

The following are the highlights of the meeting. The committee Chairmen who are Federation members are listed with their Society affiliation.

SSPC Main Meeting

(1) John Keane (Pittsburgh) has been appointed Executive Director of SSPC. Joe Bruno takes his place as Director.
(2) John Keane reported on the various research projects, exposure tests, revision of Volumes 1 and 2 of the SSPC Manual and future plans.
(3) J. Bruno reviewed progress on Project PACE (Performance of Alternate Coatings in the Environment).
(4) R. Weaver reviewed a survey on present and new methods of surface preparation.
(5) Dr. Bernard Appleman (Baltimore) reviewed projects being sponsored by FHwA (Federal Highway Administration).
(6) Dr. Richard W. Drisko (Los Angeles) reviewed the joint project between SSPC and the U.S. Navy Civil Engineering Laboratory on the relationship among surface preparation, profile, adhesion and durability.

Advisory Committee Meetings

(1) Chlorinated Rubber Paints. Chairman—Henry R. Stoner (New York). Chlorinated rubber paints with zinc-rich primers have been found to be very durable in seven-year exposures. An SSPC specification should be prepared to replace TT-P-1046A zinc-dust primer being phased out by GSA for conversion to a CID (Commercial Item Description). Work will be started to evaluate replacements for lead and chromium in primers for potable water tanks.
(2) Coal Tar Epoxy Paints. Chairman—Henry R. Stoner (New York). Draft #3 of SSPC Paint X16X-79P received a 28 to 1 vote. The negative vote will be resolved by revising the Safety Section. The Corps of Engineers and the American Wood Preservers Association have found that coal-tar coatings can be used safely if good hygienic and safety procedures are followed.
(3) Epoxy Coatings. Chairman—Dean Berger (Philadelphia). All negative votes on Draft #10 of SSPC-Paint EP-X2X-79P epoxy polyamide coatings were resolved.
(4) Highway Research Projects. Chairman—Dr. Bernard R. Appleman (Baltimore). The Federal Highway Administration and/or State Highway Department projects on coatings for corrosion protection of steel were reviewed. The following projects will be initiated in 1980: Controlled Cavitation Blasting of Highway Steel; Improved Field Reliability of High Performance Coatings.
(5) Maintenance Painting. Draft #3 of SSPC PA-X3X-78P "Maintenance Painting Guide" was reviewed. A subcommittee will prepare Chapter VII of the revised manual—"Programmed Maintenance Painting."
(6) New Surface Preparation Methods. Chairman discussed the new technology, OSHA restrictions, the effect on the environment and structural shapes. A review was conducted on classification of methods of surface preparation. Results of the literature search were reviewed. Various new methods of surface preparation were discussed.

(7) PACE (Performance of Alternate Coatings in the Environment). Chairman—William C. Johnson (Philadelphia). A PACE report dated Aug. 20, 1979 is now available. Permission has been received to identify 50–60% of the proprietary paints exposed. New studies will include LoSolve, high-solids, water-borne, nontoxic pigments and chlorinated solvents.

(8) Performance Specifications. Laboratory accelerated tests have been found to be unreliable to predict field performance. To avoid this trap, performance criteria based on an arbitrary scale and relating equally to all generic types of coatings will be developed. The first test will be salt fog performance. Data will be collated from SSPC and FHwA data.

(9) Surface Preparation. The surface preparation Specs (SP-1, SP-2, SP-5, SP-6, SP-7 and SP-10) were reviewed for final approval.

(10) Vinyl Coatings. Chairman—Tom Ginsberg (New York). Comments on Draft #1 of SSPC Paints X8X-79P and X9X-79P were reviewed. The changes agreed on will also be included in SSPC Paint X106X-79P.

(11) Revision of Volume 2. Co-Chairman—Sidney Lauren (Cleveland). The proposed layout of the new Volume 2 (Specifications) was reviewed. Sections will be as follows: General; Painting Systems; Paints; Surface Preparation; Pretreatment; Paint Application; Maintenance Painting; Safety Requirements. The possibility of preparation of a new Volume 3 (Specifications of Contractual Quality) was discussed. It was agreed that performance of any painting system depends on: Surface preparation; Film thickness; Nature of the paint. It was agreed that paint systems should be classified in two cost/quality levels: Standard; Economy.

(12) Revision of Volume I. Chairman—Dean M. Berger (Philadelphia). The various chapters to be rewritten have been assigned and are in various stages of preparation or review.

(13) Water-Borne Epoxy Coatings. Chairman—Edward G. Bozzi (New York). Data will be requested from suppliers, then the committee will prepare the initial draft of the performance specification.

(14) Zinc-Rich Performance. Chairman—Norbert Intorp (Western New York). Draft #1 of the tentative specification was reviewed in great detail and modified. Draft #2, resulting from this review, will be distributed for review.

(15) Zinc-Rich Topcoating. Chairman—Walter Pregmon (Philadelphia). Assignments were made to investigate the following in preparation for a guide: Primer treatment; Primer preparation prior to topcoating; Inspection and testing; Compatibility of topcoat; Topcoats; Application.

(16) Aluminum-Pigmented Coatings. The committee has been working with the Aluminum Association Technical Committee in Powders and Pigments to establish the energy-saving effect of aluminum-pigmented coatings. A report is being prepared for publication. The final draft of SSPC—Paint XAL-1X-79P "High Build Thixotropic Leafing Aluminum Paint" has been approved for publication.

(17) Inspection/Application. A pocket-size inspection manual is in preparation.

(18) Low-Cost Shop Paints. Chairman—William C. Spangenberg (Pittsburgh). Draft #13 is being redrafted since some raw materials specified are no longer available.

(19) Silicone Alkyds. Chairman—William A. Finzel (Detroit). The committee has completed its work and therefore did not meet.

(20) Urethanes. The "Urethane Guide" is complete except for resolution of one negative vote concerning the writing style. This will be done by a style committee. Future work will include preparation of specifications on: Primer; Intermediate coat; Topcoat; Complete paint system.

(21) Water-Base Coatings. Chairman—Arnold J. Eickhoff (New York). Specifications for the Primer, Topcoat, and System have been approved and have been presented to the SSPC Executive Committee for approval. The Committee will submit three primers varying in performance from "excellent" to "poor" to be exposed in the PACE program.

Activities by Delegate

I am rewriting the following chapters for Volume 1 of the SSPC manual: Paint Materials; Paint Application; Scaffolding; Safety.

The chapters were sent to a total of about 150 reviewers (in aggregate) and are now being revised in accordance with the suggestions of over 50 (in aggregate) who replied.

SIDNEY B. LEVINSON
Delegate

DELEGATE TO NPCA AND GOVERNMENTAL AGENCIES (Environmental Control)

As most of the activities that concern the coatings industry in the field of regulations have been directed to regulations based on the Clear Water Act of 1977 and the Resource Conservation and Recovery Act of 1977, your delegate has been a part of the NPCA Task Force on Water Quality/Waste Management.

Several meetings have been held by this task force to present the industry's positions on regulations covering the discharge of waste water and to provide information for the Environmental Protection Agency to have latex paint wastes deleted from the list of toxic wastes.

Your delegate also serves on the Labeling Committee of the NPCA, which prepared a second edition of the Labeling Guide. At the present time, the Labeling Committee is considering the regulations proposed by the Environmental Protection Agency under its authority of the Toxic Substances Control Act.

Your delegate will continue to attend those meetings and participate in their activities so that liaison between the NPCA and the FSCT can be maximized.

S. LEONARD DAVIDSON
Delegate

The next Board of Directors Meeting will be held on Tuesday, October 28, at the Hyatt Regency in Atlanta.

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TANKS A LOT FOR YOUR BUSINESS.

Pigment Synergism And Pigment Antagonism In Automotive Pigmentation

Sol Panush
Celanese Plastics and Specialties Company*

One hundred forty pigments of automotive potential were thoroughly evaluated in thermosetting acrylics, including 24 months of South Florida exposure, in over 4,000 colors to define specific areas of synergism and antagonism. The blending of unacceptable pigments to yield an acceptable system, or pigment synergism, is documented in detail across the color spectrum. The negative action of a blend of acceptable pigments which yield an unacceptable system, or pigment antagonism, is isolated and defined. Pigment antagonism is a term coined by the author to describe this unusual phenomenon.

Since the most expensive and chemically sophisticated pigments are required to meet the ultimate performance requirements of automotive pigmentation, the understanding of pigment synergism and pigment antagonism will yield rich rewards in both cost savings and aesthetic possibilities.

INTRODUCTION

Synergism and antagonism are critical to automotive pigmentation where requirements are stringent.

SYNERGISM: "A phenomenon where the mixed effect of two influences is greater than the sum of the two influences acting separately"[1] as defined in the *Paint/Coatings Dictionary*. A preferred pigment-related definition would be: the cooperative action where the blending of unacceptable pigments yields an acceptable system whose total effect is greater than the sum of the individual parts.

ANTAGONISM: This is not defined in the *Paint/Coatings Dictionary*. Pigment antagonism is a term coined by the author to describe the unusual phenomenon of a negative action where the blending of acceptable pigments yields an unacceptable system whose total effect is less than the sum of the individual parts.

The most expensive and chemically sophisticated pigments are required to meet the stringent needs of automotive pigmentations. A complete understanding of pigment synergism, pigment antagonism, and utilization of this knowledge will yield aesthetic quality, cost savings, and complete acceptability for all automotive manufacturers. Pigments of automotive potential that were thoroughly evaluated in thermosetting acrylic systems including 24 months of South Florida exposure, at various levels and blend ratios, yielded over 4,000 metallic and nonmetallic colors.

Table 1 lists those pigments that, when evaluated individually with either titanium dioxide (nonmetallics) or aluminum flake (metallics), or in combination with other pigments, yielded at least *one* usable system. Any alteration exhibited either synergistic or antagonistic features as noted in the Appendix.

SYNERGISM

Pigment synergism occurs in automotive enamels under specific conditions. These conditions are determined by the pigments, their levels, and the value of the color. Altering the relationship of the pigments in the synergistic system by increasing the level of one or the other, increasing or decreasing the reducing pigment (e.g., aluminum, titanium dioxide, etc.), or adding other colored pigments can totally negate the synergistic effects of the pigments in the initial color.

Synergism was initially encountered with a 1967 Chrysler color (BAY-2K6 Turbine Bronze Metallic) where the use of transparent yellow oxide upgraded the system into the usable range for both Florida exposure fade and exposure bronzing. The *Paint/Coatings Dictionary* defines bronzing as "a subjective, descriptive,

Presented by Mr. Panush at the 57th Annual Meeting of the Federation of Societies for Coatings Technology, October 5, 1979 in St. Louis, Mo.
*Automotive Div., 1700 Caniff, Detroit, Mich. 48212.

Table 1—Pigments Evaluated

Pigment and Supplier	Manufacturer's Pigment Code	Color Index Name	C.I. Number
Titanium Dioxides			
DuPont	R960HGHG	White A-7	Not assigned
Glidden	RCL-6	White A-7	Not assigned
LaPorte	RO-676	White A-7	Not assigned
Yellows			
I. Anthrapyrimidine			
BASF	#1560	Yellow 108	68420
Harmon	Y-5783	Yellow 108	68420
II. Flavanthrone			
Harmon	Y-5743	Yellow 24	70600
ICI	FRS (FR)	Yellow 24	70600
III. Nickel Titanate			
Ferro	V-9440	Yellow 53	77788
Glidden	Titanium Yellow/ Golden	Yellow 53	77788
Hercules	#10401	Yellow 53	77788
Siegle GmbH	AMFG	Yellow 53	77788
IV. Chelated Azo			
Ciba-Geigy	5GT (Copper)	Yellow 129	Not assigned
DuPont	YT-714-D (Nickel)	Green 10	12775
V. Isoindolinone			
Ciba-Geigy	2GLT	Yellow 109	Not assigned
Ciba-Geigy	3RLT	Yellow 110	Not assigned
VI. Chrome Yellow			
Hercules	X-2777	Yellow 34	77603
Hercules	X-3218	Yellow 34	77600
VII. Krolor Yellow			
DuPont	KY-781-D	Not assigned	Not assigned
DuPont	KY-795-D	Not assigned	Not assigned
VIII. Isoindolin			
BASF	2140HD	Yellow 139	Not assigned
BASF	#1840	Yellow 139	Not assigned
IX. Benzimidazolone			
Hoechst	H3G	Yellow 154	Not assigned
Hoechst	H6G	Not assigned	Not assigned
X. Mono Azo (without lake forming groups)			
Hoechst	H5G-70	Orange 62	Not assigned
XI. Quinacridone			
DuPont	YT-815-D	Orange 49	Not assigned
DuPont	YT-823-D	Orange 48	Not assigned
XII. Chrome Titanate			
Ferro	V-9130	Yellow 118	77894
Glidden	LP-4	Yellow 118	77894
Harshaw	#7370	Yellow 118	77894
Siegle GmbH	3FFG	Yellow 118	77894
Orange			
I. Molybdate Orange			
DuPont	YE-698-D	Red 104	77605
DuPont	YE-637-D	Red 104	77605
Hercules	X-3390	Red 104	77605
Hercules	X-3386	Red 104	77605
II. Krolor Orange			
DuPont	KO-786-D	Not assigned	Not assigned
DuPont	KO-789-D	Not assigned	Not assigned
III. Imidazole			
Harmon	OV-5982	Orange 43	71105
Hoechst	Orange GR	Orange 43	71105
IV. Di Brom Anthanthrone			
Harmon	OV-5974	Orange 3	59300
Hoechst	RK	Orange 3	59300
ICI	Red Y	Orange 3	59300
V. Benzimidazolone			
Hoechst	HGL	Orange 60	Not assigned
VI. Mono Azo (without lake forming groups)			
Hoechst	HL-70	Orange 36	11780
VII. Pyranthrone			
BASF	2640	Orange 51	Not assigned
BASF	3040	Orange 52	Not assigned
VIII. Quinacridone			
DuPont	YT-800-D	Not assigned	Not assigned

Table 1—Pigments Evaluated *(Continued)*

Pigment and Supplier	Manufacturer's Pigment Code	Color Index Name	C.I. Number
Reds And Maroons			
I. QUINACRIDONE			
A. *Red*			
DuPont	RT-759-D	Violet 19	46500
DuPont	RT-233-D	Not assigned	Not assigned
Harmon	R-6730	Violet 19	46500
Hoechst	13-7002	Violet 19	46500
Sun	228-3620	Violet 19	46500
B. *Magenta*			
DuPont	RT-243-D	Red 202	73915
Harmon	RV-6843	Red 202	73915
Hoechst	13-7000	Red 122	73915
Sun	228-2410	Red 122	73915
C. *Maroon*			
DuPont	RT-792-D	Red 206	Not assigned
D. *Scarlet*			
DuPont	RT-218-D	Not assigned	Not assigned
II. PERYLENE			
A. *Orange*			
Ciba-Geigy	BPT	Red 224	Not assigned
Harmon	R-6418	Red 224	71127
B. *Red*			
Harmon	R-6434	Red 179	71130
C. *Maroon*			
BASF	#3920	Red 179	71130
Harmon	R-6424	Red 179	71130
III. BIS AZO CONDENSATION			
Ciba-Geigy	Scarlet R	Red 166	Not assigned
Ciba-Geigy	Red BR	Red 144	Not assigned
IV. PYRANTHRONE			
BASF	3340	Red 226	Not assigned
BASF	3530	Red 216	Not assigned
Harmon	R-6430	Red 197	59710
V. MANGANESE BON			
American Cyanamid	20-6485	Red 48:4	15865
DuPont	RT-695-D	Red 48:4	15865
VI. THIO INDIGO			
Harmon	MV-6606	Red 88	73312
Harmon	MV-6667	Red 88	73312
Hoechst	MR	Red 88	73312
Violets			
I. QUINACRIDONE			
DuPont	RT-887-D	Violet 19	46500
DuPont	RT-733-D	Violet 19	46500
Harmon	RV-6902	Violet 19	46500
Hoechst	13-7011	Violet 19	46500
Sun	228-1119	Violet 19	46500
II. CARBAZOLE DIOXAZINE			
Harmon	B-4020	Violet 23	51319
Hoechst	14-4008	Violet 23	51319
Sun	246-1670	Violet 23	51319
Blues			
I. PHTHALOCYANINE			
BASF	#7560	Blue 16	74100
Ciba-Geigy	LGLD	Blue 15:3	74160
DuPont	BT-479-D	Blue 15:2	74160
DuPont	BT-284-D	Blue 15:1	74160
Harmon	B-4714	Blue 15:1	74160
Harmon	B-4804	Blue 15:1	74160
Hoechst	AFN	Blue 15	74160
Imperial	X-3485	Blue 15	Not assigned
Sun	248-1657	Blue 15:1	74250
II. IRON BLUE			
Chemetron	IBX-64	Blue 27	77510
Harshaw	4028AR	Blue 27	77510
Hercules	X-2285	Blue 27	77510
Hercules	X-3163	Blue 27	77510

Table 1—Pigments Evaluated *(Continued)*

Pigment and Supplier	Manufacturer's Pigment Code	Color Index Name	C.I. Number
III. INDANTHRENE BLUE			
BASF	#6470	Blue 60	69800
Ciba-Geigy	A3R	Blue 60	69800
ICI	3RS	Blue 60	69800
Sandoz	6583-0	Blue 60	69800
Blacks			
Cabot	#2	Black 7	77266
Cabot	BP1300	Black 7	77266
Cabot	#900	Black 7	77266
Cities Service	#14	Black 7	77266
General Carbon	#30	Black 7	77266
Browns			
I. TRANSPARENT RED IRON OXIDE			
BASF	Sicotrans 400	Red 101	77491
Chemetron	RT-9000	Red 101	77491
Hilton-Davis	30-1010	Red 101	77491
II. TRANSPARENT YELLOW IRON OXIDE			
BASF	Sicotrans 200	Yellow 42	77492
Chemetron	YT-9001	Yellow 42	77492
Hilton-Davis	30-0549	Yellow 42	77492
III. RED OXIDE			
Bayer	180FM	Red 101	77491
Cities Service	#98	Red 101	77491
Pfizer	RO-3097	Red 101	77491
Pfizer	RO-4097	Red 101	77491
Pfizer	RO-5097	Red 101	77491
Pfizer	RO-8097	Red 101	77491
Pfizer	R-1299	Red 101	77491
Reichard-Coulston	#1400	Red 101	77491
Reichard-Coulston	#1445	Red 101	77491
IV. YELLOW OXIDE			
Cities Service	#1050	Yellow 42	77492
Cities Service	#1000	Yellow 42	77492
Pfizer	XLO-2288	Yellow 42	77492
V. BROWN—ORGANIC			
Ciba-Geigy	5R	Brown 23	Not assigned
Hoechst	HFR (Benzilaziline)	Brown 25	12510
Sandoz	RL	Not assigned	Not assigned
Greens			
I. PHTHALOCYANINE			
BASF	#9360 (Yellow)	Green 36	74265
DuPont	GT-751-D (Standard)	Green 7	74260
DuPont	GT-805-D (Yellow)	Green 36	74265
Harmon	G-5400 (Yellow)	Green 36	74265
ICI	6Y (Yellow)	Green 36	74265
Sun	264-8142 (Standard)	Green 7	74260
Sun	264-4444 (Yellow)	Green 36	74265
Aluminums			
Alcoa	#7374 Medium	Not assigned	Not assigned
Alcoa	#7471 Medium-Fine	Not assigned	Not assigned
Reynolds	8-332 Fine	Not assigned	Not assigned
Reynolds	8-334 Fine	Not assigned	Not assigned
Silberline	SS-5000 Sparkle Fine	Not assigned	Not assigned
Silberline	L-582 Medium	Not assigned	Not assigned
Silberline	SS-3333 Sparkle Medium	Not assigned	Not assigned
Silberline	SS-3141 Sparkle Coarse	Not assigned	Not assigned
Silberline	SS-3124 Sparkle Coarse	Not assigned	Not assigned

Table 2—Experimental Pigment Blends To Develop Synergistically Usable Color Areas

(1) **Grays**
- a. Aluminum with Titanium Dioxide

(2) **Yellows and Golds**
- a. Anthrapyrimidine with Chrome Yellow—Nonmetallics
- b. Flavanthrone with Transparent Yellow Iron Oxide and Phthalocyanine Greens—Metallics

(3) **Oranges and Coppers**
- a. Imidazole Orange with Molybdate Orange—Nonmetallics
- b. Quinacridone Gold with Transparent Yellow Iron Oxide—Metallics
- c. Flavanthrone with Transparent Red Iron Oxide—Metallics

(4) **Reds and Maroons**
- a. Quinacridone Violet with Extra Deep Perylene Maroon—Metallics
- b. Quinacridone Red with Perylene and Transparent Iron Oxide—Metallics
- c. Quinacridones (Magentas, Reds, and Violets) with Molybdate Orange—Nonmetallics
- d. Thio Indigo Reds with Red Iron Oxides—Nonmetallics

(5) **Blues and Violets**
- a. Iron Blue with Phthalocyanine Blues—Nonmetallics
- b. Phthalocyanine Blue with Indanthrene Blue—Metallics
- c. Carbazole Dioxazine with Phthalocyanine Blue and/or Indanthrene Blue—Metallics and Nonmetallics
- d. Quinacridone Red with Phthalocyanine Blue—Metallics and Nonmetallics

(6) **Browns**
- a. Iron Blue with Molybdate Orange—Nonmetallics
- b. Organic Brown with Transparent Red Iron Oxide—Metallics
- c. Perylenes with Transparent Red Iron Oxide—Metallics
- d. Phthalocyanine Green with Transparent Red Iron Oxide—Metallics

(7) **Greens**
- a. Flavanthrone with Phthalocyanine Green and Transparent Red or Yellow Iron Oxide—Metallics
- b. Phthalocyanine Blue with Chrome Yellow—Nonmetallics
- c. Nickel or Copper Azo with Phthalocyanine Green and Transparent Yellow Iron Oxide—Metallics

(8) **Ceramics**
The blending of inorganic and organic pigments with aluminum, which produces these aesthetic colors while yielding previously unattainable 24-month exposure durability, plus overcoming formulation difficulties and cost restrictions.[3]

SOL PANUSH is a Development Associate with the Automotive Division of Celanese Plastics and Specialties Co., having joined that company in 1948. His thirty-nine year background in pigment evaluation and dispersion process engineering has led to many innovations in the coatings field. He holds a patent on transparent pigment dispersion process and is a recognized authority in the pigment field. Mr. Panush received his B.S. Degree in Chemical Engineering from Wayne State University.

appearance term applied to the metal-like reflectance which sometimes appears at the surface of nonmetallic colored materials. It is perceived at the specular angle, by observing the image of a white light source, for example, and is characterized by a distinct hue of different dominant wavelength than the hue of the paint film itself."[2] However, bronzing, after Florida exposure, is more prevalent and deleterious in metallic colors of medium to dark shades and renders them unusable. At the aluminum level required to produce the proper value of this color (BAY-2K6 Turbine Bronze Metallic), the quinacridone maroon will fade excessively and the transparent yellow iron oxide will bronze heavily. The total pigment combination synergistically yielded satisfactory Florida exposure.

46.59	Quinacridone Maroon (DuPont RT-792-D)
38.31	Transparent Yellow Iron Oxide (Hilton-Davis 30-0543)
15.10	Aluminum (Alcoa #7250)
100.00%	

Although dark blue nonmetallics (iron blue/phthalocyanine blue blends) and red nonmetallics (quinacridone red/molybdate orange blends) were being made successfully, they were not recognized as synergistic blends.

The possibility of other pigment combinations acting synergistically to fill the voids of unusable color areas led to the wide variety of pigment blends of *Table* 2.

The evaluation of blends from *Table* 2 resulted in a wide range of new pigmentations to make previously unattainable colors. While a wide range of colors was attainable, the cold facts are that less than 3% of the blends evaluated were totally acceptable for automotive enamels. Physical testing specifications vary among automotive manufacturers, ranging from 18 to 24 months of exposure durability with humidity requirements, acid sensitivity, and other tests specific to an individual automotive manufacturer. The synergistic durability of these blends varied with the pigments, their levels, and the value of the color, resulting not only in selective blending, but also in selective distribution with constant awareness of the specific customer's requirements.

Table 3 represents colors developed, presented, and marketed as thermosetting enamels from 1975 through 1979, illustrating the utilization of pigment synergism. It should be noted that different binder systems could yield different results. The synergistic improvement is noted after each color listed in the Table.

If it were possible to view synergism in a lone aspect—gloss, color, durability, etc.—the number of colors could be significantly increased. Automotive enamels must meet specific requirements in all of these areas and many others. Therefore, synergism must be viewed in respect to the total requirements on an automotive enamel.

