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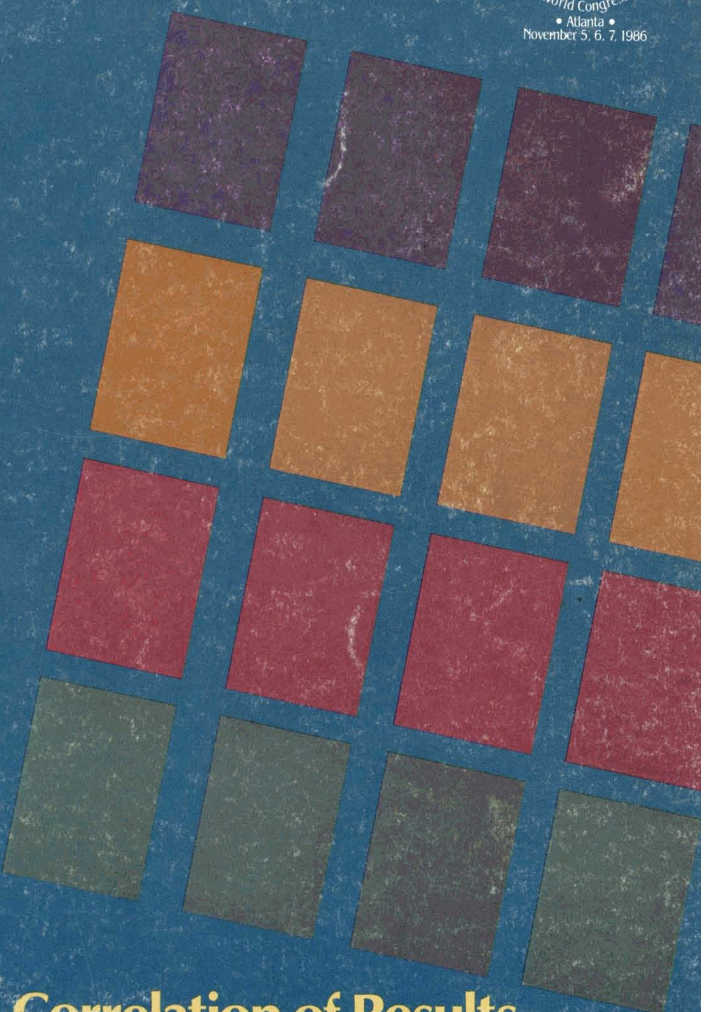
August 1986

JOURNAL OF COATINGS TECHNOLOGY



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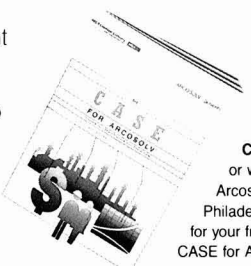

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AUGUST 1986

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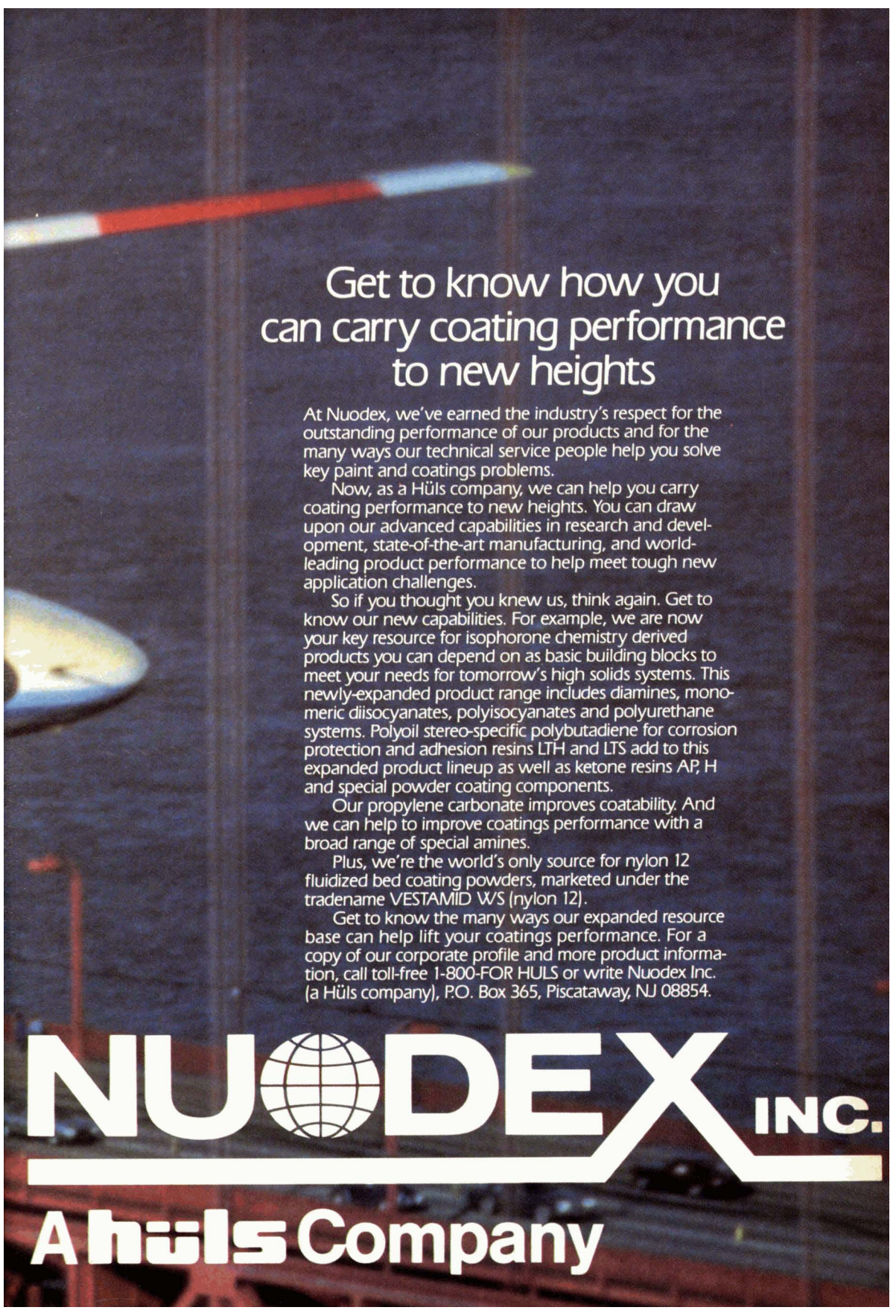
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Comment