ANTAGONISM

Pigmentation antagonism, like synergism, occurs in automotive enamels. Unlike synergism, which is normally predictable, its unique effects are not planned for and, in many cases, occur as a complete surprise. Color is

Table 3—Actual Automotive Colors Made Possible by the Use of Pigment Synergism

(1) **Silver and Grays**

a. SILVER 1977 (Exposure)
- 94.63 Aluminum (Silberline SS-3333AR)
- 0.55 Carbon Black (Cabot #900)
- 4.17 Titanium Dioxide (DuPont R960)
- 0.55 Phthalocyanine Blue (Harmon B-4714)
- 0.10 Quinacridone Red (DuPont RT-759-D)

100.00%

b. SILVER 1979 (Exposure)
- 75.09 Aluminum (Silberline SS-5000AR)
- 24.91 Titanium Dioxide (DuPont R960)
- Tint Transparent Red Iron Oxide (BASF #400)
- Tint Carbon Black (Cabot #900)
- Tint Extra Yellow Shade Phthalocyanine Green (Harmon G-5400)

100.00%

(2) **Golds, Oranges, Coppers, and Yellows**

a. RED METALLIC 1975 and 1976 (Exposure, Humidity)
- 22.0 Aluminum (Silberline L-582)
- 32.0 Quinacridone Red (Sun 228-2410)
- 46.0 Transparent Red Iron Oxide (BASF #400)

100.0%

b. COPPER METALLIC 1977 (Exposure)
- 51.47 Transparent Red Iron Oxide (BASF #400)
- 14.77 Quinacridone Maroon (DuPont RT-792-D)
- 33.76 Aluminum (Silberline L-582)

100.00%

c. BRASS GOLD METALLIC 1976 (Exposure, Acid Spot)
- 24.63 Aluminum (Silberline SS-3333AR)
- 32.92 Transparent Red Iron Oxide (BASF #400)
- 36.25 Flavanthrone Yellow (ICI-FRS (FR))
- 0.89 Carbon Black (Cabot #900)
- 5.31 Extra Yellow Shade Phthalocyanine Green (Harmon G-5400)

100.00%

d. ORANGE NONMETALLIC 1978 (Exposure, Gloss)
- 98.48 Molybdate Orange (Hercules X-3390)
- 0.97 Quinacridone Violet (Sun 228-1119)
- 0.01 Lampblack (Cities Service #14)
- 0.54 Titanium Dioxide (DuPont R960)

100.00%

e. YELLOW NONMETALLIC 1979 (Exposure, Gloss)
- 67.63 Titanium Dioxide (DuPont R960)
- 11.45 Anthrapyrimidine Yellow (BASF #1560)
- 20.92 Precipitated Yellow Oxide (Cities Service #1050)

100.00%

f. YELLOW NONMETALLIC 1976 (Acid Spot)
- 74.1 Medium Chrome Yellow (Hercules X-3218)
- 0.9 Imidazole Orange (Harmon OV-5982)
- 25.0 Titanium Dioxide (DuPont R960)

100.0%

g. ORANGE METALLIC 1977 (Exposure)
- 20.31 Aluminum (Silberline SS-3141AR)
- 44.36 Transparent Red Iron Oxide (BASF #400)
- 35.33 Quinacridone Orange (DuPont YT-800-D)

100.00%

(3) **Reds and Maroons**

a. RED NONMETALLIC 1976 (Gloss, Acid Spot)
- 92.71 Medium Krolor Orange (DuPont KO-786-D)
- 4.61 Quinacridone Violet (Sun 228-1119)
- 2.68 Titanium Dioxide (DuPont R960)

100.00%

b. LIPSTICK RED NONMETALLIC 1977 (Gloss, Humidity)
- 67.37 Quinacridone Red (DuPont RT-759-D)
- 24.71 Medium Krolor Orange (DuPont KO-786-D)
- 7.92 Titanium Dioxide (DuPont R960)

100.00%

c. RED METALLIC 1979 (Exposure)
- 24.17 Aluminum (Silberline SS-3141AR)
- 51.66 Perylene Maroon (Harmon R-6424)
- 13.91 Quinacridone Violet (Sun 228-1119)
- 9.27 Transparent Red Iron Oxide (BASF #400)
- 0.99 Carbazole Dioxazine (Hoechst 14-4008)

100.00%

d. RED METALLIC 1978 (Exposure, Humidity)
- 6.45 Aluminum (Silberline SS-3124AR)
- 1.49 Aluminum (Reynolds #8-332)
- 19.22 Perylene Maroon (Harmon R-6424)
- 31.28 Quinacridone Red (Sun 228-3620)
- 25.47 Transparent Red Iron Oxide (BASF #400)
- 15.79 Perylene Orange (Harmon R-6418)
- 0.30 Lampblack (Cities Service #14)

100.00%

e. MAROON METALLIC 1978 (Exposure, Gloss)
- 61.0 Perylene Maroon (Harmon R-6424)
- 23.0 Transparent Red Iron Oxide (BASF #400)
- 1.0 Carbon Black (Cabot #900)
- 15.0 Aluminum (Silberline SS-3141AR)

100.0%

(4) **Blues and Violets**

a. DARK BLUE NONMETALLIC 1978 (Exposure, Acid Spot)
- 44.30 Green Shade Phthalocyanine Blue (Hercules X-3485)
- 44.30 Iron Blue (Hercules X-3163)
- 5.39 Titanium Dioxide (DuPont R960)
- 6.01 Precipitated Yellow Oxide (Cities Service #1050)

100.00%

b. LIGHT BLUE METALLIC 1979 (Exposure)
- 91.14 Aluminum (Silberline L-582)
- 2.62 Red Shade Phthalocyanine Blue (Harmon B-4714)
- 6.24 Indanthrene Blue (BASF #6470)

100.00%

c. DARK BLUE METALLIC 1977 (Gloss)
- 43.90 Green Shade Phthalocyanine Blue (Harmon B-4804)
- 9.80 Red Shade Phthalocyanine Blue (Sun 248-1657)
- 37.53 Aluminum (Alcoa #7470)
- 6.37 Carbon Black (Cabot #900)
- 1.47 Anthrapyrimidine Yellow (BASF #1560)
- 0.93 Carbazole Dioxazine (Hoechst 14-4008)

100.00%

d. BLUE NONMETALLIC 1977 (Exposure, Humidity)
- 86.50 Titanium Dioxide (DuPont R960)
- 9.83 Red Shade Phthalocyanine Blue (Harmon B-4714)
- 1.74 Lampblack (Cities Service #14)
- 1.93 Carbazole Dioxazine (Harmon B-4020)

100.00%

e. LIGHT BLUE NONMETALLIC 1977 (Gloss, Humidity)
- 98.67 Titanium Dioxide (DuPont R960)
- 0.59 Red Shade Phthalocyanine Blue (Harmon B-4714)
- 0.08 Lampblack (General Carbon #30)
- 0.25 Quinacridone Red (DuPont RT-759-D)
- 0.41 Phthalocyanine Green (Sun 264-8142)

100.00%

f. DARK PURPLE METALLIC 1977 (Exposure, Gloss)
- 54.85 Green Shade Phthalocyanine Blue (Harmon B-4804)
- 35.40 Carbazole Dioxazine (Harmon B-4020)
- 0.40 Carbon Black (Cabot #900)
- 9.35 Aluminum (Silberline SS-3141AR)

100.00%

Table 3—Actual Automotive Colors Made Possible by the Use of Pigment Synergism *(Continued)*

(5) **Browns and Russets**

a. CORDOVAN METALLIC 1978 (Exposure)

18.92	Transparent Red Iron Oxide (BASF #400)
54.85	Organic Brown (Hoechst HFR)
16.96	Quinacridone Red (Sun 228-3620)
1.96	Carbon Black (Cabot #900)
7.31	Aluminum (Silberline SS-5000AR)
100.00%	

b. RUSSET SUNFIRE METALLIC 1978 (Exposure)

6.53	Aluminum (Silberline SS-3333AR)
1.58	Aluminum (Reynolds #8-332)
73.27	Transparent Red Iron Oxide (BASF #400)
11.09	Quinacridone Red (Sun 228-3620)
6.34	Quinacridone Maroon (DuPont RT-792-D)
1.19	Carbon Black (Cabot #900)
100.00%	

c. DARK BROWN METALLIC 1978 (Exposure)

71.1	Transparent Red Iron Oxide (BASF #400)
11.2	Carbon Black (Cabot BP-1300)
6.0	Perylene Maroon (Harmon R-6424)
11.7	Aluminum (Silberline SS-3141AR)
100.0%	

d. DARK BROWN NONMETALLIC 1977 (Gloss, Acid Spot)

72.14	Light Krolor Orange (DuPont KO-789-D)
8.08	Red Shade Phthalocyanine Blue (Sun 248-1657)
19.78	Precipitated Yellow Oxide (Cities Service #1050)
100.00%	

(6) **Greens**

a. LIGHT GREEN METALLIC 1978 (Exposure)

87.18	Aluminum (Silberline L-582)
1.96	Phthalocyanine Green (Sun 264-8142)
10.14	Transparent Yellow Iron Oxide (BASF #200)
0.72	Lampblack (Cities Service #14)
100.00%	

b. LIGHT LIME GREEN NONMETALLIC 1978 (Gloss, Acid Spot)

60.13	Titanium Dioxide (LaPorte RO-676)
38.20	Medium Krolor Yellow (DuPont KY-795-D)
1.67	Phthalocyanine Green (Sun 264-8142)
Tint	Lampblack (Cities Service #14)
100.00%	

c. BRITE GREEN METALLIC 1976 (Exposure, Humidity)

39.99	Aluminum (Silberline SS-3141AR)
25.41	Transparent Yellow Iron Oxide (BASF #200)
27.76	Flavanthrone Yellow (ICI FR)
0.32	Lampblack (General Carbon #30)
6.52	Extra Yellow Shade Phthalocyanine Green (Sun 264-4444)
100.00%	

the easiest and most readily determined form of antagonism. Other forms of antagonism (e.g., gloss, moisture sensitivity, exposure durability) are not as easily or readily detectable, being either more subtle or requiring extended time to develop. The stringent requirements of automotive pigmentation go far beyond the initial aesthetic qualities. The phenomenon of antagonism and its effect on automotive pigmentation is relatively new and a by-product of two recent developments: (1) cleaner, richer, brighter colors—metallic and nonmetallic; and (2) the nonchromate legislation.

These developments have significantly altered automotive pigmentation without adjusting the requirements of the specific systems involved. The specifications for gloss, moisture sensitivity, durability, flexibility, etc., remain the same. The results of these developments are a significant decrease in the flexibility with which we use current standard pigments, the development of antagonism from pigment blends noted for synergism, and the revised evaluation for new and current pigments.

The most common forms of pigmentation antagonism are:

(1) COLOR—Loss of purity when two pigments, regardless of their individual purity or chroma, of conflicting true color or undertone color are blended.

(2) GLOSS—Development of a haze of smoky/milky appearance.

(3) MOISTURE SENSITIVITY—A white opaque appearance occasionally accompanied by a loss of gloss on catalyst-induced, low-bake, repair systems when subjected to ten days of 100% relative humidity at 100°F Cleveland condensing.

(4) EXPOSURE DURABILITY—Color changes (fade or darkening), loss of gloss, surface phenomena (chalk, bronze, dirt collection), cracking or blistering when exposed at 5° South in the Miami/Fort Lauderdale area for 18 and/or 24 months.

With the exception of color, the other areas develop from blends of pigments that are individually acceptable.

Exposure Durability

The following four pigment combinations lack 24 month Florida durability. The failure modes are as indicated.

(a) Transparent Iron Oxides with Phthalocyanine Greens in dark green and gold metallics—*bronzing.*

(b) Perylene Maroon with Quinacridone Red in red metallics—*fade and bronzing.*

(c) Nickel or Copper Azo with Phthalocyanine Greens in light to medium green metallics—*fade.*

(d) Flavanthrones with Anthrapyrimidines and/or Isoindolinone Yellows in pastel yellow nonmetallics—*chalking.*

Initial Gloss

The following four pigment combinations produce lower initial gloss than what could be expected from individual pigments. Twenty-four month Florida durability failure modes are as indicated.

Table 4—Automotive Colors Unusable because of Pigment Antagonism

(1) **Gloss**
(A reduction of gloss in the pigment blend over the higher gloss of the individual pigments used.)

a. RED NONMETALLIC
74.74 Azo Orange (Hoechst HL-70)
25.23 Quinacridone Magenta (DuPont RT-243-D)
0.03 Lampblack (Cities Service #14)
100.00%

b. YELLOW NONMETALLIC
58.15 Titanium Dioxide (DuPont R960)
24.04 Anthrapyrimidine Yellow (Harmon Y-5783)
17.42 Precipitated Yellow Oxide (Cities Service #1050)
0.39 Imidazole Orange (Hoechst GR)
100.00%

c. ORANGE NONMETALLIC
35.18 Azo Orange (Hoechst HL-70)
48.98 Chrome Titanate (Siegle 3FFG)
15.84 Anthrapyrimidine Yellow (Harmon Y-5783)
100.00%

d. RED METALLIC
35.52 Quinacridone Red (DuPont RT-233-D)
22.09 Perylene Orange (Harmon R-6418)
9.30 Perylene Maroon (Harmon R-6424)
24.97 Transparent Red Iron Oxide (Hilton-Davis 30-1010)
8.12 Aluminum (Alcoa #7471)
100.00%

e. SILVER METALLIC
98.5 Aluminum (Reynolds 8-334)
1.3 Red Shade Phthalocyanine Blue (Harmon B-4714)
0.2 Carbon Black (Cabot #900)
100.0%

(2) **Moisture (Humidity) Sensitivity**
(A reduction in humidity resistance in the pigment blend over the better humidity resistance of the individual pigments used.)

a. YELLOW NONMETALLIC
77.68 Nickel Titanate (Glidden Titanium Yellow)
20.19 Isoindolinone Yellow (Ciba-Geigy 2GLT)
2.00 Isoindolin Yellow (BASF 2140HD)
0.13 Yellow Shade Phthalocyanine Green (Harmon G-5400)
100.00%

b. ORANGE NONMETALLIC
56.83 Isoindolinone Yellow (Ciba-Geigy 2GLT)
1.22 Quinacridone Red (DuPont RT-759-D)
33.00 Nickel Titanate (Siegle AMFG)
8.95 Azo Orange (Hoechst HL-70)
100.00%

c. RED NONMETALLIC
58.90 Azo Orange (Hoechst HL-70)
21.15 Quinacridone Violet (Sun 228-1119)
15.93 Quinacridone Magenta (Sun 228-2410)
4.02 Titanium Dioxide (DuPont R960)
100.00%

d. MEDIUM GREEN METALLIC
50.46 Aluminum (Silberline SS-5000AR)
35.94 Transparent Yellow Iron Oxide (Chemetron YT-9001)
11.20 Anthrapyrimidine Yellow (BASF #1560)
2.40 Extra Yellow Shade Phthalocyanine Green (Harmon G-5400)
100.00%

e. MAROON NONMETALLICS
50 — 70 Red Iron Oxide (Bayer 180FM)
50 — 30 Quinacridone Violet (DuPont RT-733-D)
100% 100%

(3) **Exposure Durability**
(A lessening of Florida exposure durability in the pigment blend over the better durability of the individual pigments used. The type of increased failure (NG equals unacceptable) is noted, e.g., chalk, bronze, fade, dulling.)

a. BRIGHT YELLOW GREEN NONMETALLIC—*NG Chalk*
52.6 Titanium Dioxide (DuPont R960)
34.9 Isoindolinone Yellow (Ciba-Geigy 2GLT)
11.1 Anthrapyrimidine Yellow (BASF #1560)
1.4 Extra Yellow Shade Phthalocyanine Green (Harmon G-5400)
Tint Precipitated Yellow Oxide (Cities Service #1050)
Tint Lampblack (Cities Service #14)
100.0%

b. BRIGHT RED METALLIC—*NG Bronze and Fade*
19.22 Perylene Maroon (Harmon R-6424)
31.28 Quinacridone Red (DuPont RT-233-D)
25.47 Transparent Red Iron Oxide (BASF #400)
15.79 Perylene Orange (Harmon R-6418)
7.94 Aluminum (Silberline SS-3141AR)
0.30 Lampblack (Cities Service #14)
100.00%

c. GREEN METALLIC—*NG Bronze*
9.76 Aluminum (Silberline SS-3333AR)
42.93 Extra Yellow Shade Phthalocyanine Green (Harmon G-5400)
44.88 Transparent Red Iron Oxide (BASF #400)
2.43 Carbon Black (Cabot BP-1300)
100.00%

d. LIME GREEN METALLIC—*NG Dull and Bronze*
51.37 Transparent Yellow Iron Oxide (Hilton-Davis 30-0549)
27.81 Nickel Azo Yellow (DuPont YT-714-D)
1.65 Extra Yellow Shade Phthalocyanine Green (Harmon G-5400)
5.73 Anthrapyrimidine Yellow (BASF #1560)
0.15 Red Iron Oxide (Pfizer RO-3097)
12.90 Aluminum (Silberline SS-5000AR)
0.39 Lampblack (Cities Service #14)
100.00%

(a) Nickel Titanates with Flavanthrones, Isoindolinone Yellows and/or Anthrapyrimidines in yellow nonmetallics—*chalking.*

(b) Aluminum with organic pigments (Phthalocyanines, Flavanthrones, Anthrapyrimidines) in silver and very light metallics—*dulling.*

(c) Quinacridones (yellow shade through violet shade) with Flavanthrones and Mono Azo Oranges in red nonmetallics —*chalking.*

(d) Perylene (orange and maroon) with Quinacridone (yellow through violet) and Transparent Red Iron Oxide in dark red, russet, and brown metallics—*bronzing.*

Humidity Sensitivity

The following blends do not have adequate humidity resistance as determined by test procedure described in Chrysler Corporation Laboratory Procedure Number 463PB-9-01.

(a) Yellow Iron Oxide with Flavanthrones, Isoindolinones or Anthrapyrimidines in yellow nonmetallics.

(b) Blends of Flavanthrones, Anthrapyrimidines and/or Isoindolinones to make yellow nonmetallics.

(c) Anthrapyrimidine with Transparent Yellow Iron Oxide to make light to medium lime metallics.

(d) Red Iron Oxides with Quinacridone Red and Violet in deep red and maroon nonmetallics.

Table 4 represents color illustrating the negative effects of pigment antagonism in thermosetting acrylic systems. Again, it should be noted that different binder systems could yield different results.

In sweeping the spectrum for hue, value, and chroma, the Appendix summarizes pigment synergism and pigment antagonism in thermoset acrylic automotive pigmentation. The pigment supplier with his code number, the color index name and number for each pigment listed in the Appendix can be found in *Table* 1.

The key to automotive pigmentation success is to permit the pigment to do what it does well, and allow other pigments to do the rest—synergistically, not antagonistically.

ACKNOWLEDGMENT

This project would not have reached fruition without the invaluable contribution of Jim Gelmini, Pigment Area Supervisor, Celanese Plastics and Specialties Co.

References

(1) "Paint/Coatings Dictionary," Federation of Societies for Coatings Technology, Philadelphia, Pa. 1978, p 410.
(2) *Ibid.*, p 72.
(3) Panush, S., "Metallic/Nonmetallic Concept for New Effect—High Chroma—Durable Colors," JOURNAL OF PAINT TECHNOLOGY, *45*, No. 581, 39 (1973).

APPENDIX

Summary of Automotive Pigment Synergism and Pigment Antagonism

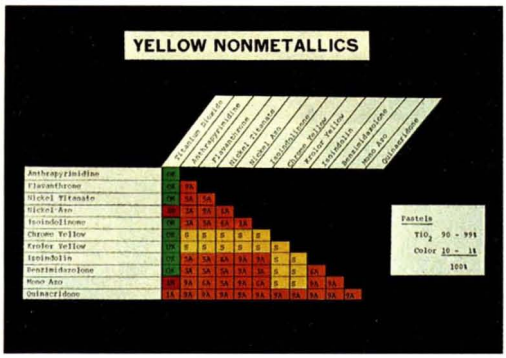
LEGEND

■ = Antagonistic
[S] = Synergistic
■ = Acceptable
■ = Not Acceptable

1 = Exposure Color
2 = Exposure Gloss
3 = Exposure Chalk
4 = Exposure Bronze
5 = Initial Gloss
6 = Ten Day Humidity
7 = Acid Spot
8 = Rheology
9 = Initial Color

e.g.,
6A would indicate that the pigment blend yielded ten day humidity antagonism.

1N would indicate that the pigment blend is not acceptable for exposure color retention.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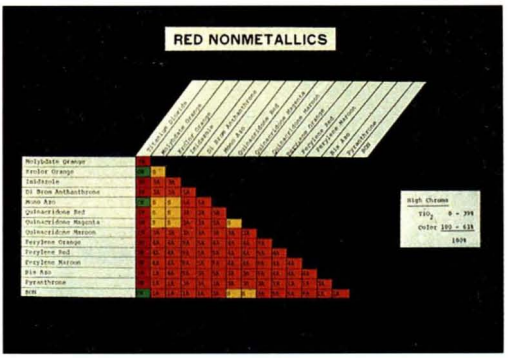
Anthrapyrimidine
Flavanthrone
Nickel Titanate
Nickel Azo
Isoindolinone
Chrome Yellow
Kroler Yellow
Isoindolin
Benzimidazolone
Mono Azo
Quinacridone
Anthrapyrimidine
Flavanthrone
Nickel Titanate
Nickel Azo
Isoindolinone
Chrome Yellow
Kroler Yellow
Isoindolin
Benzimidazolone
Mono Azo
Quinacridone
Pastels
TiO2 90 - 99%
Color 10 - 1%
100%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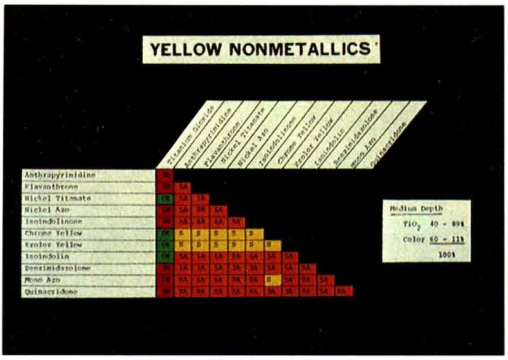
Kroler Orange
Indanthrone
Di Brom Anthanthrone
Mono Azo
Quinacridone Red
Quinacridone Magenta
Quinacridone Maroon
Perylene Orange
Perylene Red
Perylene Maroon
Bis Azo
Pyranthrone
BON
High Chroma
TiO2 0 - 39%
Color 100 - 61%
100%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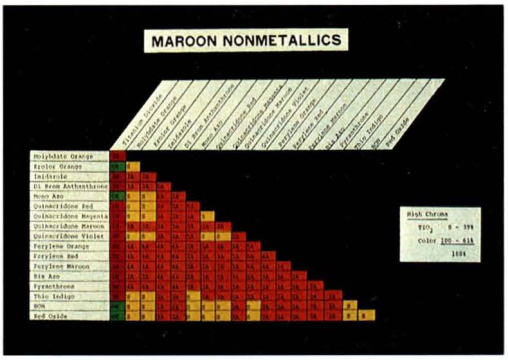
Anthrapyrimidine
Flavanthrone
Nickel Titanate
Nickel Azo
Isoindolinone
Chrome Yellow
Kroler Yellow
Isoindolin
Benzimidazolone
Mono Azo
Quinacridone
Anthrapyrimidine
Flavanthrone
Nickel Titanate
Nickel Azo
Isoindolinone
Chrome Yellow
Kroler Yellow
Isoindolin
Benzimidazolone
Mono Azo
Quinacridone
Medium Depth
TiO2 40 - 89%
Color 60 - 11%
100%


MAROON NONMETALLICS
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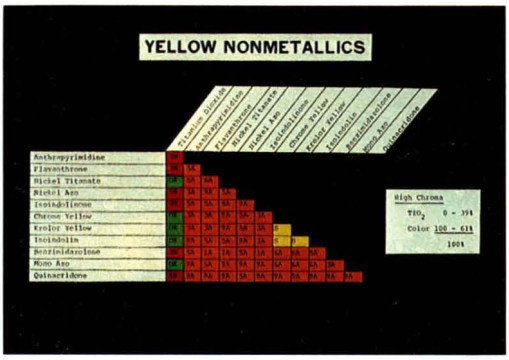
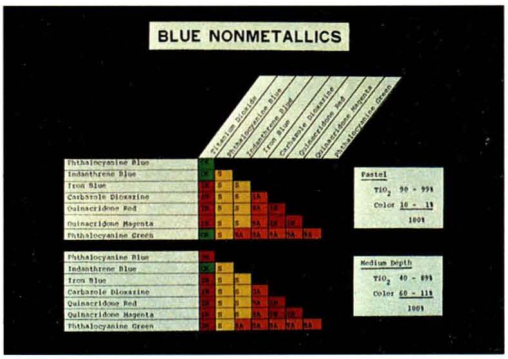
Molybdate Orange
Kroler Orange
Indanthrone
Di Brom Anthanthrone
Mono Azo
Quinacridone Red
Quinacridone Magenta
Quinacridone Maroon
Quinacridone Violet
Perylene Orange
Perylene Red
Perylene Maroon
Bis Azo
Pyranthrone
Thio Indigo
BON
Red Oxide
High Chroma
TiO2 0 - 39%
Color 100 - 61%
100%


YELLOW NONMETALLICS
Titanium Dioxide
Anthrapyrimidine
Flavanthrone
Nickel Titanate
Nickel Azo
Isoindolinone
Chrome Yellow
Kroler Yellow
Isoindolin
Benzimidazolone
Mono Azo
Quinacridone
Anthrapyrimidine
Flavanthrone
Nickel Titanate
Nickel Azo
Isoindolinone
Chrome Yellow
Kroler Yellow
Isoindolin
Benzimidazolone
Mono Azo
Quinacridone
High Chroma
TiO2 0 - 39%
Color 100 - 61%
100%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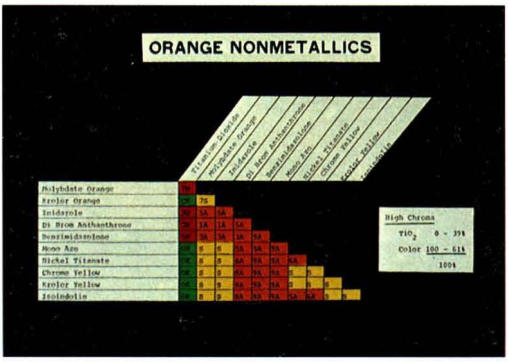
Phthalocyanine Blue
Indanthrene Blue
Iron Blue
Carbazole Dioxazine
Quinacridone Red
Quinacridone Magenta
Phthalocyanine Green
Phthalocyanine Blue
Indanthrene Blue
Iron Blue
Carbazole Dioxazine
Quinacridone Red
Quinacridone Magenta
Phthalocyanine Green
Pastel
TiO2 90 - 99%
Color 10 - 1%
100%
Medium Depth
TiO2 40 - 89%
Color 60 - 11%
100%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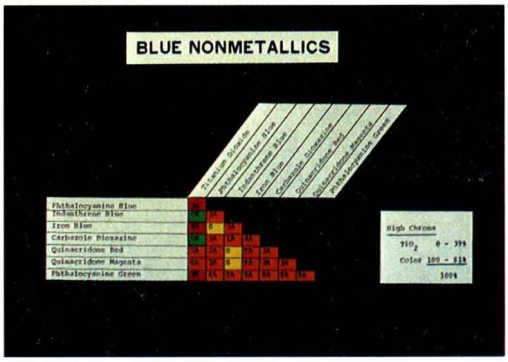
Molybdate Orange
Isoindoline
Di Brom Anthanthrone
Benzimidazolone
Mono Azo
Nickel Titanate
Chrome Yellow
Kroler Yellow
Isoindolin
High Chroma
TiO2 0 - 39%
Color 100 - 61%
100%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Indanthrene Blue
Iron Blue
Carbazole Dioxazine
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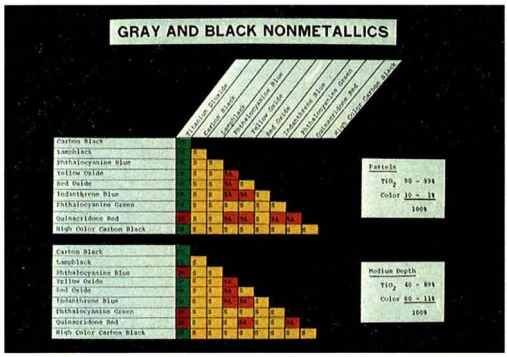
Quinacridone Magenta
Phthalocyanine Green
Phthalocyanine Blue
Thioindigoid Bordeaux
Iron Blue
Carbazole Dioxazine
Quinacridone Red
Quinacridone Magenta
Phthalocyanine Green
High Chroma
TiO2 0 - 39%
Color 100 - 61%
100%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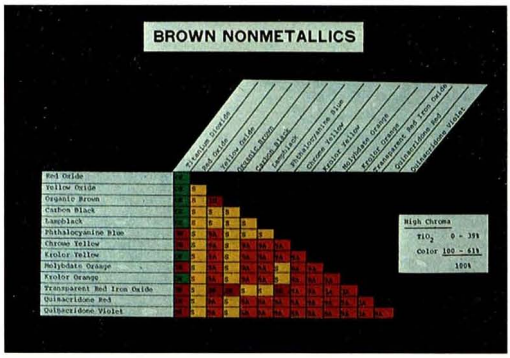
Carbon Black
Lamp Black
Phthalocyanine Blue
Yellow Oxide
Red Oxide
Indanthrene Blue
Phthalocyanine Green
Quinacridone Red
High Color Carbon Black
Pastels
TiO2 90 - 99%
Color 10 - 1%
100%
Medium Depth
TiO2 40 - 89%
Color 60 - 11%
100%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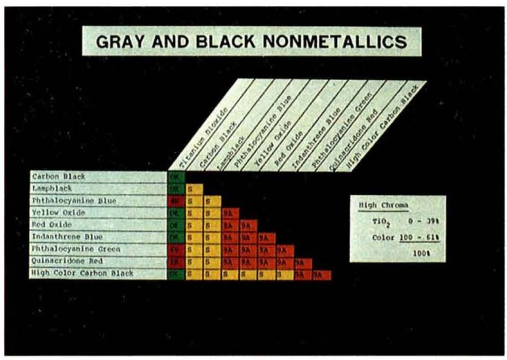
Red Oxide
Yellow Oxide
Organic Brown
Carbon Black
Lamp Black
Phthalocyanine Blue
Chrome Yellow
Krolor Yellow
Molybdate Orange
Krolor Orange
Transparent Red Iron Oxide
Quinacridone Red
Quinacridone Violet
High Chroma
TiO2 0 - 39%
Color 100 - 61%
100%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Lamp Black
Phthalocyanine Blue
Yellow Oxide
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High Color Carbon Black
High Chroma
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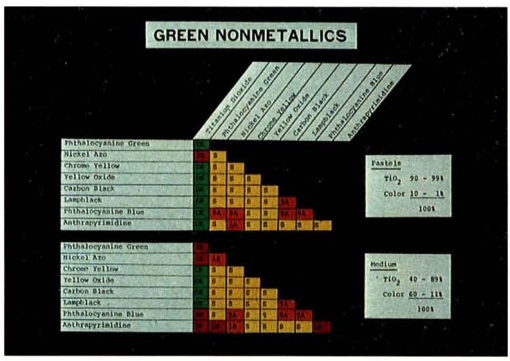
Color 100 - 61%
100%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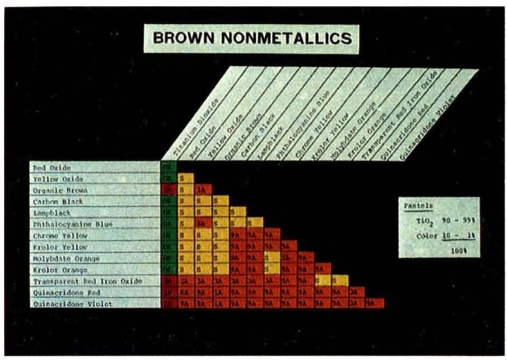
Phthalocyanine Green
Nickel Azo
Chrome Yellow
Yellow Oxide
Carbon Black
Lamp Black
Phthalocyanine Blue
Anthrapyrimidine
Pastels
TiO2 90 - 99%
Color 10 - 1%
100%
Medium
TiO2 40 - 89%
Color 60 - 11%
100%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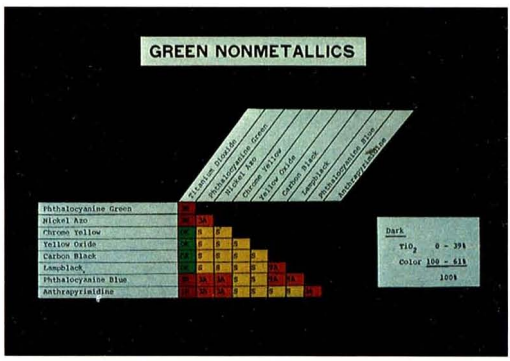
Red Oxide
Yellow Oxide
Organic Brown
Carbon Black
Lamp Black
Phthalocyanine Blue
Chrome Yellow
Krolor Yellow
Molybdate Orange
Krolor Orange
Transparent Red Iron Oxide
Quinacridone Red
Quinacridone Violet
Pastels
TiO2 90 - 99%
Color 10 - 1%
100%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Nickel Azo
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Carbon Black
Lamp Black
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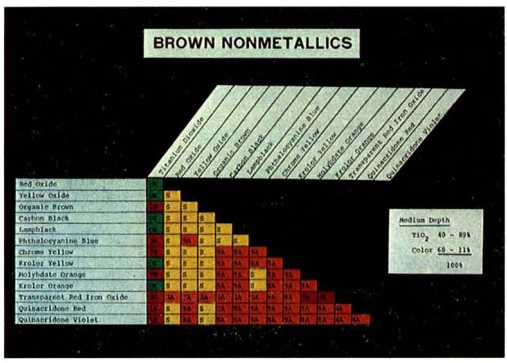
Anthrapyrimidine
Dark
TiO2 0 - 39%
Color 100 - 61%
100%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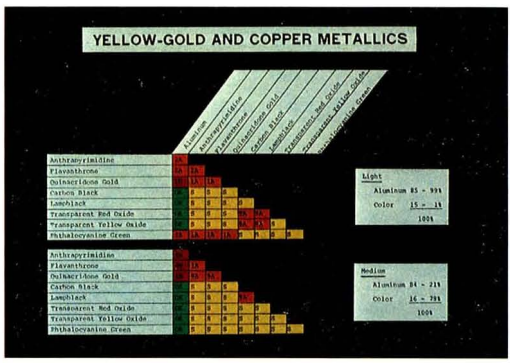
Red Oxide
Yellow Oxide
Organic Brown
Carbon Black
Lamp Black
Phthalocyanine Blue
Chrome Yellow
Krolor Yellow
Molybdate Orange
Krolor Orange
Transparent Red Iron Oxide
Quinacridone Red
Quinacridone Violet
Medium Depth
TiO2 40 - 89%
Color 60 - 11%
100%


YELLOW-GOLD AND COPPER METALLICS
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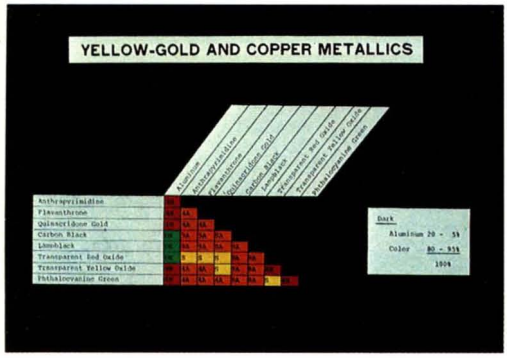
Anthrapyrimidine
Flavanthrone
Quinacridone Gold
Carbon Black
Lamp Black
Transparent Red Oxide
Transparent Yellow Oxide
Phthalocyanine Green
Light
Aluminum 85 - 99%
Color 15 - 1%
100%
Medium
Aluminum 84 - 21%
Color 16 - 79%
100%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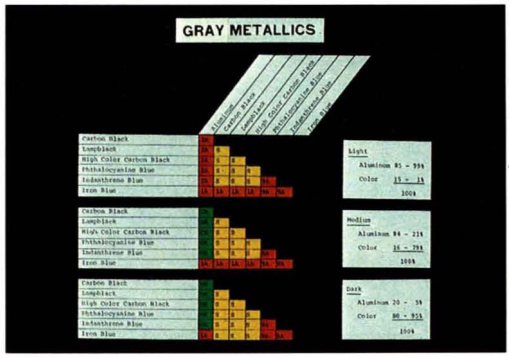
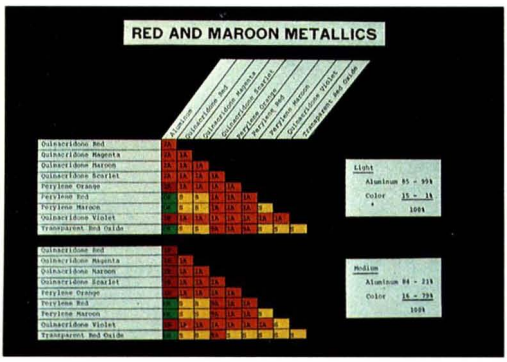
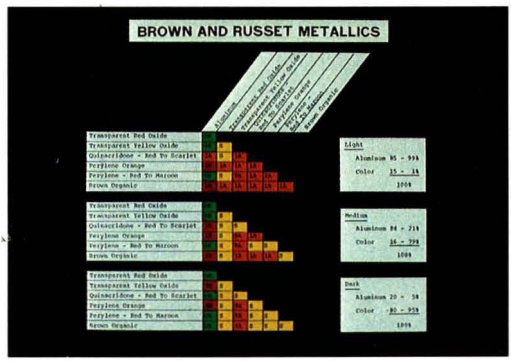
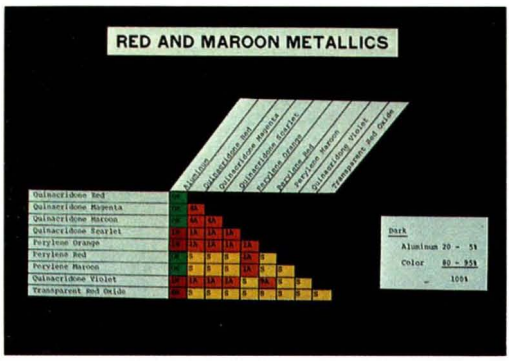
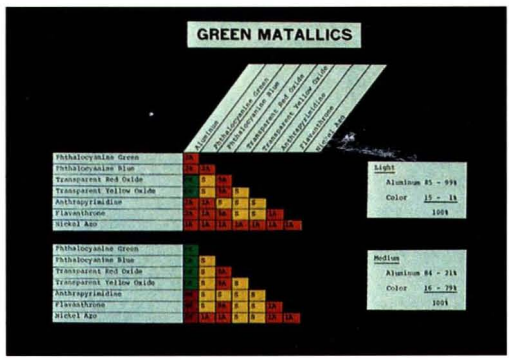
Carbon Black
Lamblack
Transparent Red Oxide
Transparent Yellow Oxide
Phthalocyanine Green
Dark
Aluminum 20 - 5%
Color 80 - 95%
100%

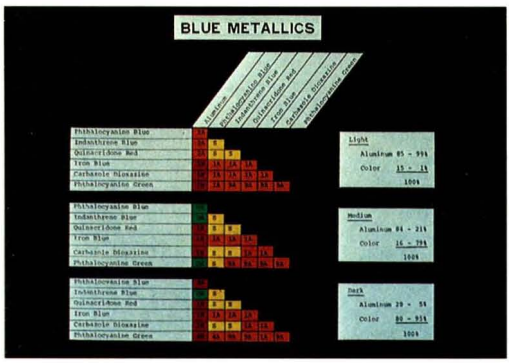

GRAY METALLICS
Aluminum
Carbon Black
Lamblack
High Color Carbon Black
Phthalocyanine Blue
Indanthrone Blue
Iron Blue
Light
Aluminum 85 - 99%
Color 15 - 1%
100%
Medium
Aluminum 84 - 21%
Color 16 - 79%
100%
Dark
Aluminum 20 - 5%
Color 80 - 95%
100%

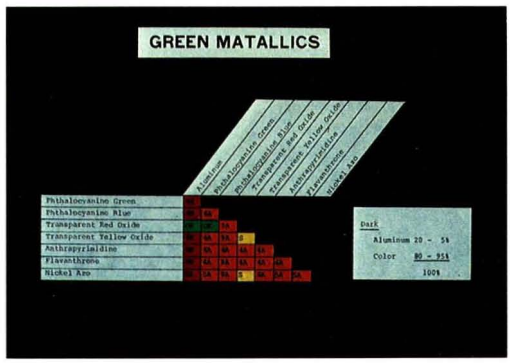

RED AND MAROON METALLICS
Aluminum
Quinacridone Red
Quinacridone Magenta
Quinacridone Maroon
Quinacridone Scarlet
Perylene Orange
Perylene Red
Perylene Maroon
Quinacridone Violet
Transparent Red Oxide
Light
Aluminum 85 - 99%
Color 15 - 1%
100%
Medium
Aluminum 84 - 21%
Color 16 - 79%
100%


BROWN AND RUSSET METALLICS
Aluminum
Transparent Red Oxide
Transparent Yellow Oxide
Quinacridone - Red To Scarlet
Perylene Orange
Perylene - Red To Maroon
Brown Organic
Light
Aluminum 85 - 99%
Color 15 - 1%
100%
Medium
Aluminum 84 - 21%
Color 16 - 79%
100%
Dark
Aluminum 20 - 5%
Color 80 - 95%
100%


RED AND MAROON METALLICS
Aluminum
Quinacridone Red
Quinacridone Magenta
Quinacridone Maroon
Quinacridone Scarlet
Perylene Orange
Perylene Red
Perylene Maroon
Quinacridone Violet
Transparent Red Oxide
Dark
Aluminum 20 - 5%
Color 80 - 95%
100%


GREEN METALLICS
Aluminum
Phthalocyanine Green
Phthalocyanine Blue
Transparent Red Oxide
Transparent Yellow Oxide
Anthrapyrimidine
Flavanthrone
Nickel Azo
Light
Aluminum 85 - 99%
Color 15 - 1%
100%
Medium
Aluminum 84 - 21%
Color 16 - 79%
100%


BLUE METALLICS
Aluminum
Phthalocyanine Blue
Indanthrone Blue
Quinacridone Red
Iron Blue
Carbazole Dioxazine
Phthalocyanine Green
Light
Aluminum 85 - 99%
Color 15 - 1%
100%
Medium
Aluminum 84 - 21%
Color 16 - 79%
100%
Dark
Aluminum 20 - 5%
Color 80 - 95%
100%


GREEN MATALLICS
Aluminum
Phthalocyanine Green
Phthalocyanine Blue
Transparent Red Oxide
Transparent Yellow Oxide
Anthrapyrimidine
Flavanthrone
Nickel Azo
Dark
Aluminum 20 - 5%
Color 80 - 95%
100%

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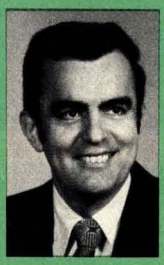

LEON KUTIK

is Director of Research and Technical Operations for the Coatings Group of Dutch Boy, Inc. He received a B.S. Degree from C.C.N.Y. and a M.B.A. Degree from the University of Chicago. A recent transferee to the Baltimore Society, Mr. Kutik has served on the Technical Advisory Committee. He has also served the New York Society as a member of the Board of Directors and as Secretary of its Technical Committee. A recipient of the New York Society's Kienle Award, Mr. Kutik has been a member of the Editorial Review Board since 1969.

HERBERT E. HILLMAN

has been associated with the coatings industry for 40 years. He is President of F.O. Pierce Co., Long Island, N.Y. and Group Vice-President of RPM, Inc. President of the New York Society in 1952, he served as Chairman of the Technical Committee in 1958, 1959, and 1967. Mr. Hillman received the Society's PaVaC and Kienle Awards in 1957 and 1960, respectively. In the Federation, Mr. Hillman served on the Board of Directors in 1956 and on the Federation Council from 1958–60. He has been on the Publications Committee since 1971.

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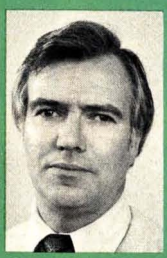

IAN H. McEWAN

received the Ph.D. Degree from the University of Wales. He joined C-I-L Paints, Inc. in Toronto in 1958. Dr. McEwan currently serves as Research Manager for Decorative and Refinish Automotive Products, as well as for Exploratory Research. He is a member of the Toronto Society.

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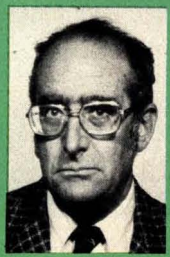
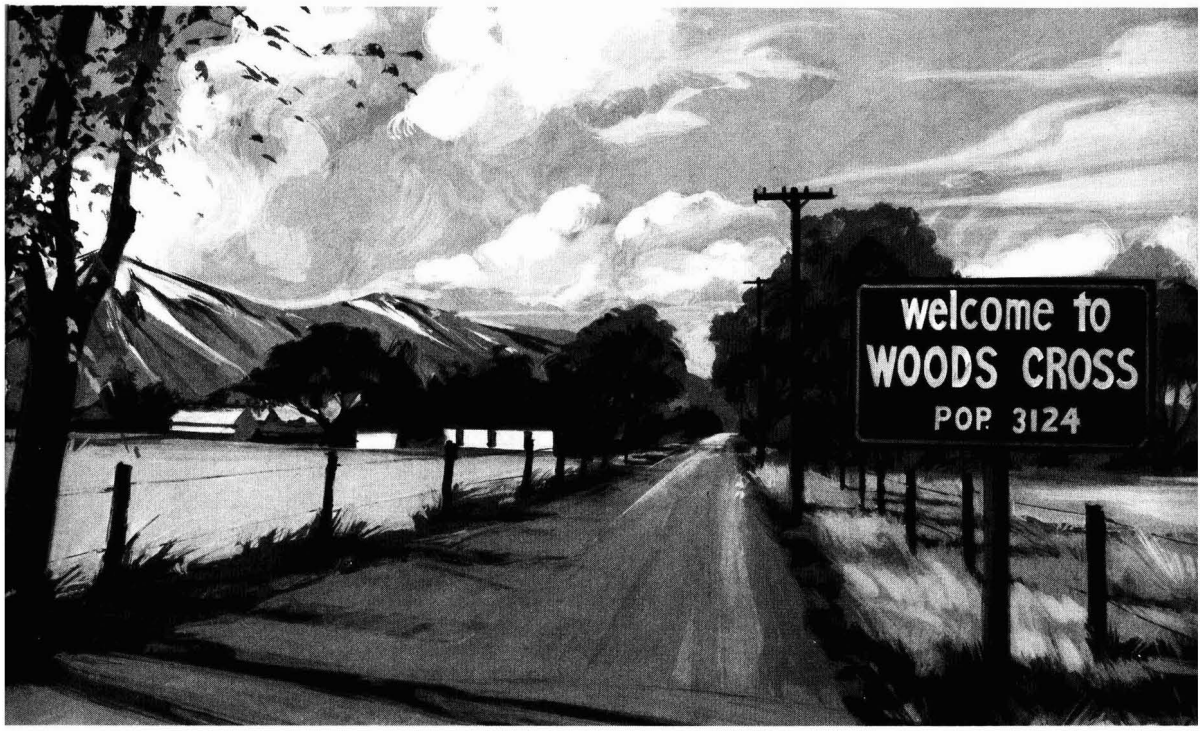


JOHN L. GARDON

obtained a degree in Chemical Engineering from the Swiss Federal Institute of Technology and the Ph.D. Degree from McGill University. He formerly served as Director of Research and Development of the Coatings and Ink Div. of M&T Chemicals and as Director for Whittaker Corp's Southfield Coatings and Chemicals Research Center. He recently became a Vice-President of Sherwin-Williams Co. in Chicago. Dr. Gardon was recipient of a 1966 Federation Roon Award. He is a member of the Chicago Society.



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PROCEEDINGS/NUMBER 138

Report of the Research Director

Raymond R. Myers*
Research Director, Paint Research Institute

Introduction

The Paint Research Institute actively supports two programs and has made a small start on a third. Mildew defacement is securely in the hands of a committee appointed by the donors to the consortium; water-borne systems are under study in a program guided by a PRI-appointed committee and supported by in-house funds. One grant is designed to pace our entry into the study of oligomers that would attract outside support.

Several other programs still remain on the books: corrosion control and analytical methods are two; alternative routes to hiding appears to elicit less interest as a third. Photochemical curing has been shelved as a topic for at least a year.

Ideas from the National Science Foundation-cosponsored workshop in 1978 are found in the reports of 12 task forces. Whether many of them can survive the two years that have now elapsed is in question, as indicated by the fate of the aqueous systems task force, discussed in the next section.

Report on Grant Progress

AQUEOUS SYSTEMS

Fred Eirich's summary of Task Force D (Physical Chemistry of Water-Soluble and Dispersible Coatings) listed the following action topics: Effect of MW and aggregation; Microdispersions; Cosolutes; Rheology; Film formation, crosslinking; Morphology, pigments; and Additives, stability.

These and other topics that were generated as a result of considering the shortcomings of WSD systems became the starting point in PRI's APEX (Aqueous program, experimental) effort. Three projects were based on a standard copolymer designed by the monitors; one project centered on latexes and is reported here only in the interest of completeness.

When the monitors met in January 1980, the list of action topics changed markedly. Solvent- and water-retention, water sensitivity of the dried film, and difficult syntheses all have disappeared from the list of disadvantages. From my vantage point the industry has not been stagnant, as some say!

In place of the original list of inconveniences, the monitors substituted the following lineup:

(1) High viscosity, with great concentration dependence.

(2) Sensitivity of film properties to R.H. (film pops at low R.H., sags at high R.H.).

(3) Sensitivity to thermal effects.

(4) Application difficulties (especially at high speed and in electrostatic spray).

(5) Requirement of a cosolvent and a solubilizing agent.

(6) Need for flexibility/hardness balance.

(7) Restriction to low molecular weight.

(8) Retarded drying.

The viscosity-concentration relation is being studied, as are film properties and the requirements of cosolvents and solubilizers. We are most in need of an application laboratory, and this need epitomizes what is wrong with our present organization. Application studies in a university setting (the only kind we can afford) would require a committed faculty member with a dedicated laboratory. It might be possible to find a research group with high-speed applicators and spray guns, but persuading them to turn their attention to our problems would wipe out our budget.

Basic research is cheaper. Three principal investigators are uncovering the answers to some of the questions posed. The questions bear the stamp of relevance, and so the answers must be relevant if they address the questions. The first three projects described below are evaluated with this factor in mind.

No. 68Aq—Viscosity Control in Water-Borne Coatings

PRINCIPAL: Loren Hill, of North Dakota State University

OBJECTIVES: (1) Preparation of a standard copolymer.
(2) Characterization of the standard.
(3) Determination of effect of formulation variables on viscosity.
(4) Explanation of the phenomenon.

PROCEDURES:

After the copolymers were prepared by free-radical polymerization in t butanol, molecular weights were determined by GPC and vapor pressure osmometry.

*Kent State University, Chemistry Dept., Kent, Ohio 44242.

The formulation variables were: (a) Acid number (35 and 70); and (b) Design of neutralization (50 to 100%).

RESULTS:

Hill originally proposed to study the effect of molecular weight on the location and height of the viscosity peak. Evidently the expected independence of the peak location from MW prevented this objective from being high priority. Hill has since left NDSU and the project has been terminated. To preserve his good name it is pointed out that the monitors requested greater initial emphasis on the preparation and characterization of the polymer. In fact, there is surprisingly little follow-up on the viscosity work. Everybody knows that viscosity peaks and that this peak is a problem. Almost every person who has pondered why has concluded that the hydrophobic parts of the polymer are associated so as to present minimal exposure to water, but some deny that this effect is as potent as the hydrogen bonding which exists all the way through the dilution scale.

At any rate, the low acid number gave a more pronounced η peak at 25% solids than did the high acid number at 23% solids. The peaks moved to higher values at lower concentrations as the shear rate in the viscometer was decreased.

RELEVANCE:

Whether spraying, rolling, or even brushing, peak viscosity should be avoided; so relevance to application problems is evident. Of the four objectives which were considered relevant by the monitors, (1) was met; (2) was met as far as conventional means of characterizing polymers are concerned, but there are morphological characterizations that need attention. Not all planned formulation variables were covered, and the explanation needs confirmation. All in all, I would judge the project a success in its incomplete state.

No. 13Aq—Film Formation and Polymer Transitions

PRINCIPAL: Raymond R. Myers, of Kent State University

OBJECTIVES: (1) Determination of film-forming characteristics of standard WSD copolymer.
(2) Explanation in fundamental mechanical terms of this and related transitions.
(3) Design of instruments uniquely suited to coatings in transition.

PROCEDURES:

The standard copolymer was neutralized to various degrees with amines of varied structure; dilutions with water were followed by application to a quartz substrate on which the film dried. Development of rigidity and weight loss were measured as a function of time. Results were expressed in terms of the concentration at which rigidity first appeared and the rate of increase in rigidity as concentration continued to increase beyond the yield value concentration. Molecules swollen by water or by electrostatic repulsions of polar groups gave earlier yield values.

In a different procedure, the standard copolymers dissolved in t butanol and in less polar solvents, such as dioxane, were studied with respect to their dielectric relaxation behavior. In order to ascertain how various parameters influence the conformation and morphology of the molecule, advantage was taken of the drastic effect that delocalized dipoles exert on dielectric properties. In the early stage of the investigation, which will turn to a study of relative humidity effects and of various degrees of neutralization with different amines, an attempt was made to learn what groups in the copolymer were responsible for the various transitions observed when frequency and/or temperature were scanned.

Although poly(acrylic acid) is not likely to be used in these early dielectric studies (as it was in the early impedometer work), there is a strong likelihood that an acrylic ester without any acid groups will be used in the dielectric work. The copolymer displays transitions that must be attributed to side groups, and an ester homopolymer appears to be the best candidate to narrow the field.

The ancillary measurement in connection with the dielectric work is ^{13}C NMR. We suspect adduct formation involving t butanol, and are using t butanol as a limiting reactant in a dioxane system. Evidence of the tertiary carbon as revealed by NMR becomes important information.

RESULTS:

Impedometer Studies—In response to the first objective, the film-forming characteristics of both model compounds and the standard WSD copolymer were revealed. In the case of the model compound poly(acrylic acid), these studies led to a discovery that high degrees of neutralization led to yield values when the film contained as little as 30% solid, after which considerable shrinkage occurred leading to high residual stresses. These stresses were compensated by the retention of enough water to plasticize the film, and this softening effect rendered the film mechanically unsuitable. Naturally, the high acid number rendered it too water sensitive to be a practical film.

The main result of the poly(acrylic acid) impedometry was the emergence of a working hypothesis for the copolymer studies. We think that the succession of protons stripped from the polymer during the first half neutralization differs appreciably from the second half succession. Elementary acid/base theory is invoked to explain this difference. Then, during the second half neutralization, the possibility for ion cluster formation first appears. Ion clusters imply water clusters, and these were found in the reported poly(acrylic acid) research.

This hypothesis will receive the acid test in studies yet to be performed. The monitors want relative humidity to be investigated first, but during the accumulation of data, special note will be taken of the dependence of humectant tendencies on degree of neutralization. Copolymers with AA blocks should show a drastic upturn at half neutralization; others should not.

The dielectric studies revealed that t butanol cannot be used as a solvent for the study of relaxations because it is too polar. This finding was turned to gain in that we began to pick up evidence of adduct formation with t butanol. If this is the case, t butanol would permanently plasticize the film, or at least display an abnormally low activity coefficient on evaporation. Therefore, our studies are directed at this time toward the interaction of t butanol as a minor solute in a system containing the standard copolymer dissolved in dioxane.

RELEVANCE:

The relevance of film forming characteristics has been pointed out, both in the Workshop Proceedings and in describing the results of this year's progress. Water and cosolvent retention were among the original problems facing water-borne systems.

Explanation of the mechanical transitions which the standard copolymer undergoes is a necessary prelude to tailoring WSD systems that would display more bland behavior in a given temperature range. One does not want a coating resin to scan several decades of hardness when the temperature increases by ten degrees.

The dipolar transitions bear directly or indirectly on diffusional properties of films and, therefore, they relate eventually to corrosion resistance. Our hopes are for a different kind of relevance: if clusters of charged groups are found, or if adducts are found with some candidate cosolvents, polymer synthesis and paint formulation may receive new directions.

Instrument design directed uniquely to coatings is a bonus. Years ago this was our primary objective; now it has dropped to third place.

No. 67Aq—Surface Tension Measurements in Water-Borne Protective Coatings

PRINCIPAL: Henry P. Schreiber, of Ecole Polytechnique

OBJECTIVES: (1) Determination of critical surface tensions of water-borne coatings.
(2) Explanation of morphological changes in these coatings on drying and on aging.

PROCEDURES:

A thermal gradient bar is used in an isothermal mode to ascertain critical surface tensions γ_c of eight coatings cast from carboxylated polymers. When used in a thermal gradient mode, the dependence of γ_c on temperature is ascertained. Wetting liquids are placed as drops on the coating at various temperatures and the area of the drop is measured; when the area suddenly expands the wetting angle is assumed to be zero.

Time-dependent changes in the free surface are monitored as the film ages. Increases in surface tension are attributed to oligomer migration to the surface using the energy of demixing as the driving force.

Seal strengths (to study the polymer-metal interface without an intervening free surface) are accomplished by heating overlapped coated foils to 180° C, then drawing the sandwich apart in an Instron tester.

RESULTS:

The standard copolymer at acid numbers 35 and 70 did not demix when aged at 60° C and gave only a slight indication of an increase in the critical surface tension at 90° C. These changes may have been due to surface oxidation.

Seal strengths of the standard copolymers did not change at 90° C for 96 hr. This constancy implies that migration of low-energy moities to the interface does not occur. Styrene/butyl acrylate/methacrylic acid terpolymers displayed considerable loss in seal strength on heat aging.

The monitors expressed more interest in the coating-substrate interface than in the free surface. Contemplated work will coat films onto foil which can be removed by amalgamation. Surface state characteristics will be ascertained on the polymer-metal interface.

Aging in the presence of atmospheric contaminants will be studied.

Published research involving the technique used in this study showed that the exudation of plasticizers from cast films could be detected by an increase in γ_c.

RELEVANCE:

Although preference was expressed for interfacial tension measurements as a relevant feature, morphological changes in a cast film could be beneficial or deleterious; at any rate they should be controllable, and this implies that they be measurable.

Determination of plasticizer compatibility, if not relevant in itself, should have a parallel in the study of cosolvents which have been declared to be relevant.

Transitions in cast films on heating, including the glass transition, should relate to the ability of a coating to withstand thermal stresses.

No. 36Aq—Rheological Properties of Uniform Latices

PRINCIPAL: Irvin M. Krieger, of Case Western Reserve University

OBJECTIVES: (1) Utilization of uniform latices in the study of properties of aqueous dispersions.
(2) Control of the surface change in emulsifier-free latices.

PROCEDURES:

Well-characterized latices were prepared from azo-disulfonate initiators so as to contain strong acid surface charges. These samples were destroyed accidentally and the new fellow could not reproduce them.

An ionic comonomer was used in an alternative preparation. Copolymerization being a random occurrence at best, this method generated unwanted polyelectrolyte. Up to six centrifugations were necessary to remove these species.

RESULTS:

Vinyl benzyl sulfonate copolymers were made, ion exchanged, and centrifuged. Preliminary measurements were made of the colloid vibration potentials, but because of polymer preparation difficulties these potentials were not determined on the sulfonated copolymer.

Vibration potentials were supposed to add to the rheological studies of the second electroviscous effect to tell the ion distribution around the particles. This information would help in understanding dispersion stability (without surfactants).

RELEVANCE:

The relevance of this work depends directly on the need for controlled functionality on latex particles. Two schools of thought exist regarding built-in ionic groups vs. surfactants: one school says the surfactant-free latex would be superior; the other says the ionic groups would constitute a permanent locus for water sensitivity, just as bad as residual surfactant.

Because the preoccupation with latices did not fall in the province of WSD systems, Dr. Krieger did not apply for a renewal of this grant.

MILDEW CONSORTIUM

Operation of the mildew program by a consortium of the eight supporting members (six companies, the NPCA, and PRI) has been an initial success. After a two-year original commitment, all of the supporters have either signed for the third year which begins on October 1, 1980 or the committee representative has registered a positive recommendation for continuance.

Success is measured in an additional way. At least two Federation bodies want to perform development tests on one of the consortium's findings. This interest gives us a chance to find out relatively painlessly how an independently-minded consortium will react to wide dissemination of research results from restricted sponsorship. With both the Association and Federation among the sponsors there are several hundred reasons why their members should participate. Besides, the initial discovery of the polymer that fights back at mildew was made before the consortium started, so that this development serves as a shakedown test of how a consortium best interacts with the PRI hierarchial structure.

One setback was corrected during this year. Program Manager Eveleigh resigned and he was replaced, effective March 1, 1980, by Dr. Charles Yeager, a registration specialist from California.

No. 57Mi—Preparation of Mildew Metabolites, and their Degradation of Paints. Preparation of a Paint Polymer Which "Fights Back"

PRINCIPAL: Charles U. Pittman, Jr., of University of Alabama

OBJECTIVE: (1) Preparation of mildewcide-grafted polymers suitable for coatings.

(2) Evaluation of these polymers in vitro as mildewcides and coatings made therefrom on test fences as mildew-resistant coatings.

PROCEDURES:

Pentachlorophenol acrylate was copolymerized with ethyl acrylate in a loading of 0.1% to 6% and the resulting polymer was tested for fungicidal activity in Petri dish cultures of *A. pullulans*. The biocide, TK100, and 8-hydroxyquinoline were also made into copolymers.

The pentachlorophenol polymer was made into a paint by blending 2% with an acrylic ester. The paint had 53% solids and a pH of 4.7, adjusted to 6.8 with NaOH.

Similar preparations were made with 3,4,5-tribromosalicylanilide acrylate.

Paints were applied to white pine lumber panels and exposed at Brownsville, Texas and San Francisco.

Preparations from 8-hydroxyquinoline were carried through the Petri dish testing stage which served as a screen for the earlier samples.

RESULTS:

Accelerated (Petri dish) tests of the 8-hydroxyquinoline acrylate revealed a zone of inhibition not observed with the PCP and TK 100 grafts reported earlier. Because zones of inhibition imply that the fungicide is not anchored but is leaching into the agar, the possibilities for this compound resisting the ravages of weathering are not good.

The 8-hydroxyquinoline copolymer allowed a complex array of genera to grow on outdoor exposure. *A. pullulans* was observed within four months.

PCP and TBS (tribromosalicylanilide) copolymers were well on their way to testing in a realistic pigmented paint formulation when the cooperator withdrew from the testing program. This setback coincided with our change to a consortium (with a resulting loss to the program of this particular cooperator) and is not likely to recur. However, large-scale testing has been delayed because of our experiences in hydrolysis on the test fence. The monitors are cautious about having widespread testing outside the consortium of a formulation that fails because of a hydrolyzable linkage to the polymer backbone.

RELEVANCE:

Anchored biocides should be nontoxic as well as longlasting.

Fungicides that fail because of physical properties (low boiling or water soluble) can be anchored and, thereby, made into useful copolymers.

No. 61 Mi—Role of *Aureobasidium pullulans* in the Deterioration and Disfigurement of Paint Films

PRINCIPAL: Robert A. Zabel, of State University of New York

OBJECTIVES: (1) Determination of the conditions under which *A. pullulans* deteriorates latex paint films.
(2) Determination of the effects of several pioneer invaders on *A.p* deterioration.
(3) Determination of *A.p* growth patterns in controlled culture.

PROCEDURES:

The three objectives were fine-tuned so as to indicate the procedures to be used:

(1) Quantify *A.p* biomass and ascertain if the fungus uses a particular paint component.

(2) Employ different *A.p* strains to minimize test strain bias.

(3) Increase VV exposure and learn why it increases mildew development.

(4) Relate free moisture in films to *A.p* growth and ascertain if pore size in the film is the major factor.

Preinoculated sapwood blocks and sterilized paint film squares provided the specimens. These were enclosed in square glass jars and stored at various temperatures and humidities.

SEM was used to observe the location of hyphal growth and to seek evidence of film lysis in the vicinity of the hyphae.

Inception and intensity of *A.p* growth were determined by the darkness of the growth and by the detection of glucosamine.

RESULTS:

A.p (in axenic culture, with no other invaders) uses only exogenous carbon, not carbon from the film. All weight changes can be accounted for; *A.p* hyphae contain glucosamine whereas hydrolyzed paint samples do not, and the glucosamine content can be extrapolated to *A.p* biomass.

Previous estimates of paint film moisture levels corresponding to RH and wood moisture levels have been confirmed.

Nutrients for *A.p* are found in Rautela and Cowling mineral media, with glucose, and also with pollen and with sapwood extracts.

RELEVANCE:

If accidental nutrient provides all of the carbon source for the prevalent organisms in mildew defacement, searches for ways to prevent nutrient from invading the formulation may be futile.

Assay techniques used in this grant show promise for the industry.

Humidity levels for optimum mold growth provide valuable information, particularly in connection with knowledge of the role of the wood substrate.

No. 64Mi—Control of Cell-Wall Biosynthesis of *Aureobasidium pullulans*

PRINCIPAL: Donald J. Siehr, of University of Missouri—Rolla

OBJECTIVES: (1) Biosynthesis of *A. pullulans* cell walls so that a rational attack on this organism can be mounted.

PROCEDURES:

Incorporation of radioactivity from glucose added to the growth medium was used to monitor the effectiveness of agents used to suppress the utilization of glucose.

RESULTS:

Regeneration of the cell wall by protoplasts has not been as rapid as expected, nor as complete. The protoplasts take up glucose but in a two-hour period the uptake is not influenced by the agents added to inhibit fungal growth: Polyoxin D, Metrasol, and TK 100. Mercury phenylacetate stopped the incorporation of ^{14}C.

This group is now growing a wide variety of protoplasts in the presence of radioactive glucose. From these they are attempting to recover newly formed fibril nets. They will also enzymatically hydrolyze the isolated polysaccharide and seek ^{14}C in the hydrolysate.

In general, conditions for regeneration of cell walls or polysaccharides resembling cell walls will be established. Along with this mission, the precursor of melanin (the black pigment) will be isolated if possible. Once this precursor is isolated it will be added to *A.p* protoplasts to learn if it fosters melanin production along with the cell wall.

RELEVANCE:

Knowledge of how *A.p* grows and how it manufactures unsightly pigment is a necessary precursor to finding a rational way to combat its growth and/or pigmentation.

An unpigmented fungus should not resist UV from sunlight.

OLIGOMERS

As we enter the 1980's we find increasing emphasis on low- to middle-molecular weight compounds. This is a legacy from the high-polymer area, which has outstripped oligomers in virtually every conceivable way, and from the coatings field, which started out with Nature's first oligomer. If we were to take advantage of this legacy we would advance the physical chemistry of oligomers along the lines similar to high polymers.

Here is a golden opportunity to conduct basic research unique to coatings. No contemporary polymer scientist would be expected to move in this direction unless the coatings industry provides the incentive.

A consortium to study oligomers to provide background for those interested in compliance coatings ranging from high solids to WSD's was the first new direction to be attempted as an outcome of the 1978 Workshop. Although we offered the services of a fairly well-knit cadre of faculty members from institutions ranging from Canada to Buffalo to North Dakota and New Jersey, the consortium did not materialize.

The PRI Trustees started the program on a small scale. One proposal, by Loren Hill at NDSU, was deemed worthy as a starting grant, around which a consortium could build slowly as funds became available. Hill has since left NDSU but the grant is active under the direction of Zeno Wicks. It just started last fall, and, as a consequence, the proposal is summarized here rather than progress on the grant.

No. 6901—Methacrylate Oligomers

PRINCIPAL: Zeno Wicks, of North Dakota State University

OBJECTIVE: (1) Preparation of oligomers for high-solid and possibly other compliance coatings.

PROCEDURES:

Alkali metal alkoxides serve as anionic initiators for oligomerizing without polymerizing methacrylic esters. Reaction temperatures run to 120°C; an alcohol is added to terminate the reaction; and the DP is controlled to values below 17 by the monomer to alcohol ratio rather than by initiator. Polydispersity is about 1.3.

Carboxyl termination can be performed by saponification of some of the ester groups.

Characterization will be by GPC, vapor pressure osmometry, and NMR. Carboxyl group placement will be determined by esterifying with a higher alcohol and observing the effect on MWD.

RELEVANCE:

The only compliance coatings that can use high molecular-weight resins are the latexes. High solids, WSD, powder, and radiation curables all need flowing materials.

The polymers produced in this initial grant should help steer the course for a consortium.

Unless the formulator of a compliance coating is dealing with a latex he is not likely to be using high polymers. Many of the coating types being developed these days deal with medium molecular-weight compounds that act like polymers in general but which have a greater part of their chemistry residing in the end groups and functional groups.

Evaporation of Solvents From Water-Borne Systems During Baking

Takeo Imai and Kenjiro Tsubouchi
Kansai Paint Company Limited*

It is generally accepted that baking type water-borne formulations are inferior in application to conventional formulations. Aiming at the solution to these problems, the behavior of solvent evaporation from coated films during baking was investigated by using experimental techniques, such as: thermogravimetric analysis; differential scanning calorimeter; gas chromatographic analysis; and dynamic spring analysis.

As a result of these experiments, it was found that skinning is more readily developed at the surface of water-borne systems than in conventional systems, causing the occurrence of retardation of solvent diffusion which is reflected in film popping.

INTRODUCTION

Because of recent regulations curtailing the emission of organic solvents into the air, there has been a growth in the use of water-borne systems in every field of the coatings industry. Among several types of water-borne systems available is a baking system which has been developed for the industrial coatings industry.

Whereas, electrodeposition primers are used predominantly in the automobile industry, worldwide, water-borne formulated topcoatings present certain difficulties in their application process. For this reason, their practical application to top coat has not had much success. Generally, the following defects have been found in water-borne coatings when compared with conventional solvent-based coatings: susceptibility to ambient temperature and humidity; poor control of rheological properties; and the tendency to develop popping and sagging. All of these problems are considered to be closely related to the performance of solvents included in the system, but few studies have been reported on the role played by these solvents.

The purpose of this current study was to investigate the evaporation behavior of solvents during baking and to discuss its correlation with the phenomenon of popping, one of the most troublesome problems in industrial applications of water-borne coatings systems.

Regardless of the drying type, air or baking, it is known that water-borne formulations foam more readily than solvent-based formulations. However, popping is not a phenomenon solely characteristic of water-borne formulations; it is also recognized as occurring in conventional baking type enamels. It has been stated by Bell[1] that air bubbles entrapped during the application process are the cause of popping. A similar conclusion has also been reached by Babel[2] with respect to solvent systems. In regard to water-borne systems, the existence of a correlation between the amount of entrapped air and the popping tendency has been determined.[3] Therefore, some of the popping which occurs in water-borne systems may be caused by entrapped air: however, this may not be the sole reason.[2] In a study[4] of water-borne systems, it was found that a coated panel, free of entrapped air, showed no popping when baked at 130° C, whereas popping did occur when a panel was baked at 180° C. Therefore, in this regard, water-borne systems are different from conventional systems.

Popping may be defined as eruptions of volatile matter in a film after it has become partially set, resulting in craters. The lack of the self-healing property of the film is related to the fluidity of coated films during baking. In the baking process, the fluidity is first improved as a result of a reduction in viscosity due to rising temperature. Subsequently, the decrease in fluidity follows from the increase in solid content caused by solvent evaporation.

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Table 1—Summarized Listing of Samples Used in Experiments

No.	Resin[a]	Solid Content (%)	Cosolvent Abbr[b]	Cosolvent Content (PHR)[c]	Ratio of Cosolvent to Water	Remarks
S-01	Polyester-1	25	EGME	30	1/9	
S-02	Polyester-1	25	EGMB	30	1/9	
S-03	Polyester-1	25	DEGDE	30	1/9	
S-04	Polyester-1	25	DEGDE	15	1/19	
S-05	Polyester-1	25	DEGDE	7.5	1/39	
S-06	Polyester-1	25	IPA	58	1/4.2	
S-07	Polyester-1	25	2EEA	30	1/9	
S-08	Polyester-1	25	DEGDM	30	1/9	
S-11	Acrylic-1	23	EGMB	33.3	1/9	
S-14	Polyester-2	29.5	EGMB/DEGME(1/1)	45	1/4.3	
S-15	Polyester-2	39	EGMB/DEGME(1/1)	45	1/2.5	Contains 30PHR PRD[d]
S-16	Polyester-3	31.4	EGMB	20	1/9.9	
S-17	Polyester-3	27.1	EGMB	40	1/5.8	
S-18	Polyester-3	36.1	EGMB	80	1/1.2	
S-19	Polyester-3	42.8	EGMB		Water free	
S-20	Acrylic-2	21	EGMB	36.5	1/9.4	
S-21	Acrylic-2	19.3	EGMB	50	1/7.4	
S-22	Acrylic-2	18.2	EGMB	80	1/4.6	
S-23	Acrylic-2	34.2	EGMB		Water free	
S-24	Acrylic-2	23.1	EGMB	36.5	1/8.1	Contains 25PHR PRD
S-25	Acrylic-3	33	EGMB	36.5	1/4.6	

(a) Polyester-1, -2 and -3 are water-soluble type resins having different compositions; acrylic-1 and -2 are water-soluble type resins having different compositions, and acrylic-3 is a colloidal dispersion resin.
(b) See *Table* 2.
(c) PHR means parts per hundred parts resin.
(d) PRD means polyol type reactive diluent.

Since the viscosity of water-borne systems is highly dependent on the composition of the solvents, consisting usually of water and organic cosolvents, the change in solvent composition due to the difference in their volatilities during drying should affect the fluidity of the systems. Also taken into account are amines, which are usually incorporated in water-borne systems to neutralize COOH groups in order to water-solubilize polymer molecules. Amines can evaporate rapidly during the early stages of baking, decreasing the water-solubility of the polymer molecules in the film. At the final stage of baking, crosslinking reactions should occur between base resins and the melamine compounds used as a crosslinking agent. This, then, must be reflected in a tremendous increase in the viscosity of the system.

As described above, the drying behavior of the baking type water-borne coatings is very complicated. Because of this, this study employs such experimental techniques as thermogravimetric analysis (TGA), differential scanning calorimeter (DSC), gas chromatographic analysis

Table 2—Physical Properties of Solvents

Solvent	Abbr.	Molecular Weight	Boiling Point °C, 760mm	Heat of Vaporization Kcal/mol	Vapor Pressure mmHg, 25°C
Isopropanol	IPA	60.1	82.3	9.57	44.49
Ethyleneglycol monoethyl ether	EGME	90.1	135.6	9.69	5.30
Ethyleneglycol monobutyl ether	EGMB	118.2	171.2	11.7	0.85
Diethyleneglycol monoethyl ether	DEGME	134.2	202.7	11.34	0.13
Diethyleneglycol dimethyl ether	DEGDM	134.2	159.8	10.31	3.4
Diethyleneglycol diethyl ether	DEGDE	162.2	188.4	11.7	0.38(20°C)
2-ethoxyethyl acetate	2EEA	132.2	156.3	10.6	1.09(20°C)
Water		18.02	100.0	10.6	23.76

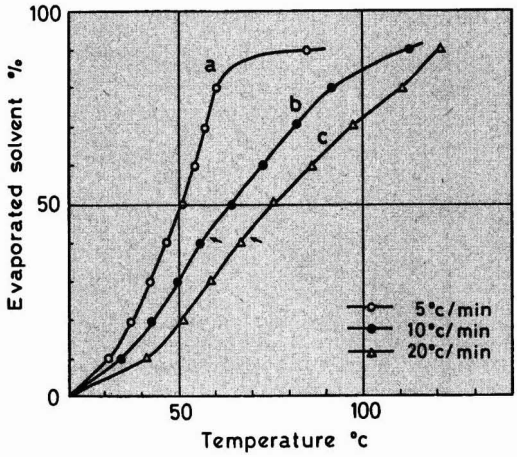

Figure 1—Evaporation curves obtained at different rates of heating (S-01)

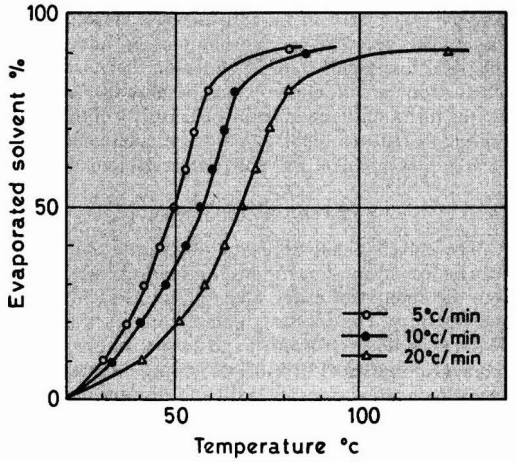

Figure 2—Evaporation curves obtained at different rates of heating (S-02)

(GC), and dynamic spring analysis (DSA), to investigate the problem.

EXPERIMENTAL

Samples

The samples used in this study are summarized in *Table* 1. The base resins, polyester and acrylic, were synthesized in our laboratory. *Table* 2 shows the characteristics of the organic solvents used as cosolvents in this study.

Apparatus

The TGA and DSC experiments used the differential scanning calorimeter Model TG-DSC (Rigaku Denki Co.), which is capable of obtaining TGA and DSC diagrams simultaneously.

GC was performed using a specifically designed apparatus (Nippon Chromato-Kogyo Co.) which provided analysis of evolved gases during baking. Because this device had a built-in flame ionization detector unsuitable for the determination of water, an additional gas chromatograph was used (Model JGC-1100, Japan Electron Optics Laboratory Co.) to detect the residual water in coated films. This device was assembled with an alternative thermal conductivity detector or hydrogen flame ionization detector.

DSA was conducted using the Rheovibron Model DDV-II-B (Toyo Measuring Instruments Co.). DSA, a recently developed experimental technique[5,6] which can determine the dynamic visco-elastic properties of semi-solid samples, is especially useful in recording the change of such properties with time. A small copper wire spring (5×10mm) was used as the carrier for the liquid sample to be tested. Thus prepared, the spring carrying the

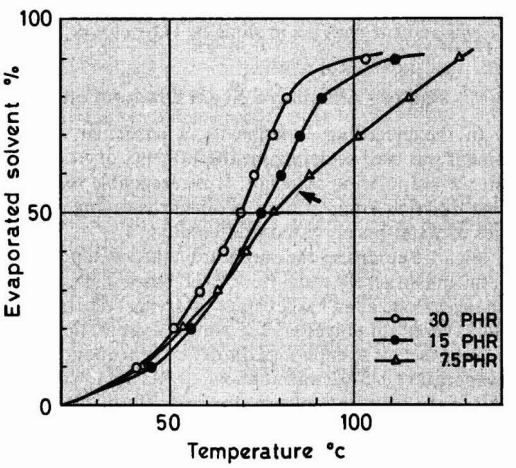

Figure 3—Influence of the amount of cosolvent added on evaporation curves (S-03, S-04 and S-05, RH = 20°C/min)

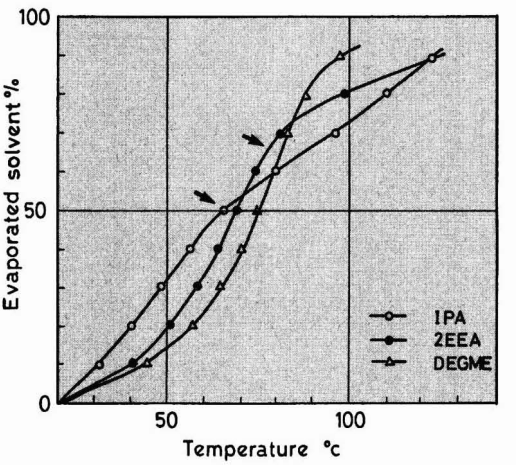

Figure 4—Influence of the volatility of cosolvent used on evaporation curves (S-06, S-07 and S-08, RH = 20°C/min)

sample was placed in the instrument. This experiment determines the storage- and loss-moduli, and the mechanical loss factor (tan δ). However, the storage- and loss-moduli are of relative values because they are given in the forms of the ratio based on elasticity of the carrier spring so that the obtained moduli are designated relative storage modulus (Er') and relative loss modulus (Er").

Evaporation Curves

The aspects of solvent evaporation from coated films can be seen by plotting the evaporation curves representing the amount of evaporated solvent at each stage of temperature. The necessary data are obtained from the TGA experiments. *Figures* 1 and 2 show the evaporation curves for samples S-01 and S-02 which contain ethyleneglycolmonoethyl ether (EGME) and ethyleneglycolmonobutyl ether (EGMB), respectively, as cosolvents. Experiments were made using three different rates of heating (RH), increasing 5, 10, and 20° C per minute.

Two stages governed the drying of the coatings, i.e., wet stage and dry stage.[7] Dry stage solvents evaporated much more slowly under the conditions controlled by the internal diffusion process. There exists between the two an intermediate stage which produces a smooth transition of evaporation curves when conventional coatings are tested. In the case of water-borne systems, however, the situation is somewhat different; arrows show curves b and c in *Figure* 1 breaking abruptly. This is also apparent in *Figures* 3 and 4. *Figure* 3 demonstrates the effect of the amount of cosolvent added where diethyleneglycol diethyl ether (DEGDE) was used. *Figure* 4 shows the influence of volatility of cosolvents, where isopropanol (IPA), 2-ethoxyethyl acetate (2EEA), and diethyleneglycol dimethyl ether (DEGDM) were used. These suggest that a change in slope in the evaporation curve tends to occur when a smaller amount of cosolvent or a higher volatile cosolvent is used.

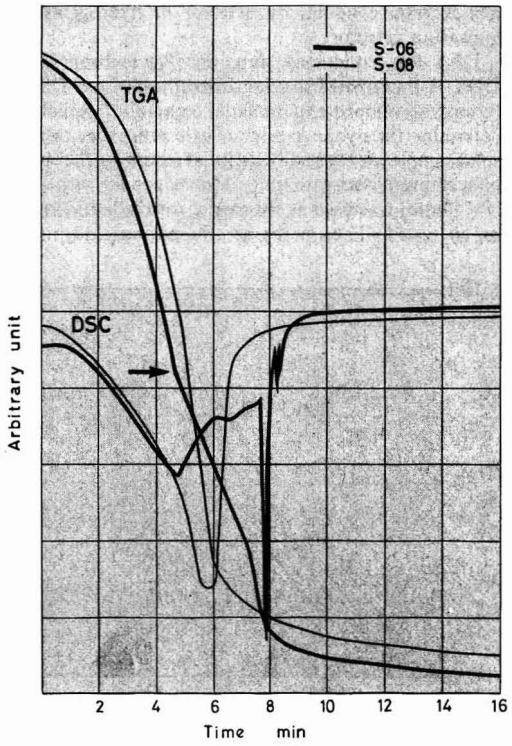

Figure 5—TGA and DSC diagrams obtained for S-06 and S-08 (RH = 20° C/min)

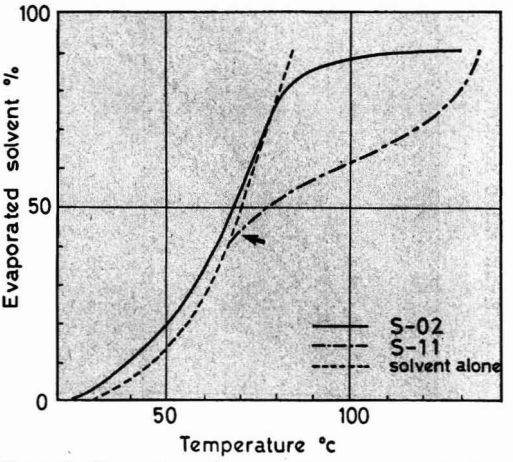

Figure 6—Comparison of evaporation curves obtained for samples based on polyester (S-02) and acrylic (S-11) (RH = 20° C/min)

This change in slope is also found in the TGA curve shown in *Figure* 5. Note the turbulence in the DSC curve for S-06 caused by an unusual volatilization which emerged in that sample. The remains of such a volatilization can be identified visually on the sample withdrawn from the DSC apparatus. Therefore, a phenomenon analogous to popping should occur under this experimental condition. These series of experiments confirm that a relationship exists between the turbulence in DSC curves and the changes in slope in TGA curves.

Factors Affecting Solvent Evaporation

In the preceding experiments, a particular type of binder was used to determine the influence of cosolvents on the evaporation behavior. It is reasonable to expect that different kinds of binders affect the drying properties of water-borne systems differently.

Figure 6 compares the evaporation rates of a polyester resin and an acrylic resin. Here, S-11, based on an acrylic, changes slope at an earlier stage of drying relative to the S-02, based on polyester. The solvent evaporation from coatings seems to enter into the dry stage at about 80% of evaporation in S-02, and at about 40% in S-11. Compare this to the evaporation curve for neat solvent, consisting of water and EGMB, in *Figure* 6.

Recently, reactive diluents have been recommended to improve water-borne formulations. A polyol type reactive diluent (PRD) was used in this study, resulting in

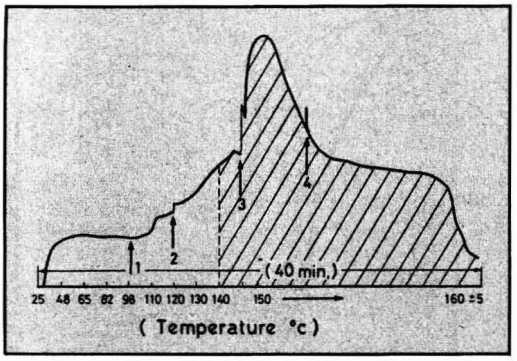

Figure 7—Variation of the total gas evolution during baking (S-14)

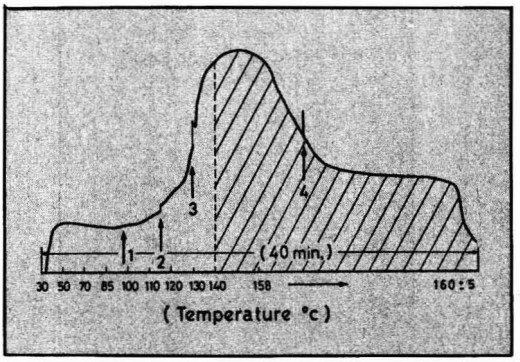

Figure 8—Variation of the total gas evolution during baking (S-15)

the elimination of the slope change in the TGA curves. A more precise investigation of the performance of PRD was made by using GC techniques, thereby determining the total amount, as well as the composition of evolved gases.

Figures 7 and 8 show the total gas evolution. It was interesting to see that S-15 with PRD loses solvents faster than S-14 without PRD. For comparison, the higher temperature region has been separated from the lower region at the arbitrarily chosen temperature of 140° C.

In S-14 and S-15, a mixture of EGMB and DEGME was used as a cosolvent. In order to find the change in their proportion of evolved gases, four samples were made in each run of total gas evolution analysis. The times at which the samples were taken are noted with arrows in *Figures* 7 and 8. The GC curves for the third and fourth samples are shown in *Figure* 9. These indicate that evaporation of DEGME was suppressed through the introduction of PRD.

These findings indicate that PRD in water-borne systems is effective in retarding the formation of a barrier structure in the films so that the solvent diffusion from bulk to surface can occur freely in the later stage of drying. This conclusion is supported by the viscoelasticity shown in *Figure* 10. Since the mechanical loss factor can be used as a measure of viscosity, it can be said that the viscosity of S-15 stayed at lower levels than that of S-14 during baking, except at the final stage, where crosslinking reactions were thought to occur.

Field Testing

The actual performance of water-borne formulations was field tested in accordance with a typical procedure for industrial coatings.

Steel panels, previously prepared with a primer and surfacer, were sprayed with nine samples containing different compositions (*Table* 1). The spraying was controlled to give film thicknesses increasing gradually from 15 to 65μ. After 10 min of flashing, the panels were baked for 30 min at 140° C.

Popping tendency was evaluated for each sample by testing the critical thickness, defined as that thickness below which films do not pop, meaning that the sample which is more ready to pop has the less critical thickness. The values for the critical thicknesses obtained are given in *Table* 3, in which is also shown the existence, or absence, of turbulence in the DSC curves. Consistent correlations are seen to exist between the amount of cosolvents included and the critical thickness, as well as the turbulence in DSC curves; the utility of PRD is also indicated.

DISCUSSION

When TGA is used at different rates of heating, certain information about the activation energy can be derived. According to Reich and Stivala,[8] who studied the thermal decomposition of polymers, the apparent activation energy can be expressed as

$$\log (RH) / T^2 = -E/(2.3\ RT) + \text{const.}$$

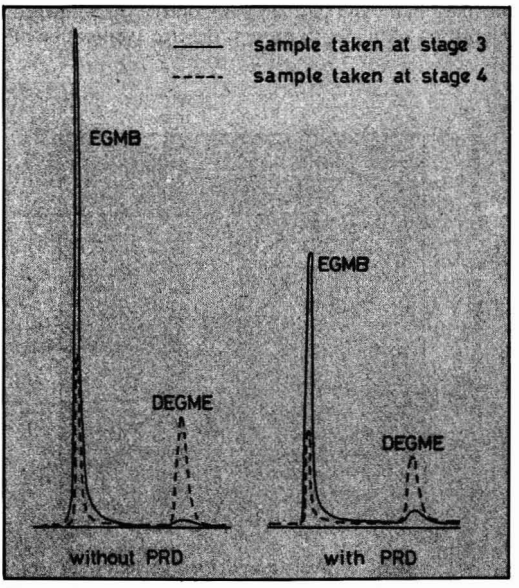

Figure 9—Comparison of the compositions of evolved gases sampled from S-14 and S-15 at given stages of baking

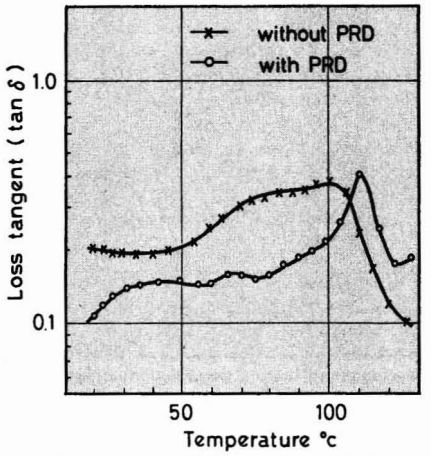

Figure 10—Variation of tan δ during baking (S-14 and S-15, RH = 2.5 °C/min)

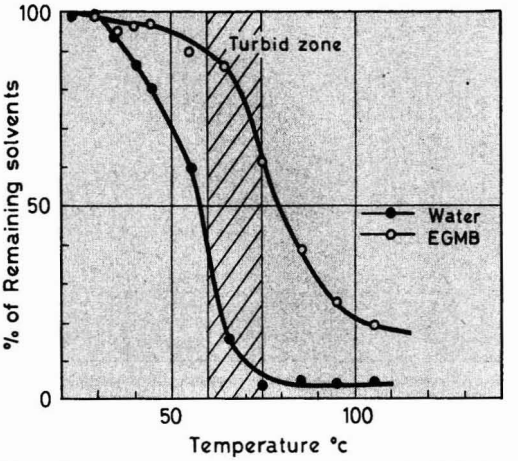

Figure 12—Variation of the amounts of residual solvents during baking (S-16, RH = 2.5 °C/min)

where E is the apparent activation energy for solvent evaporation and is characteristic of the given degree of evaporation; T is the temperature at which evaporation degree was attained; and R is the gas constant.

The above approach was applied to this study and *Figure* 11 was obtained by plotting E against the degree of evaporation. It can be seen that the slopes for neat solvent and S-02 are similar. Evaporation patterns in *Figure* 6 support this finding. In contrast to this, S-01, S-14, and S-15 show a marked lowering in E as drying progresses (*Figure* 11). It is assumed that these three samples are governed by a different mechanism of drying than S-02. This lowering of E, therefore, means that, as the temperature is raised, solvent evaporation becomes more difficult because of the strengthened interaction of binder to prevent the free evaporation of solvents. It has been found that formulations with a marked lowering of E have a general tendency to pop.

To understand the performance of water during baking, samples were taken intermittently from films and dissolved in DEGME for GC analysis. The results (*Figures* 12 and 13) show that water evaporates in preference to cosolvent mostly in a temperature range below 100° C; however, some water remains in the film beyond that temperature.

The appearance of wet films at first varied from transparent to turbid as temperature rose, but it returned to transparent after some time in the turbid state. It is thought that, while in the turbid state, a conversion from O/W emulsion to W/O emulsion occurred. *Figures* 12 and 13 show that the turbid state extends from the beginning of cosolvent evaporation to the cessation of water evaporation. Although the turbid state might be expected to have a correlation with the slope change found in evaporation curves, this could not be proven, for the turbid state always occurred in every sample, while slope change did not.

In the period after the slope change, wet films are assumed to be conditioned to the state where solvent evaporation is strongly restricted. The slope change has a

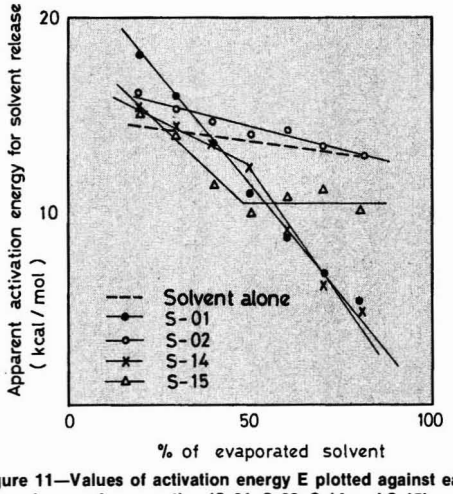

Figure 11—Values of activation energy E plotted against each degree of evaporation (S-01, S-02, S-14 and S-15)

Table 3—Results of Field Testing

Sample No.	Content of Cosolvent PHR	Critical Thickness μ	Existence of Turbulence in DSC
S-16	20	25	+
S-17	40	28	−
S-18	80	31	−
S-19	water free	17	−
S-20	36.5	17 ~ 20	+
S-21	50	24	±
S-22	80	25	−
S-23	water free	53	−
S-24	36.5	36	±

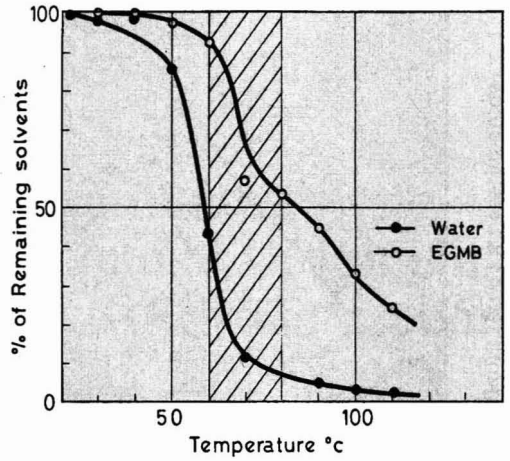

Figure 13—Variation of the amounts of residual solvents during baking (S-20, RH = 2.5°C/min)

tendency to occur in formulations with a markedly lower E at advanced evaporation stages. This occurrence and the lowering of E suggests the accumulation of overheated solvents in wet films and that, sooner or later, these solvents must evaporate eruptively with the resulting popping in films.

Closer observation of the change in appearance in wet films during drying showed a thin, transparent layer existing above the turbid bulk which increased its stickiness, leading in time to skinning. Although the lower bulk was in a liquid state, the surface skin was solid enough to be handled easily.

With respect to the solvent evaporation from polymer solutions, Sletmoe[9] has found that solvents must diffuse (1) through the bulk liquid; (2) through the liquid surface film; and finally, (3) through a stagnant air film adjacent to liquid. The surface layer mentioned is thought to correspond to the second step assigned by Sletmoe, and it

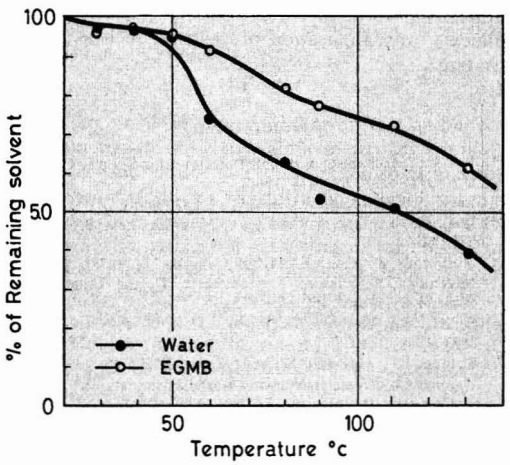

Figure 14—Variation of the amounts of residual solvents during baking (S-25, RH = 10°C/min)

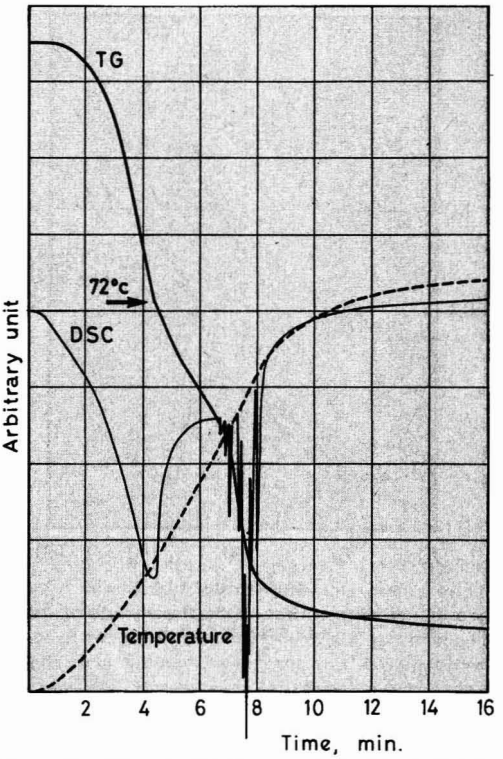

Figure 15—TGA and DSC diagrams obtained for S-25 (RH = 20° C/min)

plays an important role in the drying of water-borne formulations. The probable amine evaporation is also considered to act as a promoter for skin formation, providing it with a hydrophobic nature.

The above is shown in *Figures* 14 and 15, where an

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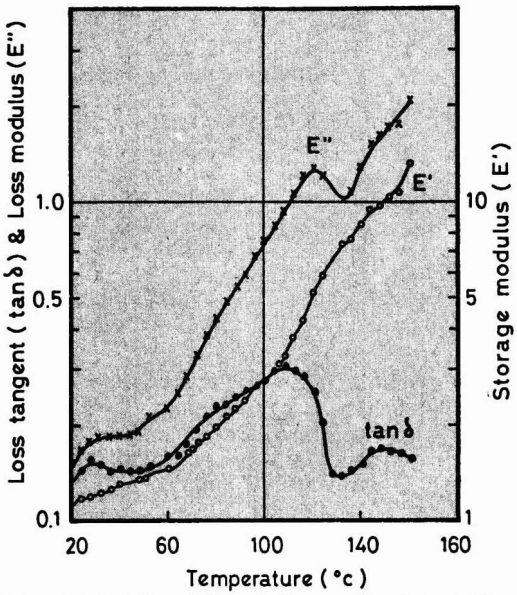

Figure 16—Variation of visco-elastic properties during baking (S-19, RH = 4° C/min)

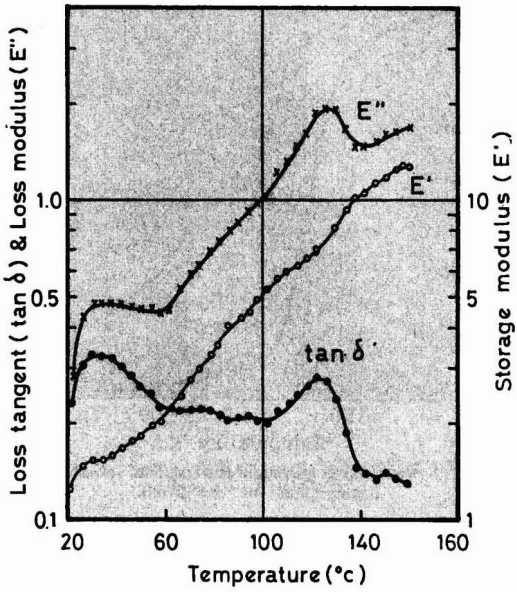

Figure 17—Variation of visco-elastic properties during baking (S-16, RH = 4° C/min)

acrylic colloidal dispersion was used as a binder. It is generally thought that colloidal dispersion resins pop more easily than water-soluble resins. Surface skin formed at about 60° C, while the analysis of residual solvents showed solvent evaporation being hindered at about the same temperature (*Figure* 14). Further, the change in slope was seen to occur in the vicinity of that temperature, viz., 72° C (*Figure* 15). Although there is a slight difference in temperature, thought to result from the difference in RH applied in the experiments, the above results are consistent enough to be worthwhile and to serve as an explanation for the mechanism for popping in water-borne formulations.

In *Figures* 16 and 17, the results of DSA in detecting the occurrence of early skinning in water-borne systems are shown. An early increase in tan δ for a water-borne system is shown in *Figure* 17. This means a significant increase in viscosity, indicating skin formation during the early stage of baking. In contrast, *Figure* 16 shows that the tan δ obtained for a solvent-based formulation remained at a lower level for a considerable time after baking was started. Unfortunately, this particular study could not identify what was responsible for popping; however, the study did show that, without fail, the turbulence in DSC curves fell in a decided temperature range from 110 to 135° C. This does suggest the possible responsibility of water for popping.

SUMMARY

In this study, the behavior of solvents during baking was investigated in order to reveal the mechanism of solvent evaporation in baking type water-borne systems. Experiments, using mostly water-soluble type samples based on polyester and acrylic resins, employed such techniques as TGA, DSC, GC, and DSA.

An abrupt change in evaporation was found in water-borne systems. This effect, not found in conventional systems, was identified in evaporation curves, as well as TGA curves. The occurrence of an abrupt change in slope means that overheated solvents must accumulate in the system to result in the eruptive evaporation at the advanced stage of drying.

Visually, water-borne coatings appear to have a surface skin, which acts as a barrier against solvent diffusion from the bulk to the surface, reflecting the detected slope change.

The mechanism for popping in water-borne systems is thought to be explained by the preceding. It is suggested that popping could be prevented by the suitable selection of binders, neutralizers, cosolvents, crosslinkers, reactive diluents, and application procedures, such as rate of heating.

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Quantitative Crystalline Pigment Analysis By X-Ray Diffraction

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The technique of x-ray diffraction is described and shown to offer a direct and simple method for providing a definitive crystalline pigment analysis of paint films. The advantages of positive identification of silicate extenders and modifiers and speed of analysis are discussed. Precision and accuracy data for quantitative determinations for typical pigments are presented. A table of constants relating intensities with concentrations for 15 common pigments is included.

INTRODUCTION

X-ray powder diffraction is an instrumental method of analysis in which the intensity of x-rays reflected from a specimen is recorded as a function of the angle of reflection. The angular position of the intensity maxima is related to the spacings, d, between crystallographically equivalent planes of atoms and the wavelength of radiation used, λ, by Bragg's Law:

$$\lambda = 2d \sin \theta \quad (1)$$

The sets of "d" spacings, i.e., the diffraction pattern, are characteristic of the crystalline species present in the specimen. Since no chemical information about a sample is obtained directly in x-ray diffraction, identification of an unknown is done by matching the pattern for the unknown with patterns of authenticated materials. This process is often simplified by obtaining elemental composition data by x-ray fluorescence or other means. Because of the nature of the phenomenon, diffraction is only useful for the identification of crystalline materials. An example of a diffraction pattern is presented in *Figure* 1.

The fundamental idea behind the use of x-ray diffraction for quantitative analysis is that the intensity of a diffraction pattern is proportional to the concentration of a given substance in the specimen under consideration.[1,2,3] Several factors complicate this scheme, with the most important one being the differing absorptive properties of the substances comprising the specimen. This results in a different, nonlinear relationship between intensity and concentration for each substance in every different mixture. A detailed examination of these complications is given by Klug and Alexander.[1] However, to obtain the concentrations of each substance relative to the unknown concentration of one substance in the mixture rather than absolute concentration, it is possible to greatly simplify the mathematical complexities.[4] The significance of these relative concentrations will be discussed.

THEORETICAL BACKGROUND

Klug and Alexander[1] showed that the intensity of diffracted x-rays from the Jth component of a mixture and from some selected set of planes, i, is given by

$$I_{iJ} = \frac{K_{iJ} f_J}{\overline{\mu}} \quad (2)$$

where K_{iJ} depends upon the nature of component J and the geometry of the apparatus. The volume fraction of component J in the mixture is given by f_J. The absorption coefficient of the mixture, $\overline{\mu}$, depends on composition; therefore, the absolute intensity I_{iJ} is not simply linearly dependent on f_J. It is necessary, therefore, to use calibration curves for every conceivable mixture of pigments to relate absolute intensities to absolute concentrations. However, if only relative concentrations are desired, only the ratio of each intensity to some reference peak in the pattern is needed, which eliminates the dependence on $\overline{\mu}$.[5]

$$\left(\frac{I_{iJ}}{I_{iR}} = K_{iJ}^{iR} \frac{X_J}{X_R}\right) \quad (3)$$

In equation (3), R refers to the reference substance, which is a component of the sample. The weight fraction of any

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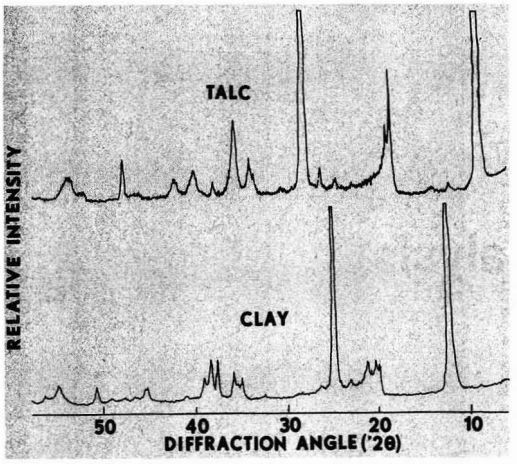

Figure 1—Diffraction patterns of two common silicate extender pigments. The clay used was Engelhard ASP-170

other component in the mixture is given by X_J. Equation (3) relates the weight ratios of components to the intensity ratios of these components. To perform quantitative analysis, intensity ratios can be measured on the diffraction pattern and then divided by K_{IJ}^{IR} to obtain the weight ratio.

The constant K_{IJ}^{IR} depends on the component being measured, the reference material, and the diffraction lines selected, but it is independent of concentration. If it can be assumed that all components have been identified, percentage composition can be determined by

$$\left(\% J = \frac{100 \quad \frac{X_J}{X_R}}{\frac{X_J}{X_R} + \frac{X_K}{X_R} + \cdots \frac{X_R}{X_R}} \right) \qquad (4)$$

It should be noted that this percentage is based only on crystalline materials. Thus, for a paint, they will not be the percentages of each pigment in the whole paint film.

This method is, in principle, identical to the method described by Chung in his papers on the "Matrix Flushing" technique.[6,7,8] The mathematical formalism has been somewhat simplified and the use of corundum as a reference material has been dropped.

In the present study, the values of the constants relating weight and intensity ratios were experimentally determined. The ubiquity of TiO_2 in paint systems makes it a good, if not ideal, choice for the reference substance. Paints of known composition were prepared and intensity ratios were read from the resulting diffraction patterns. In principle, it should be necessary to measure only one calibration standard for each material to determine this constant; however, to minimize error, several standards of varying composition were measured and the average constant was determined.

EXPERIMENTAL

The samples were prepared for diffraction analysis by dispersing pigment grade materials in an alkyd resin of about 55% solids. A Cowles disperser was used for the pigment grinding process and was continued until the particle size was less than 25 μ as measured on a Hegman bar. Each of these master batch dispersions contained only one pigment and was made up in the range 40 to 60% pigment, based on dispersion solids. Samples containing several pigments were prepared by mixing various amounts from the master batches. The mixtures were then drawn-down as 3 mil wet films on aluminum stock and dried in a 105° C oven for an hour. One inch square pieces were cut from these panels to be used in the diffractometer.

The rutile titanium dioxide used in these experiments was DuPont TiPure® R-900. Since this material is only 94% TiO_2, the calculation for TiO_2 concentrations in paint samples are corrected by this factor. TiO_2 values represent true concentration of TiO_2 and not the amount of surface treated material.

Two other factors which can have a significant effect on results are particle size and nonrandom orientation of platy or acicular pigments (mica, aluminum, etc.). The optimum particle size for the diffraction phenomenon is in the range 0.1 μ to 45 μ.[1] If the crystallites present are larger than 45 μ, generally, there will not be enough of them present to provide a statistically random distribution resulting in "noisy" peak shapes. On the other hand, extremely small crystallites result in line-broadening which can be severe enough to make a peak unrecognizable. In practice, one finds that inorganic pigments are usually of the correct size, while organic pigments show line-broadening.

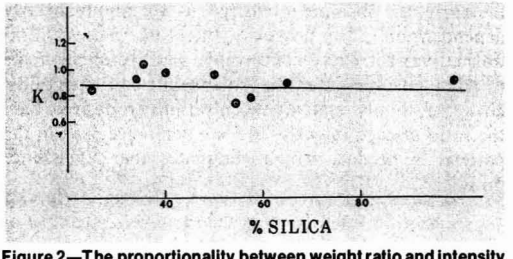

Figure 2—The proportionality between weight ratio and intensity ratio, K_{IJ}^{IR}, for silica referenced to rutile. The silica used was Illinois Minerals A-25

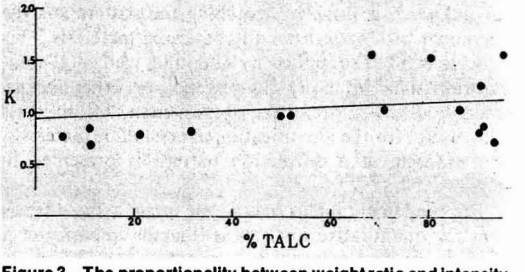

Figure 3—The proportionality between weight ratio and intensity ratio, K_{IJ}^{IR}, for talc referenced to rutile

Table 1—Quantitative Analysis Constants[a]

Substance	Diffraction Line "d" Spacing	Constant Relating Weight Ratio To Intensity Ratio
Barium sulfate	3.44	1.75
Calcium carbonate (Calcite)	3.02	0.80
Clay	7.18	0.94
Iron oxide (hematite)	2.52	3.61[b]
Iron oxide (goethite)	4.18	0.53[b]
Mica (muscovite)	10.04	0.81
Zinc molybdate	2.80	1.70[b]
Silica (diatomaceous earth)	4.07	1.25
Silica (quartz)	3.40	0.91
Strontium chromate	3.43	0.36[b]
Talc (magnesium silicate)	9.28	1.07
Titanium dioxide (anatase)	3.58	0.69
Titanium dioxide (rutile)	3.25	1.00
Zinc oxide	2.81	0.79
Zinc yellow (hydrated zinc potassium chromate)	3.28	2.13

(a) These constants are based on TiO_2 (Rutile) as the reference material. (d = 3.25)
(b) Indicates constants determined by examining only one calibration standard.

There is no easy or foolproof way to overcome preferred orientation effects. Determinations of mica will, therefore, be less accurate and precise than those of rutile, for instance. These problems can be minimized, however, by preparing standards from the same grades of pigment expected in the samples and by carrying out the dispersion process as described.

The intensity data were collected on a Norelco diffractometer equipped with a solid state scintillation counter, graphite-monochromatized Cu Kα radiation, and Canberra Industries pulse height analyzer. The x-ray generator was operated at 40 kV and 30 m A. Peaks were scanned at 1° in 2θ per minute in the range from 4° in 2θ to 40° in 2θ, and intensities were measured as the peak height to background. A complete analysis is usually concluded in less than one hour.

RESULTS AND DISCUSSION

The constancy of the K_{ij}^{IR} values while composition is varied is demonstrated in *Figures* 2 and 3 for quartz and talc referenced to rutile. Scatter is observed in the proportionality constants obtained; however, the slope of the straight line through the data is zero within experimental error. It should be noted that this kind of derivative plot exaggerates experimental error. As will be seen, percentage compositions calculated from an average of the constants plotted in *Figures* 2 and 3 are quite reproducible and accurate. These constants have been determined for a number of common pigments and are presented in *Table* 1. *Table* 2 presents accuracy data for the determination of TiO_2, silica (quartz), and talc in two and three pigment paints. For each paint composition, three separate panels were prepared and measured once on the diffractometer. The experimental values are averages of these three measurements for each paint. The agreement between the known composition and experimentally determined values is quite good. *Table* 3 presents precision data for the determination of TiO_2 and silica (quartz). These data are based on the three determinations for each of the three different compositions. Since different panels were used in each determination, this standard deviation is representative of the method, rather than just a verification of x-ray counting statistics.

Table 2—Accuracy of Pigment Analyses

Paint	Weight % TiO_2 Theory	Weight % TiO_2 Exptl.	Weight % Silica Theory	Weight % Silica Exptl.	Weight % Talc Theory	Weight % Talc Exptl.
A1	10.1	10.4	89.8	89.6	—	—
A2	50.0	46.9	50.0	53.1	—	—
A3	89.8	91.8	10.1	8.2	—	—
B1	50.0	54.1	10.0	7.8	40.0	38.1
B2	50.0	50.1	25.0	23.3	25.0	26.6
B3	50.1	49.2	39.8	37.9	10.1	12.9

Table 3—Precision of Pigment Analysis

Paint	TiO_2 % Std. Dev.	Silica % Std. Dev.
Two component	1.5	1.4
Three component	3.3	2.9

Examples of the use of this technique and the constants presented in *Table* 1 to analyze whole paints are presented in *Table* 4. Each paint was prepared by making a drawdown on aluminum panels and allowing them to dry. Again, the agreement is quite good.

X-ray diffraction has two distinct advantages over various types of chemical and instrumental analyses: (1) Results identify compounds directly, and not simply constituents of compounds; and (2) elaborate sample preparation is not necessary. The first of these is particularly important for samples containing silicates and/or free silica. Spectrographic or x-ray fluorescence analyses yield an elemental identification, e.g., Si, Al, Mg, and Ca, etc., or their oxides. This makes a unique structural and compositional identification of the particular silicates present difficult, at best. Furthermore, quantitative analysis is little more than an estimate. Therefore, silicates or other materials that differ only by crystal structure are impossible to distinguish by elemental analysis tech-

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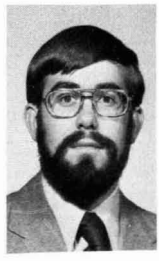

Table 4—Analysis of Whole Paints

Pigment	Weight % Experimental	Weight % Formula
Water-base floor and deck paint		
TiO_2	14.3	14.8
Silica	36.2	36.5
$CaCO_3$	49.5	48.7
Alkyd exterior		
TiO_2	45.2	44.8
Silica	17.9	20.6
$CaCO_3$	27.2	25.0
Talc	9.7	9.6
Wood filler		
TiO_2	25.0	26.0
$CaCO_3$	62.7	61.2
$BaSO_4$	12.3	12.8

niques. X-ray diffraction, however, will identify silicates by mineralogic type, such as talc, mica (muscovite), clay, and free silica (quartz). *Figure* 1 compares the diffraction patterns of two of these phases.

The second major advantage is the minimal sample preparation.[5,9] Powdered pigments are placed in the diffractometer without any prior preparation. Similarly, paint chips or painted panels are run as received. Whole paints are prepared by making a "drawdown" of 3 to 4 mil dry thickness on aluminum or other suitable flat substrates.

CONCLUSIONS

X-ray diffraction has been demonstrated to be an accurate and precise method of pigment analysis for whole paint films. It offers particular advantages in the areas of positive identification and simplicity of sample preparation. In addition, a set of experimentally determined constants relating weight and intensity ratios are provided, as well as a procedure for how these are determined. Quantitative estimates of the precision to be expected have also been calculated.

ACKNOWLEDGMENT

The author wishes to thank Jerry Ratliff and Andrea Piontek for their valued suggestions and experimental work.

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Three Unsolved Color Perception Problems Fundamental to Achieving Better Results In Industrial Applications of Color Science

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While applied color science as practiced in colorant producing and using industries has made much progress in the last decade in terms of instrumentation, a widening gap is perceived between what common color calculations are believed to deliver and what they can deliver on the basis of the known underlying principles of color perception. The three most pressing unsolved problems, color difference evaluation, color constancy or adaptation evaluation, and color depth and colorant strength evaluation, are discussed.

The extensiveness of the research necessary to solve these problems leads to the conclusion that a cooperative effort is required in order that results can be obtained in a reasonable period of time. It is suggested that what is needed is an industrially funded organization to work out the solutions.

Introduction

The application of color science, in particular, color measurement and calculations for colorant formulation, production control, and quality control, has become pervasive and widely accepted in the colorant producing and using industries. A proliferation of symposia, workshops, and courses indicate the substantial interest of the involved industries in this subject. The number of colorant formulation systems in the U.S. is estimated to be over 500 and the number of color measuring instruments to be, possibly, over 1000.

The economical advantages of using applied color science are substantial and obvious. Quality control of incoming colorant raw materials proceeds rapidly and accurately by means of measurement and computation. Economically optimal colorant formulations that are technically acceptable (metamerism, fastness properties) can be identified quickly from a range of colorants, and production control is rapid and objective and no longer done by trial and error. Color difference evaluation and color sorting simplify the problems of color quality control by putting objective numbers on the differences between the standard and production lots.

The emerging picture of technicians happily sitting at computer terminals making rapid measurements, and the computer copiously printing out the results of its calculations, accurately determining strength, shade, degree of metamerism, etc., is not inaccurate; however, it must be tempered by the knowledge that the scientific foundation on which many of these calculations are based is often slender. This does not, by itself, detract from the general usefulness of the resulting data. But there is a natural tendency for people not directly involved and not widely knowledgeable in color science to take results of measurements and calculations uncritically at face value. There is a danger of a gap developing between what color science is expected or believed to deliver in everyday practice and what it can deliver on the basis of current knowledge. The fundamental problem is the difficulty of relating measured results to human sensations. A major factor of this difficulty is the variability of individual human beings both within an individual as a function of time and between individuals.

The (partial) answer to this problem has been the "standard observer" representing the average human being under average conditions. To date, only the color matching abilities of the standard observer have been defined with sufficient scientific accuracy, leading to the CIE system of colorimetry. Other color vision properties and perceptions have been probed only superficially or under conditions that have little to do with the technical realities of manufacture and control of colored products. Yet the results of these probings form the basis for many calculations, the fruits of which flow effortlessly out of the computer printer. These so easily calculated results, however, are based on limited studies conducted with personal sacrifice by a few dedicated individuals or small groups committed to progress in their chosen field (with support of their organizations in some cases).

The remaining problems are of such magnitude that it is unlikely on the basis of combined individual efforts that the necessary answers will be forthcoming in a reasonable time span. Current efforts in the field of color difference evaluation indicate that, at the same level of investigative activity, substantial progress in color difference evaluation can only be expected after one to two decades. These are realities that need to be faced by plant management who are counting on ap-

This article was published originally in *American Dyestuff Reporter*, pp. 28-32, March 1980, under the title "The Three Unsolved Problems of Applied Color Science," and is reprinted here by permission of the publisher.

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plied color science for improved productivity in the years to come. The obvious answers involve a cooperative and guided effort to identify the most pressing problems from the point of view of the industrial user and to make a concerted and concentrated attempt at solving them or at least reducing the uncertainties.

The three most important unsolved problems in color science from the point of view of the industrial user involve (in this writer's opinion) color difference evaluation, color constancy, and depth of color.

Color Difference Evaluation

Objective color difference evaluation involves the measurement of reflectance properties of colored materials and the calculation of numerical values expressing the difference in color perceived by the average observer between two of them. The significance of this problem for the colorant producing and using industries needs no discussion. The international guiding body in matters of colorimetry, the CIE, has, in 1976, recommended two color difference formulas, the CIELAB formula and the CIELUV formula, in order to promote uniformity of usage and to check the proliferation of color difference formulas. These formulas were chosen from several of similar merit for use until a considerably better formula can be developed.

The reality of small color difference evaluations of paint and textile samples using the CIELAB formula is exemplified in *Figure* 1, based on data from a recent study.[1] The figure illustrates the correlation between color difference values based on the visual evaluations of some 30 observers, statistically evaluated to yield the visual scale, and color differences for the same samples based on reflectance measurement and color difference calculation. There are a total of 179 samples involved representing six areas of color space. It is clearly evident that the result is unsatisfactory. Color differences with a visual scale value of 2, for example, can have calculated color differences from 0.8 to 5.5 units. These results are quite typical and are similar to those obtained with other color difference formulas and other sets of visual data.

The trend among industry people who are cognizant of these facts has recently been to determine, for each color produced, individual tolerance limits that are specific for a given company. While this may be useful and, in fact, is the only solution for quality control of colored products where the answer may not strictly depend on the magnitude of perceived color difference, it is clearly not a satisfactory overall solution to the color difference problem. Accurate color difference evaluation is also important in colorant formulation, determination of indices of metamerism, index of color constancy, evaluation of fastness test results, etc.

In the long run, nothing less than the establishment of a "standard color difference observer" will do. To accomplish this goal, extensive visual judgments of small color differences are required to determine the influence of a number of variables on the judgments as well as a representative set of visual data on which to base an improved color difference formula.

Color Constancy

Color constant objects are those that appear to have the same color when viewed under different light sources. Objects that have a different color appearance under different light sources are commonly said to "flare." That an object can have the same appearance when viewed successively under two lights of different color is due to the adaptation effect of the human visual system. This effect tends to "center" the response of the human visual system on the prevailing illumination in a qualitative and quantitative sense. It makes a shirt look white in the cool light of the clear northern sky as well as in the warm dim glow of candle light.

To predict by calculation the effects of adaptation is quite useful for a number of practical reasons. It lets the designer choose his colors physically in such a way that the harmonious effect he tries to achieve, say, in clothing design or in interior decoration is preserved under various types and levels of illumination. Together with a better color difference formula, it helps to more accurately determine color differences seen under light sources other than the one on which the color difference formula originally has been based. It also can help to clarify

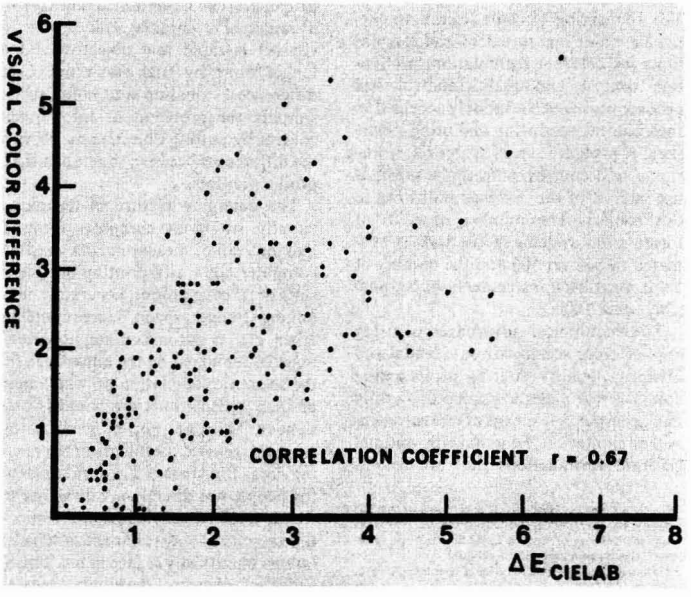


Figure 1—Scatter diagram of the correlation of 179 visually judged small color differences versus the corresponding calculated color differences (CIELAB formula). For details on data see Reference (1)

metamerism due to change in illuminant and to make its index more meaningful to the user.

A formula for color constancy predicts, as illustrated schematically in *Figure* 2, the colorimetric shift that is associated with equality of perception under two different light sources. Hypothetical colored object C is seen to have the same color appearance in, for example, tungsten light as compared with daylight if its position in the chromaticity diagram shifts to point 1. If it would shift to point 2, it would be said to flare greener. The distance from point 1 to point 2, expressed in terms of an accurate color difference formula, would be an index of color constancy.

It is obvious that different color transformations apply to different reference and test illuminants. A color constancy formula and an index of color constancy would also help in clarifying and in more meaningfully quantifying practical matching situations involving metamerism where there is a residual color difference under the reference light source.

Comparable with the color difference field, many adaptation formulas have been proposed over the years. However, there has been no agreement on their usefulness and quality. Currently, there is considerable interest among color scientists in the adaptation or constancy problem.[2] But progress is slow and existing research goals often do not run parallel with the needs of the colorant producing and using industries. What is needed, here again, is a determination of the effects of various factors on the color constancy judgment and of a set of data that represent the standard color constancy observer.

Depth and Strength

One of the most common problems to solve in the colorant-related industries is that of determining the strength of a colorant relative to that of another one used as standard. The economical importance of this question does not need to be belabored. The strength, simply expressed, means that the colorist needs to use x parts of test colorant B to obtain an identical coloration to that obtained with 100 parts of standard colorant A. If the colorants are chemically and physically identical, only colorant B happens to be more diluted with an inert diluent as compared with colorant A, the problem is an easy one of analytical chemistry or physics. However, this theoretical situation rarely applies in practice. More often than not, the two colorants differ, at least in part, chemically, or physically, or both, or they are not even the same colorants. The color produced by the test colorant may differ from that produced by the standard colorant in one, two, or all three dimensions of color.

The problem changes now from one of physics to one of psychophysics, involving the observation and judgment of a human observer. The parameter that needs to be evaluated is depth: are the two colorations that are being compared equally deep in color or not? The question of which colors are seen to be equally deep has up to now been totally disregarded by color science and the guiding body of colorimetry, the CIE. It has been, for many decades, of considerable interest to individual colorists.[3] It is ultimately the only answer to the question of relative strength determination of colorants that are chemically and/or physically dissimilar. The current situation is well exemplified by the software offering of one of the leading makers of color measurement and formulation systems. To calculate the strength of a colorant compared with a standard based on reflectance measurements of colorations made with the two colorants, the user of the system has six options:

(1) K/S at wavelength of maximum absorption of standard;

(2) K/S at wavelength of users choice;

(3,4,5) equality of X, Y, or Z tristimulus value; and

(6) integrated pseudo K/S.

Additional methods are used by other color technologists. The results of the various calculations will most likely differ. The choice of mode of calculation depends on the user's experience in specific cases or his predilections. The true answer (for the standard observer) is based on the perception of equality of depth. What needs to be established is (in one frame of reference) the position and shape of the plane in the CIE color space that contains all colors perceived to be equally deep as the standard color (see *Figure* 3). With this knowledge, strength determination becomes a simple question of adjusting the concentration of the test

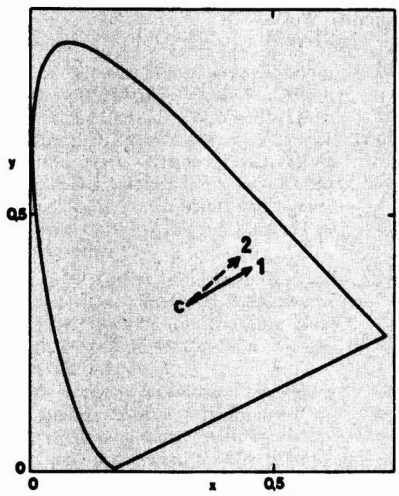


Figure 2—Schematical representation in the CIE chromaticity diagram of the colorimetric shift of color C from daylight to tungsten light. Point 1 represents a constant color, point 2 one that "flares" greener

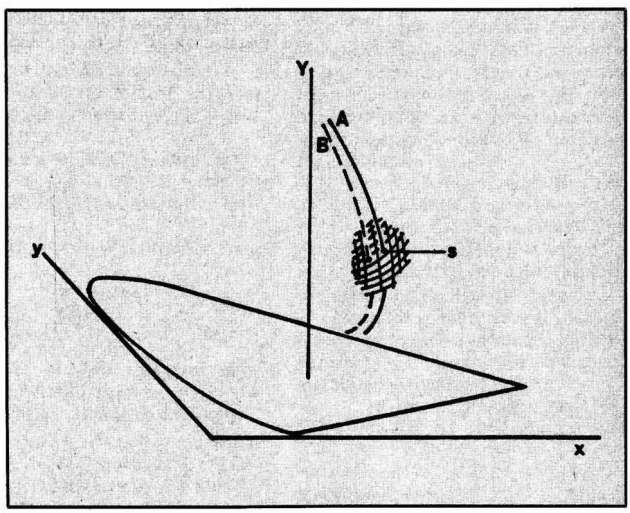


Figure 3—Schematical representation in the CIE color space of the trace of two similar colorants A and B (chromaticities at various concentrations) and a portion of a plane containing all colors that are seen to have equal depth to standard colorations(s)

colorant until the related colored material is perceived to have an equally deep color as the standard colored material. The strength is then calculated from the relative concentrations.

A number of depth formulas have been proposed over the years but none has proven to be satisfactory.[4] The reason involves, again, the development of formulas on the basis of too slender sets of visual data. Extensive visual determinations of the perception of equality of depth (definition of a standard depth observer) are needed for an accurate quantification of depth.

Conclusion

While the progress of applied color science in the colorant producing and using industries has been no less than spectacular in terms of measurement and calculating capabilities in the past decade, little progress has been made in expanding and solidifying the visual data on which much of the calculations are based. Crudely put, we can today calculate an index of metamerism in a split second and to two decimals, but it is likely to be 200% in error based on the average human judgment. This situation can be expected to persist into the foreseeable future until the economic sectors involved recognize the problem and undertake a well-planned, cooperative effort to solve it or at least to reduce its magnitude. The path to be taken is quite clear, there are enough experts to do the work or to guide it. What is needed is an industrially-funded organization whose purpose it is to solve these problems.

References

(1) Kuehni, R.G. and Marcus, R.T., "An Experiment in Visual Scaling of Small Color Differences," *Color Research and Application*, *4*, 83–91 (1979).

(2) See: Helson Memorial Symposium on Chromatic Adaptation, February 3–6, 1980, Williamsburg, VA, sponsored by the Inter-Society Color Council and the International Color Association.

(3) a) Godlove, I.H., "Tinctorial Strength, Depth of Dyeings and Money Value of Dyes," *American Dyestuff Reporter*, *43*, 685 (1954).

b) Gugerli, U., "Zur Bestimmung relativer Farbstoffstaerken auf farbmetrischem Wege," *Chimia*, *15*, 39 (1961).

c) Gall, L., "Versuche zur farbmetrischen Erfassung der Standardfarbtiefe," *Proceedings Color 69*, Stockholm, Sweden, 563 (1969).

d) Taylor, M.E., "An Instrumental Method for Determining Equal Depth of Shade," *Textile Chemist and Colorist*, *2*, 149 (1970).

e) Brockes, A., "Zur Problematik von Farbstaerke und Farbtiefe," *Textilveredlung*, *10*, 47 (1975).

(4) Kuehni, R.G., "Standard Depth and Its Determination." *Textile Chemist and Colorist*, *10*, 75 (1978).

United Kingdom Orders of FSCT Educational Literature

Mr. Ray Tennant, of the Birmingham Society, will act as a source of Federation educational literature (Color-matching Aptitude Test Set; Infrared Spectroscopy; Paint/Coatings Dictionary) for United Kingdom customers. Anyone interested in receiving these items is urged to contact Mr. Tennant. His address is: Carrs Paints Limited, Westminster Works, Alvechurch Road, Birmingham B31 3PG, England.

Society Meetings

Birmingham — May 1

A moment of silence was observed in memory of retired member Manfred Hess, who died recently.

David Penrice, of Newtown Industrial Finishes, spoke on "CONFESSIONS OF A SMALL PAINT MANUFACTURER."

According to Mr. Penrice, a successful company depends on the right people, the right products, the right premises and equipment, as well as the right attitude. With a slide presentation, he demonstrated a conscientious sales force and illustrated sales techniques used. Cooperation between sales and technical departments was emphasized. Mr. Penrice also showed examples of laboratory equipment and quality control testing. Among the topics he discussed were production, distribution, product range, administration, credit control, and job satisfaction.

BRIAN ADDENBROOKE, *Secretary*

C-D-I-C — Apr. 14

John Bax of Pacific Scott-Bader, spoke on "GLASS-LIKE LATEX COATINGS."

In addition, Dr. Ross Parks, of Monsanto, gave a presentation on "PLASTICS ARE FOR REAL."

ROBERT D. THOMAS, *Secretary*

C-D-I-C — May 12

The following officers were elected for the year 1980-81: President—W. J. Frost, of Ashland Chemical Co.; Vice-President—Robert D. Thomas, of Perry & Derrick Co.; Secretary—Nelson W. Barnhill, of Inland Div., GMC; Treasurer—Robert Burtzlaff, of Potter Paint; and Society Representative—William Mirick, of Battelle Institute.

Larry J. Culver, of Eastman Chemical Products, Inc., spoke on "MISCIBILITY CHARACTERISTICS OF ORGANIC SOLVENT/WATER MIXTURES FOR WATER-BORNE COATINGS."

Mr. Culver's presentation highlighted the importance of temperature considerations in dealing with solvent/water combinations and showed the effects on the phase boundary of various cosolvent additions.

In addition, Dr. Carl Bishop, of Monsanto, spoke on "CHEMICALS—BENEFICIAL OR HARMFUL?"

ROBERT D. THOMAS, *Secretary*

Golden Gate — Apr. 14

Lowell Cummings, of the Education Committee, announced that next year's tentative program will consist of the following four sessions: basic formulation, advanced formulation, basic concepts of the paint industry, and plant tour field trips.

Harry Saradarian, of the Environmental Protection Agency, spoke on "CURRENT AND NEW REGULATIONS ON HAZARDOUS WASTE DISPOSAL."

Mr. Saradarian stated that new Federal regulations will be published on the Resource Conservation and Recovery Act of 1976. He discussed changes in these regulations, pointing out that California has led the nation in hazardous waste programs. All of the regulations are geared to control hazardous waste from its generation to its disposal by means of a manifest, he said. Mr. Saradarian emphasized the importance of insuring the proper handling of waste at disposal sites. Under the new program, each company will be liable for their waste as long as it is identifiable, he concluded.

DON L. MAZZONE, *Secretary*

Kansas City — May 8

The following officers were elected for the year 1980-81: President—Richard Warren, of Cook Paint & Varnish Co.; Vice-President—Bill Smith IV, of Valspar Corp.; Secretary—Mike Bauer, of Tnemec Co., Inc.; and Treasurer—Meryl Bertrand, of Pratt & Lambert, Inc.

Society Honorary Member R. Van Deutekom was presented with a 50-year pin.

The Educational Committee sponsored a slide and tape presentation on ASTM 2805 Method of Measuring Hiding Power.

RICHARD WARREN, *Secretary*

Los Angeles — Apr. 9

A moment of silence was observed in memory of Ralph LeFever, of Cyprus Industrial Minerals, who died recently.

Fred Hoffman, of the Environmental Protection Agency, spoke on "HAZARDOUS WASTE DISPOSAL REGULATIONS."

Mr. Hoffman revealed that, as a result of a court order, the compilation of final regulations on hazardous waste disposal must be completed this month. He discussed the reasons for the 3001 Resource Conservation Recovery Act, citing such problems as water contaminated by leakage from industrial dump sites, toxic chemicals which have vaporized in land fills and have exposed populated areas to hazardous fumes, and fires which have erupted in chemical waste disposal areas. The Love Canal area was declared a disaster area because pollution and health hazards exist due to industrial waste disposed of 25 years ago, he said.

Mr. Hoffman stated that the procedures to be published will include "Standards for Generators" and "Standards for Transporters and Notification." The regulations will also cover containment of waste, and those involved in the treating, storing, and disposing of hazardous waste will need a permit. Fines for not complying with these standards will be severe, he continued. First offenders will be fined $10,000 per day, and second offenders will be fined double this amount.

Q. Along with setting up current companies for future liabilities, what is EPA doing to solve or promote waste disposal technology?

A. The EPA has a large R & D facility in Ohio. The hazardous waste program is the number one priority. Research is directed towards answers in treatment technology, disposal technology, and incineration.

Q. Generator responsibility "forever" may be fine, but unfair if the generator is a large corporation that is financially capable and available 5, 10, or 15 years from now. What is to happen to the small noncorporated generator? Will this spell the end to small business?

A. Generator responsibility is a law laid out by Congress. What happens 5, 10, or 15 years from now worries me also. The permit problem calls for a closure plan and a fund to be established to take care of problems after the disposal site is closed. If a generator is not around any longer, emergency measures will be taken. There is debate in Congress right now about establishing an emergency fund.

ROMER E. JOHNSON, *Secretary*

Northwestern — May 6

Jim Larson, of Cargill, Inc., spoke on "A SMORGASBORD OF HIGH SOLIDS."

Mr. Larson presented results of a recent study of intermediate and high-solids

baking enamel compositions that was designed to illustrate formulation parameters and cost performance tradeoffs involved in converting to high solids. This study compared a series of four baking-type polyester enamels, including a 35% volume solids conventional system, two intermediate compositions at 65 and 75% solids, and a very high, 90% solids product. Physical, application, and performance properties were evaluated, he said.

In sand milling the four formulations, it was found that the pigment wetting properties of the lower molecular weight polymers in the higher solids systems were improved, but had a tendency to foam during pigment dispersion. Mr. Larson stated that a tendency was found for wide discrepancies in nonvolatile determinations as solids contents were progressively increased. All four systems demonstrated Newtonian flow characteristics, he continued.

According to Mr. Larson, certain performance properties of the four systems, such as gloss, hardness, reverse impact, detergent resistance, and exterior durability, were similar. Salt fog and humidity resistances were also similar on phosphate-treated metal. On cold rolled steel substrates, however, the conventional system outperformed the higher solids systems. Cost comparisons favor high-solids formulations when cost is calculated on the basis of equal dry film thickness, he revealed.

Mr. Larson concluded his presentation by pointing out that the formulation of high-solids coatings presents a complex challenge to the coatings chemist, but evidence is accumulating that cost-effective, high-solids systems are feasible.

G. DALE ERNST, *Secretary*

Pacific Northwest — Mar. 20

George Grossman, of Q-Panel Co., spoke on "ACCELERATED WEATHERING TESTING."

ART BRAGG, *Secretary*

Piedmont — Apr. 16

Society President, John Hajnos, of Ashland Chemical Co., proposed that the club donate $2400, over a two-year period, for the Education Committee. This $1200 per year stipend would enable Dr. Melvin Hurwitz to coordinate programs and assist students in their course selection.

Bill Johnson, of the Environmental Protection Agency, spoke on "REGULATING THE WOOD FURNITURE INDUSTRY."

Mr. Johnson stated that the charge of the wood furniture industry is to meet the ambient air quality amendment to the Clean Air Act by 1982. As paint is sprayed, the solvents go into the air and mix with the nitrates emitted from automobile exhausts, he explained. This oxidizes into ozone, which creates problems and must be controlled.

To arrive at the proper guidelines, EPA commissioned the firm of Booz, Allen & Hamilton, in 1978, to make recommendations based on trial runs, Mr. Johnson continued. With the cooperation of both the paint and furniture industries, these trial runs were successful. As Mr. Johnson explained, however, the poor appearance of the furniture, half of which was aqueous-coated, prompted the EPA to delay the implementation of strict controls on the wood furniture industry.

The EPA did submit a draft of control guidelines in April 1979 to 200 recipients, he said. In this draft, the guidelines for all wood furniture was tentatively set at 120# solvent emitted per 1000 square feet of furniture. Included in the negative responses expressed by the wood furniture and coatings industries was the belief that this would penalize the high end furniture manufacturer. Mr. Johnson stated, however, that from this draft, the final guidelines were scheduled to be submitted by December 1979. These were delayed due to the validity of comments received after the April draft, he said.

Mr. Johnson concluded with a discussion of the cooperation between the General Services Administration (GSA) and the EPA. The GSA had agreed to purchase aqueous-coated wood furniture for a certain application, Mr. Johnson related. However, the Federal government has placed a temporary freeze on all GSA purchases of furniture.

JAMES ALBRIGHT, *Secretary*

Western New York — Apr. 8

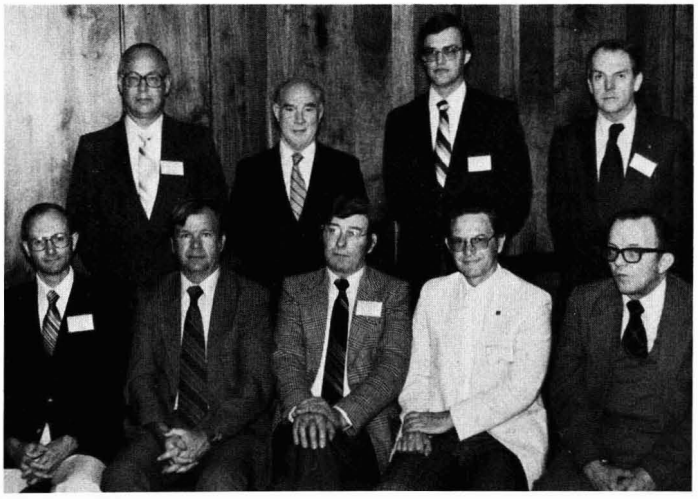
Dr. Albert Rocklin, of Shell Chemical Co., spoke on "COSOLVENTS FOR WATER-BORNE COATINGS."

Dr. Rocklin described his work which is concerned with the behavior of mixtures of solvents and water during evaporation under controlled conditions. A designed experiment of five variables was conducted and the results were analyzed by computer to generate an equation that predicts the evaporation behavior of mixtures of solvents and water, he said. The equation can be used to find solvent combinations and evaporation conditions that give solvent enrichment of a coating during evaporation.

Based on his work, Dr. Rocklin indicated that relative humidity had the greatest effect on solvent/water mixtures. Increases in humidity greatly retarded the evaporation of water. Since the solvents were unaffected by the humidity, the system became "solvent poor" as evaporation progressed, he explained. Also significant was the temperature of the surrounding atmosphere. The amount of water in the blend was found to be unimportant, he said.

In conclusion, Dr. Rocklin cautioned that his work was performed on relatively simple blends and that actual coatings containing polymers, pigments, and additives were vastly more complex.

JAY A. ROBEY, *Secretary*



Pacific Northwest Society Board of Directors for 1980–81. Seated (left to right): Past-President Walter B. Clyde; President Curtis P. Bailey; President-Elect Richard P. Stewart; Secretary Bob Miller; Past-President John A.J. Filchak. Standing: Administrative Secretary and Past-President William A. Shackelford; Past-President Michael Griffen; Treasurer Robert S. Hogg; and Society Representative and Past-President Deryk R. Pawsey. Not shown: Art Bragg

Elections

HOUSTON

Active

CONFER, KENNETH L.—Consultant, Houston, Tex.

Associate

CHRISTOPHER, CHRIS—N L Chemicals, Tomball, Tex.
O'SHEA, JOHN E.—Freeport Kaolin Co., New Orleans, La.

LOS ANGELES

Active

BRENNAN, JOSEPH—Benjamin Moore & Co., Los Angeles, Calif.
BURALL, ROBERT C.—Western-Specialty-Ctngs., Los Angeles.
BURNS, DOUGLAS R.—Whittaker Coatings HCI Div., Colton, Calif.
DAVIS, JOHN J.—WC Richards Company, Anaheim, Calif.
DUDZIK, NORMAN J.—Nelson Technical Coatings, South El Monte, Calif.
FIFER, VERN—Elixir Industries, Gardena, Calif.
FIMBRES, CONRAD C.—Consultant, Pico Rivera, Calif.
GASMENA, ROLAND L.—Ameron PCD., Brea, Calif.
GORMLY, TIMOTHY D.—D.F.C. Co., Los Angeles.
GROSS, EDWARD A.—Zynolyte Products Co., Compton, Calif.
HARUJI, SAKUGAWA—Ameron PCD., Brea.
LEEPER CYRUS, JR.—Cyron Coatings Co., Paramount, Calif.
MCKINNIE, J.R.—Formal Co., Los Angeles.
MILFORD, ELLEN—Whittaker Ctngs. & Chems., Colton.
OWEN, KEITH G.—Whittaker Ctngs. & Chems., Colton.
SHAH, SUBHASH—International Coating Co., Cerritos, Calif.
VANDERHOEK, ROBERT F.—Guardsman Chemicals, Inc., South Gate, Calif.
YAN, PETER—Easton Aluminum, Van Nuys, Calif.

Associate

BINGHAM, BRUCE W.—T.H. Goldschmidt Products, Costa Mesa, Calif.
BURROWS, BILL—Hunter Labs., Los Angeles, Calif.
HARTMAN, ROBERT W.—Cyprus Industrial Minerals, Los Angeles.
JASNOSZ, JOHN J.—McKesson Chemical, Los Angeles.
MITZNER, JEFF L.—Saramco, Gardena, Calif.
MOEBUS, C.R.—Cyprus Industrial Minerals Co., Los Angeles.
MOISEVE, DAVID J.—Pacific Coast Drum, Whittier, Calif.
O'FARRELL, ROLAND J.—McCloskey Varnish Co., Los Angeles.
RUDOLPH, F.E.—American Cyanamid Co., Los Angeles.
SHOUT, PHYLLIS—McKesson Chemical Co., Tustin, Calif.

NEW YORK

Active

AMRICH, GEORGE M. JR.—Hoboken Paints, Lodi, N.J.
CANTOR, JOSEPH—Josad Consultants, Inc., Elmhurst, N.Y.
CUEVAS, DANILO L.—Engelhard Industries, East Newark, N.J.
ECK, EUGENE—ConEdison, Astoria Queens, N.Y.
GOLDSTEIN, ALVIN W.—Pyramid Paint Prod. Inc., Brooklyn, N.Y.
GUEVIN, PAUL R. JR.—AMF, Inc., Stamford, Conn.
GYURIS, JOSEPH—Merck & Co., Inc., Rahway, N.J.
HOLLEY, LEONARD—CIBA-GEIGY, Ardsley, N.Y.
HUSTED, THOMAS E.—Cellofilm Corp., Woodridge, N.J.
MORALES, ELENITA S.—Alcan Ingot & Powders, Elizabeth, N.J.
O'BRIEN, JOHN J.—Cellomer Corp., Newark, N.J.
PROVING, VINCENT J.—Norton and Son, Inc., Bayonne, N.J.
WAELDE, LAWRENCE R.,—Norton and Son, Inc., Bayonne.
WEINER, LOUIS—Red Devil Paint & Chemicals, Mt. Vernon, N.Y.

Associate

KOROL, RICHARD T.—Drew Chemical Corp., Boonton, N.J.
LOGUE, LINDSAY A.—Laporte (North America) Ltd., Hackensack, N.J.
SHERIDAN, PETER J.—International Minerals & Chemical, Lynbrook, N.Y.

PACIFIC NORTHWEST

Active

KO, REYNALDO—Kokem Products, Inc., Portland, Ore.
PULLES, BERT—Flecto Coatings Ltd., Richmond, B.C., Can.
ROGERS, JAMES—Westcan Ind. Coatings, Burnaby, B.C., Can.
WHITESIDE, ALEX E.—Portland, Ore.

Technical Articles in Other Publications

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

Journal of the Oil and Colour Chemists' Association

Published by Oil and Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex, HAO 2SF England

Vol. 62 No. 12 December 1979

Saarnak, A.—"Characterisation of the Interaction between Pigments and Binder Solution Using Rheological Measurements"; 455–460.

Singh, B.P., Chandra, S., and Vasishtha, A.K.—"Coatings Based on Fatty Acid - Modified Cellulose Phthalate Resins"; 470–474.

Leonard, M.W.—"Study of the Effects of Increasing Crystallinity in Polyvinylidene Chloride-Coated Polypropylene (Prop C) and Cellulose (mxxT/s)"; 461–469.

Rascio, V.J.D., Caprari, J.J., delAmo, D., and Ingeniero, R.D.—"Raft Trials of Anticorrosive Paints of High Resistance"; 475–485.

Vol. 63 No. 1 January 1980

Papo, A. and Torriano, G.—"Rheological Properties of High-Build Paints Containing Castor Oil Derivatives"; 10–14.

Sengupta, S.C., Ghosh, D., Das, R.K., and Sinha, A.R.—"Modification of Shellac. Part I: Using Ethylene Glycol and Dicarboxylic Acids"; 15–22.

D'Alkaine, C.V., Garcia, C., Corti, H. and Gomez, D.—"Epoxy-Chromate Coatings: Electric Membrane Results"; 23–27.

Gunn, D.J.—"Coating of External Plywood Cladding Panels"; 28–33.

Hendifar, A.R. and Tirgan, M.R.—"A Gas Chromatography Study of Grape Dripping Oil"; 34–36.

Organic Coatings and Plastics Chemistry Preprints

Preprints of papers presented before ACS Division of Organic Coatings and Plastics Chemistry at ACS 179th National Meeting, Houston, Texas

Vol. 42 March 1980

Interfacial Synthesis
- New frontiers and recent applications (13 papers)
- Phase transfer catalysis (6 papers)
- New polycondensation systems (5 papers)

Borden Award - Polymer Colloids (12 papers)

Biomedical and Dental Applications
- Cardiovascular applications (6 papers)
- Dental applications (14 papers)
- Medical applications (5 papers)
- Biologically active polymers (5 papers)
- Bio materials (5 papers)

New Applications for Plastics (10 papers)

Mechanisms of Film Formation from Powders, Melts and Solutions (9 papers)

Characterization of Molecular Structure of Polymers by Photon, Electron, and Ion Probes
- Molecular charge states in polymers and molecular crystals (10 papers)
- Fundamentals of XPS, UPS and MO theory applied to polymers (10 abstracts)
- Applications of polymer surface analysis (9 abstracts)
- Spectroscopic characterization of molecular structure at polymer interfaces by optical and infrared spectroscopy (6 papers)

International Symposium on Photodegradation, Photooxidation and Photostabilization of Organic Coatings (24 papers)

New Concepts in Coatings and Plastics Chemistry
- Polymer synthesis and evaluation (5 papers)
- Electrically conductive polymers and other polymer properties (5 papers)
- Polymer studies at transition temperatures (5 papers)

History of Polymer Science and Technology (19 abstracts)

For information regarding the price and availability of this publication, please contact Dr. John Lupinski, Research & Development Center, Bldg. K1, General Electric Company, P.O. Box 8, Schenectady, N.Y. 12301.

Paint Manufacture

Published by Wheatland Journals Ltd., 157 Hagden Lane, Watford WD1 8LW, UK

Vol. 50 No. 1 January/February 1980

Smith, C.A.—"Pigmentation of Heat-Resistant Paints"; 16–17.

Ellinger, M.L.—"Anticorrosion and Marine Paints" (Literature review); 22–23.

Please consult *Chemical Abstracts Service Source Index* or the *Union List of Serials/New Serials* at the nearest public or college library for the location of listed periodicals in American libraries.

Meetings/Education

L.A. Society Reinstates Scholarship Program

In an effort to develop career awareness of the coatings industry among students, the Los Angeles Society has reinstituted its scholarship program. Scholarship criteria have been revised to encourage academic training of people for employment in the coatings industry, hopefully in the Southern California area.

The qualifications for scholarship candidates are as follows:

(1) Scholarship candidates must reside within the geographical boundaries of the Los Angeles Society for Coatings Technology as defined in the LASCT Constitution and By-Laws.

(2) The applicant must be planning to pursue a course of study leading to a BA, BS, MS or PhD in science, engineering, or mathematics. Students majoring in some aspect of coatings technology will have preference over those majoring in other phases of science, engineering, or mathematics.

(3) Merit evaluation will be based upon the candidate's college transcript, or upon college board entrance examination (SAT or ACT) results if the applicant has not previously attended college.

(4) Candidates meeting the above qualifications are eligible for the competition. Scholarships will be awarded in the order of priority listed below.

a. Any person currently employed in the coatings industry and who is a member, or could qualify as a member, of the LASCT.
b. Children of members, or of persons who could qualify as members, of the LASCT.
c. Other relatives of members, or of persons who could qualify as members, of the LASCT.
d. Persons not now in the Southern California area coatings industry or related to such persons, but who would like to train for possible future employment in the coatings industry.

(5) Scholarships will be awarded on a one-year basis.

(6) Renewal of scholarships will be contingent upon continued interest in pursuing a degree in science, engineering, or mathematics, maintenance of a 3.0 grade point average (A = 4.0), and continued availability of LASCT scholarship funds. (Students holding LASCT scholarships for the 1979-80 year may apply for renewal without changing their majors to the science, engineering, or mathematics fields.

(7) Evaluation of applications for scholarships and scholarship renewals will be made by the LASCT Scholarship Committee. Scholarship Committee recommendations must be approved by the LASCT Board of Directors. All decisions of the Board of Directors of the LASCT in any matter connected with the scholarship competition are final.

(8) Letters of application for scholarships or scholarship renewals will be solicited in November of 1980. Applications, accompanied by the required transcripts or college entrance board examination results must be received by the Chairman of the LASCT Scholarship Committee by January 31, 1981. Any award or awards made for the 1981-82 school year will be announced about April 1, 1981.

Levinson Addresses Technion in Israel On Architectural Organic Coatings

Sidney B. Levinson, President of D/L Laboratories, N.Y, recently lectured paint chemists and architects at Technion, the Israel Engineering University, in Haifa. His presentation, suggested by John H. White, Director of the Israel Paint Research Association, was entitled "Organic Coatings for Architectural Metals."

In his lecture, Mr. Levinson focused on the most popular types of industrial finishes, or chemical coatings, presently used in the U.S. These include alkyds, polyesters or oil-free alkyds, both solvent-thinned and water-thinned acrylics, and solvent-thinned or dispersion-(organosol) type vinyls. After discussing the reasons for the use of each type, he compared them for the method of cure and their relative appearance, performance, resistance, and durability properties.

While in Israel, Mr. Levinson also visited Tambour Askar Paints, Ltd. in Akko, the largest paint plant in the country.

NDSU Dedicates Coatings Lab

The North Dakota State University Polymers and Coatings Department has designated its coatings laboratory as the Fanny Spitz Breskman Memorial Laboratory. Mrs. Breskman's son, Joseph S. Breskman, has contributed $20,000 for new equipment and instrumentation for the Laboratory named in his mother's honor. Mrs. Breskman was the daughter of George and Ester Spitz, early settlers of Northeastern Pennsylvania, and wife of Dr. Louis Breskman, M.D., for more than 40 years.

Joseph Breskman, her only child, received his A.B. Degree in Chemistry from the University of Pennsylvania and his M.S. in Organic Chemistry from Catholic University. Since 1949 he has been President of the Sentry Paint and Chemical Company of Darby, Pennsylvania. Sentry manufactures chemical coatings. Since 1977, he has also been President of Wabash Products of Terre Haute, Indiana who also manufactures chemical coatings. He and his wife Dotty have been married 33 years with three children and four grandchildren. Ellis Breskman, one of their sons, was a graduate student at NDSU receiving the Ph.D. Degree in Chemistry with a major in Polymers and Coatings in 1975. Ellis is now employed by Sentry Paint and Chemical.

Chemical Risk Management Featured at Lehigh

The Lehigh University Office of Continuing Education, in cooperation with the EASTEK Corp., will offer a four-day chemical risk management seminar on the Bethlehem campus, July 21-24.

The seminar is intended for technically trained managers in manufacturing, research, engineering and marketing, as well as emergency response personnel.

The seminar director will be Charles A. McMenamy, Vice-President, safety research, EASTEK Corp. Included in the course will be the textbook "Product Safety Management and Engineering" and the NIOSH/OSHA Guide to Chemical Hazards.

For further information and registration material, contact Dr. James Brown, Office of Continuing Education, Sayre Building No. 26, Lehigh University, Bethlehem, Pa. 18015.

People

Dr. John L. Gardon has been named Vice-President and Technical Director, Chemical Coatings Div., of the Sherwin-Williams Co. A member of the Chicago Society, Dr. Gardon formerly served as Director, Research & Development, of the Coatings and Ink Div. of M&T Chemicals, Inc. and as a Trustee of the Paint Research Institute.

Meanwhile, **John G. Breen** has been elected Chairman of the Board of Directors for the company. Mr. Breen will continue to hold the title of President and Chief Executive Officer.

Dr. F. Thomas Krotine has joined Sherwin-Williams as Senior Vice-President of Research and Development. He will report directly to Mr. Breen.

Union Carbide Corp., New York, NY, has promoted **Richard A. Lemmick** to Sales Representative in its Coatings Materials Div., southeast sales region. He is a member of the Southern Society.

In addition, **Anne M. Saad** has been named Technical Representative in the company's central sales region. Ms. Saad is a member of the Detroit Society.

In a recent election of the National Coil Coaters Association, the following officers and directors were selected: President—**Donald K. Lutes, Sr.;** Vice-Presidents—**A.R. McInnes** and **J.R. Pickering;** Treasurer—**John H. Geyer;** and Board of Directors—**Ray Cunio, John G. Dickson, Richard J. Krause,** and **Omar K. Skiver.**

Reappointed to positions on the Management Staff of NCCA were: Executive Director—**Thomas A. Fernley III;** Executive Secretary—**Jere D. Lawrence;** Marketing Services Director—**Don White;** Associate, Marketing Services—**Tony Carroll;** and Legal Counsel—**George M. Schlosser.**

Herbert A. McKenzie will join the Hilton-Davis Chemical Group, Cincinnati, OH, in the newly created position of Executive Vice-President. Most recently, Mr. McKenzie served as Manager of the Polymer Additives Dept. of the American Cyanamid Co.

Gardner Laboratory Div. of Pacific Scientific Co., Bethesda, MD, has named **Roger Wells** to the position of Director of Marketing. He will be responsible for all international and domestic marketing and sales activities for the company's appearance measuring and physical testing instrumentation.

J.L. Gardon

R.A. Lemmick

J.S. Crafts

R.M. Christenson

John S. Crafts has been elected Technical Vice-President of Seibert Oxidermo, Inc., Detroit, MI. He recently held the position of Manager of Technical Services. Mr. Crafts is a member of the Detroit Society.

Mike Nichols has joined the development laboratories, Industrial Coatings Div., of Progress Paint Manufacturing Co., Louisville. He will serve as a Coatings Formulator for custom finishes and will assist in new product development.

Four new Assistant Vice-Presidents have been appointed by the International Marine Coatings Div. of International Paint Co., Inc., New York. **Owen Jones** will assume responsibility for the West Gulf region and will be headquartered in Houston. With headquarters in Miami, **Edward D. Siren** will take charge of the Southeast district. **Joseph G. Barecchia** has been appointed Assistant Vice-President of the Northeast. He will be based in the company's New York executive sales office. **Thomas M. Curry** will be based in New Orleans, with responsibility for the East Gulf region.

Scott Hoffman has joined Nason Automotive Finishes Div., The O'Brien Corp. in South San Francisco as a Sales Representative. He will take charge of the company's product line in Texas and Louisiana.

Jerry Scott, General Manager of the Polymer Div. of H.B. Fuller Co., St. Paul, MN, has been elected Vice-President of the firm.

Allen Shalom has been appointed to the laboratory staff of the Clay Div. of the J.M. Huber Corp., Huber, GA in the position of Pilot Plant Engineer. Mr. Shalom will initiate and implement research and development programs involving clays and other pigments.

PPG Industries, Inc., Coatings & Resins Div., Allison Park, PA, has promoted **Dr. Roger M. Christenson** to the position of Director of Research of its Research and Development Laboratory. He is credited as inventor or co-inventor of over 100 patents issued in North America and Europe. Dr. Christenson is a member of the Pittsburgh Society.

Intercoastal Paint Co., Inc., Houston, TX, has appointed **Otto J. Mileti, Jr.** to the position of President of the firm. He has contributed 34 years of experience to all phases of the paint industry. Mr. Mileti is a member of the Houston Society.

John D. Whiteman has been promoted to Project Leader at the Spring House location of the Rohm and Haas Co. In this position, Dr. Whiteman will be responsible for the high solids program in industrial coatings, emphasizing reduced pollution and lower energy requirements.

Larry Lewandowski has been named President of J.D. Mullen Co., Denver, CO. He will assume responsibility for overall business management and outside sales effort for the company. Mr. Lewandowski is a member of the Rocky Mountain Society.

Sunbelt Chemicals, Inc., Dallas, TX, has named **Kenneth L. Confer** District Manager for the Houston-Texas Gulf Coast sales area. He is a member of the Houston Society.

Thiokol Corp., Newtown, PA, has named **Thomas J. Golder** General Manager of its Specialty Chemicals Div. Mr. Golder, who succeeds **Gary L. Mossman,** had been President of the Oxo-Alcohols Div. of W.R. Grace & Co.

Karen J. Davis has joined California Resin and Chemical Co., Inc., Vallejo, CA as a Chemist. Her research will focus on emulsions and other water-reducibles.

Fred W. Montanari, President of NL Chemicals, has been elected to serve as Executive Vice-President of operations of NL Industries, New York, NY.

Meanwhile, **Theodore C. Rogers** has been elected President, Chief Operating Officer, and a member of the NL Board of Directors.

Frank W. Hendricks has been elected to head the newly formed International Div. of Rust-Oleum Corp., Vernon Hills, IL. In addition to his new responsibilities, he will continue to serve as Vice-President of manufacturing and technology.

Rust-Oleum has also named **Bruce Brouillette, John Fethiere, John Hall,** and **Martha J. Shafer** Senior Chemists at its Evanston, IL Research and Development Center.

Terry L. Karhan has been named Director, Planning and Development, for The Harshaw Chemical Co., Cleveland, OH. With this appointment, Mr. Karhan assumes responsibility for the direction of company planning activities and the development and implementation of marketing plans in new business areas.

Eugene H. Buttle has joined Reliance Universal, Inc. as Vice-President and General Manager of the company's Specialty Coatings Div. Mr. Buttle will assume responsibility for the specialty coatings operations in Somerset, NJ; Zion, IL; Houston, TX; and Louisville, KY.

In an effort to improve trade sales product growth, the National Paint & Coatings Association has reorganized members of its staff into a Consumer Products Div., headed by **Richard Weiss.** Most recently, Mr. Weiss served as Director of Marketing for Hollister, Incorporated.

Mark Padow, formerly Director of the Trade Sales Div., has been named Associate Director, Administrative, of the new division. He will assume new administrative and planning functions and will maintain liaison with committees in the trade sales area.

NPCA has also named **Liz S. Elliott** Associate Director, Product Promotion. Ms. Eliott will be responsible for the in-house product promotion program and for special projects, including a national public relations campaign.

In addition, **Bonnie Benhayon** will expand her activities as Manager of Editorial Services and **Kathy Haley** will continue in the position of Writer/Editor, developing feature articles on decorating with paint.

The Process Chemicals Div. of Diamond Shamrock Corp., Morristown, NJ, has promoted **Joseph F. Yatczyn** to Senior Technical Sales Representative of specialty chemicals. Mr. Yatczyn is a member of the New York Society.

R.A. Roeder has been appointed Department Manager for the Titanium Dioxide Dept., of Cyanamid. He will be located at the headquarters of the Industrial Chemicals Div. in Wayne, NJ.

Dr. Evord F. Knights has been appointed Vice-President, development, for the Petrochemical Group, Union Chemicals Div., Union Oil Co. of California. Dr. Knights formerly served as Manager of manufacturing for the group.

In addition, the petrochemicals Group has named **William F. Murphy** to the newly created post of General Manager, polymers. He will be responsible for marketing the firm's polymers and hot melt adhesives.

Letters to the Editor

CPVC Information Challenged by Reader

TO THE EDITOR:

The article in your March issue by Messrs. Brown, Stoy, and Scibek ("New Formulating Parameters in the Switch from Bag to Slurry Clay") displays a complete misinterpretation of the relative effects of solution and latex binders on the observed CPVC's for similar pigmentations. Had its authors consulted my original work on the subject rather than the referenced paraphrase published five years later by Ramig, I do not believe that any such confusion would have resulted.

While it is probable that anyone who has ever had any practical experience in paint formulation will be aware that CPVC's are always lower, for the same pigmentation, in latex paints than in solvent-base paints, such misstatements should not be permitted to stand unchallenged in the literature, since those lacking such experience—but perhaps accepted as "authorities" in paint technology because of their expertise in some loosely related scientific endeavor—may not only accept them as factual, but later quote them to substantiate erroneous conclusions.

The binding power index, referred to as the "binder index" on page 58 of the article in question, is a numerical representation of the relative binding abilities of solution and latex binders, and is *always less than unity* due to the inferior binding capability of a dispersion of semi-solid globules as compared to even the same polymer deposited from solution. The smaller the particle size of the dispersed polymer, and the greater its ability to deform at ambient temperatures (due to lower glass-transition, increased plasticizer, lower molecular weight, etc.), the higher the binding power index. Since these same factors tend to decrease mechanical and freeze-thaw stability, the binding power index is unlikely to exceed 0.85 for any polymer emulsion intended as a paint vehicle. For many widely used commercial examples, it is closer to 0.65, or somewhat lower.

The relationship is such that the following equation applies:

$$\frac{1}{CPVC_n} - 1 = \frac{x}{CPVC_a} - x$$

where $CPVC_n$ = CPVC in solvent-base system
$CPVC_a$ = CPVC in latex system
x = binding power index

The 55 PVC test formulations evaluated by Messrs. Brown, Stoy, and Scibek are, therefore, considerably further above their CPVC's than suggested by their oil-absorption CPVC's (sic), rather than slightly below as the authors infer. This will, of course, also be apparent to experienced formulators from the lack of "breaks" in any of the performance curves.

It is hard to understand how your board of reviewers could have permitted this error to pass, but the fact that they did would seem to support my cited fears for allowing it to go unchallenged.

FRED B. STIEG
Pigmentech Consulting
Jekyll Island, GA.

Author Elaborates Regarding CPVC

TO THE EDITOR:

We are delighted that Mr. Stieg has chosen to expand on our very brief CPVC comments in the article "New Formulating Parameters in the Switch from Bag to Slurry Clay." They do merit amplification.

Indeed, theoretical or practical aspects of CPVC in solvent and water-borne paints are most dissimilar. The pioneering oil absorption method of the Philadelphia Club was cited by us because it provides a common bench mark that many still recognize. All appreciate the deficiencies. The original 1959 technique is additive. The effects of actual dispersion and the wetting characteristics of intricate solvent based polymer blends are not fully accounted for.

For latex paint calculations, Ramig makes a number of significant points. He discusses not only the derivation of his binder index, but also the enormous effect of pigment packing. He notes the considerably reduced oil absorption of three pigment mixtures.

The four pigment mixtures in our test paints exhibit a similar packing effect that is sometimes evident for certain broad particle size distributions and shape factors. These much lower vehicle adsorptions by most of our mixed pigment combinations produce higher recalculated CPVC values that accommodate the effect of binder index numbers. Thus, we still arrive at the 50–55% level in latex. Mr. Stieg's simple transposition to latex of our original, additive Philadelphia CPVC's has led him to assume much lower numbers.

As professional formulators, we turn again to the final reality of our paint test data. Practical measures of film tightness and integrity appear to confirm our estimated CPVC zones. It may be that this work demonstrates the contribution of all slurries. The maximized TiO_2 and extender dispersion that they offer insures better pigment packing and higher CPVC.

WILLIAM S. STOY
Engelhard Minerals &
Chemicals Div.
Edison, N.J.

Coming Events

FEDERATION MEETINGS

1980

(Oct. 28)—Federation Board of Directors Meeting. Hyatt Regency Hotel, Atlanta, Ga. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, Pa. 19107).

(Oct. 29–31)—58th Annual Meeting and 45th Paint Industries' Show. Atlanta Civic Center, Atlanta, Ga. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, Pa. 19107).

1981

(Mar. 24–26)—"Symposium on Color and Appearance Instrumentation." Executive West, Louisville, KY. Jointly sponsored by Federation of Societies for Coatings Technology, Manufacturers Council on Color and Appearance, and Inter-Society Color Council. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, Pa. 19107).

SPECIAL SOCIETY MEETINGS

1980

(Sept. 17–18)—Montreal and Toronto Societies Joint Symposium on "Corrosion." 17th in Montreal; 18th in Toronto.

(Oct. 7)—Cleveland Society Manufacturing Committee Symposium, "Formulation for and Utilization of Pigment Dispersion Equipment." Cleveland Engineering and Scientific Center, Cleveland, Ohio. (G. Dubey, Cambridge Coatings, Inc., 5461 Dunham Rd., Cleveland, Ohio 44137).

1981

(Mar. 4–6)—Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim, CA.

(Mar. 11–13)—Southern Society. 45th Annual Meeting. Plaza South Hotel, Birmingham, AL (Peter F. Decker, Union Carbide Corp., 17 Executive Park Drive, N.E. Atlanta, GA 30359).

(May 1)—Montreal Society. Fiftieth Anniversary dinner-dance. Montreal, Que.

(May 1–2)—Pacific Northwest Society. Annual Symposium. Washington Plaza Hotel, Seattle, WA.

OTHER ORGANIZATIONS

1980

(Aug. 18–Nov. 21)—Paint Short Courses at University of Missouri-Rolla. Introductory, Composition of Paints—Aug. 18–22; Basic Quality Control—Aug. 25–29; Introduction to Paint Formulation—Sept. 8–12; Advanced Paint Formulation—Sept. 15–19; Refresher Course for Maintenance Engineers, Contractors, and Painting Inspectors—Nov. 10–14; Job Estimating Workshop for Painting Contractors—Nov. 17–21. (Norma Fleming, Continuing Education, University of Missouri-Rolla, 501 W. 11th St., Rolla, Mo.)

(Aug. 18–22)—"Advances in Emulsion Polymerization and Latex Technology" Short Course. Schatzalp Berghotel, Davos, Switzerland. (Dr. Gary W. Poehlein, Director, School of Chemical Engineering, Georgia Institute of Technology, Atlanta, GA 30332.)

(Aug. 27)—Joint Symposium American Chemical Society, Industrial and Engineering Chemistry Div. Inter-Society Color

Council, "Advances in Color Technology," San Francisco, Calif. (Dr. Lawrence Lerner, Harmon Colors Corp., Box 419, Hawthorne, NJ 07507.)

(Sept. 14–17)—"Advanced Coating Technology," Williamsburg, Va. (Institute of Applied Technology, Jean L. Kaplan, 1200–17th St., N.W., Suite 406, Washington, D.C. 20036.)

(Sept. 18–19)—Society of Plastics Engineers 4th Annual Decorating Plastic RETEC. Sheraton Center Hotel, Toronto, Ontario, Canada. (Stephen Kennedy, Binks Manufacturing Co., 9201 W. Belmont Ave., Franklin Park, IL 60131.)

(Sept. 23–25)—Association of Finishing Processes of the Society of Manufacturing Engineers, 5th International Conference and Exposition on Radiation Curing. Park Plaza Hotel, Boston, Mass. (AFP/SME, Technical Administrator, Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, Mich. 48128)

(Sept. 24–26)—National Coil Coaters Association Fall Technical Meeting, Marriott Lincolnshire Resort, Lincolnshire, Ill. (NCCA, 1900 Arch St., Phila., Pa. 19103.)

(Sept. 29–Oct. 3)—"Nuclear Quality-Assured Coating Work," Boston, Mass. (Institute of Applied Technology, Jean L. Kaplan, 1200 - 17th St., N.W., Suite 406, Washington, D.C. 20036.)

(Sept. 30–Oct 2)—The Metals Society, International Conference, "Production and Use of Coil-Coated Strip." Metropole Hotel National Exhibition Centre, Birmingham England. (T.L. Hughes, The Metals Society, 1 Carlton House Terrace, London SW1Y 5DB).

(Oct. 5–8)—Society of Plastics Engineers and Fire Retardant Chemicals Association Joint Conference on "Flammability in Building and Construction—Today and Tomorrow." Ponte Vedra Club, Ponte Vedra Beach, FL. (Fire Retardant Chemicals Assoc., 265 Post Road West, Westport, CT 06880).

(Oct. 7–9)—AFP/SME "Liquid Coatings Conference." Conrad Hilton Hotel, Chicago, IL. (Susan Buhr, Society of Manufacturing Engineers, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Oct. 13–15)—Society of Plastics Engineers National Technical Conference, "Coloring of Plastics; Update of 'The Law and You'." RETEC sponsored by the Baltimore Section and Color and Appearance Div., Baltimore Hilton Hotel, Baltimore, Md. (Robert C. Foley, Society of Plastics Engineers, 656 W. Putnam Ave., Greenwich, Conn. 06830.)

(Oct. 13-17)—"High Performance Coating Procedures," Monterey, Mexico. (Institute of Applied Technology, Jean L. Kaplan, 1200 - 17th St., N.W., Suite 406, Washington, D.C. 20036.)

(Oct. 14–16)—Seventh Annual Conference on Energy, "Energy Future: Prophets, Profits & Policies!" University of Missouri-Rolla/Department of Natural Resources. (Dr. J. Morgan, Conference Director, 122 Electrical Engineering, University of Missouri-Rolla, Rolla, MO 65401.)

(Oct. 17–19)—University of Waterloo Short Course, "Developments in Polymer Technology." Hotel Toronto, Canada (Prof. A. Rudin, Dept. of Chemistry, University of Waterloo, Waterloo, Ontario, Canada).

(Oct. 27–29)—93rd Annual Meeting, National Paint and Coatings Association, Atlanta Hilton Hotel, Atlanta, Ga. (Karen Bradley, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005.)

(Nov. 5–6)—Third Resins & Pigments Exhibition. Hotel Nikko, Dusseldorf, Germany.

(Nov. 7–9)—University of Waterloo Short Course, "Engineering Aspects of Polymer Systems." Hotel Toronto, Canada (Prof. A. Rudin, Dept. of Chemistry, University of Waterloo, Waterloo, Ontario, Canada).

(Nov. 10–14)—"High Performance Coating Procedures," Houston, Tex. (Institute of Applied Technology, Jean L. Kaplan, 1200 - 17th St., N.W., Suite 406, Washington, D.C. 20036.)

(Nov. 11–13)—4th International Conference of Paint Research Association, Excelsior Hotel, London Heathrow Airport. (PRA, Waldegrave Rd., Teddington, Middlesex TW11 8LD, England.)

(Nov. 19–21)—3rd Annual Western Plastics Exposition. Anaheim Convention Center, Anaheim, Calif. (Western Plastics Exposition, 1625 17th St., Santa Monica, CA 90404.)

1981

(Jan. 21)—ASTM Symposium, "Regiments for Predicting Permanence of Decorative and Protective Surfaces." Orlando, FL. (Symposium Chairman Garmond Schurr, Sherwin-Williams Co., 10909 S. Cottage Grove Ave., Chicago, IL 60628).

(Apr. 6–10)—National Association of Corrosion Engineers "Corrosion/81." Sheraton-Centre and Hotel Toronto, Toronto, Ontario, Canada. (Conference Coordinator, NACE, P.O. Box 218340, Houston, TX 77218).

(June 17–20)—Oil and Colour Chemists' Association Conference, "Alternative Technologies in Coatings." Stratford Hilton Hotel, Stratford-on-Avon, England. (The Director and Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF, England.)

(Sept. 20–25)—4th Congress of the Association Internationale de la Colueur, "COLOR 81." International Congress Centre (ICC), Berlin (West), Germany. (Prof. Dr. Heinz Terstiege, (AIC COLOR 81), Bundesanstalt fur Materialprufung (BAM), Unter den Eichen 87, D-1000 Berlin 45, Federal Republic of Germany).

(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.)

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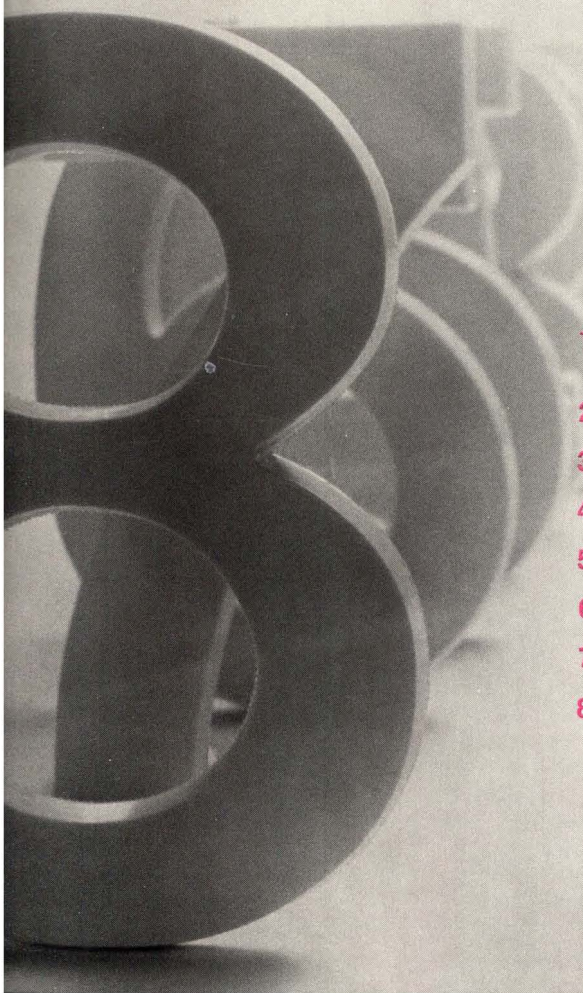

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