New FSCT Series on Coatings Technology—Updating an Industry Resource

Initial monographs in the new Federation Series on Coatings Technology are now available: Film Formation . . . Introduction to Polymers and Resins . . . and Radiation Curing (soon to be followed by similar treatises on Solvents . . . Automotive Coatings . . . Coil Coatings . . . Corrosion . . . and Film Defects)—the forerunners of some 35 booklets covering the major areas of coatings technology.

They supplant the previous monographs, initiated in 1964, which have been among the most important educational tools offered by the Federation. Over the years they've served as the basic text for innumerable coatings courses, and a goodly number of industry newcomers have been introduced to the real world of coatings technology via the "Federation booklets."

But the many changes which have taken place since the inception of the original Series mandated an update to reflect current theory and practice, hence development of the new monographs.

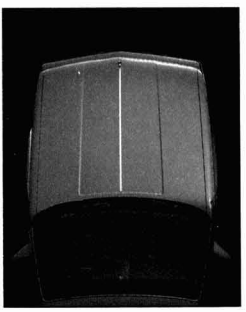
Like their predecessors, they're authored by well-known and knowledgeable industry personnel. And manuscripts are reviewed by members of an Advisory Board whose names are familiar to readers of the JCT: Tom Miranda (Whirlpool); Darlene Brezinski (DeSoto); Loren Hill (Monsanto); Joe Koleske (Union Carbide); Hugh Lowrey (Perry & Derrick); Stan LeSota (Rohm and Haas); Percy Pierce (PPG); and Joe Vasta (Du Pont).

The time, care, and attention being devoted to this project should assure that the Series will continue as a valuable industry teaching and training resource.

Thomas A. Kocis,
Contributing Editor

About tailoring solvent systems in high-solids coatings.

And the science of watching paint dry.



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CORRELATION OF RESULTS FROM 'COLOR-MATCHING APTITUDE TEST' SCORES—Birmingham Paint, Varnish and Lacquer Club

Journal of Coatings Technology, 58, No. 739, 41 (Aug. 1986)

Data from tests performed by several organizations using the 1978 version of the Color-matching Aptitude Test Set were collated and compared with similarly collected data for the 1964 version of the test. Small but significant differences in the mean individual color row scores were noted between the versions, although the total scores in each case gave a normal Gaussian distribution. This enables a revised interpretation of scores to be drawn up for the 1978 test version. An age-dependence for mean scores was also observed, with the best mean scores being achieved by examinees in the 25-29 age group.

INFLUENCE OF THE DESIGN OF INSTRUMENTS ON THE ACCURACY OF COLOR-DIFFERENCE AND COLOR-MATCHING CALCULATIONS—H. Schmelzer

Journal of Coatings Technology, 58, No. 739, 53 (Aug. 1986)

In color-difference calculations for samples with extremely high metamerism (uncommon in practice), an influence of the band width of the instrument or the number of measurement points is noticeable. In color-matching calculations for samples with steep reflectance factor curves, the error caused by the instrument design can be up to four CIELAB units between the sample and its calculated match. For common samples, the deviations caused by laboratory work (sample preparation) or other factors, such as by pigment flocculation, are greater. If one calculates the color strength of a pigment from K value at reflectance minimum, the results can be affected by the band width of the monochromator.

POLYESTER RESIN SYNTHESIS TECHNIQUES FOR ACHIEVING LOWER VOC AND IMPROVED COATING PERFORMANCE—J.D. Hood, et al.

Journal of Coatings Technology, 58, No. 739, 49 (Aug. 1986)

For the past several years, the coatings industry has faced the challenge of increased regulation of solvent emissions. Lowering the molecular weight of the polyester resin appears to be a feasible approach to higher-solids coatings. However, studies have shown there is an optimum point in lowering the molecular weight below which the VOC of the enamel actually increases. Typically, one-stage resin cooks are employed, leading to high levels of unreacted monomers and oligomers which are volatilized during VOC determinations. Selectively staging the addition of the polyol to minimize the formation of unwanted products is an important key to quality systems for higher-solids enamels with good physical properties.

HIDING POWER AND THE COST-EFFECTIVENESS OF TITANIUM DIOXIDE—F.B. Stieg

Journal of Coatings Technology, 58, No. 739, 61 (Aug. 1986)

The cost-effectiveness of titanium dioxide as a producer of white hiding power and tinctorial strength has been a neglected variable in paint formulation. The hiding power of any existing paint formulation can be developed at minimum total raw-material cost by one, *and only one*, combination of titanium dioxide content and total solids volume—and this optimum combination may call for the use of *more titanium dioxide* rather than less. Formulation variables, hiding power, and raw-material costs are interrelated in such a way that relatively simple mathematics may be used to identify the combination yielding maximum cost-effectiveness for simple paint systems. Since this has not been done in the past, every existing product line offers opportunities for significant cost savings.

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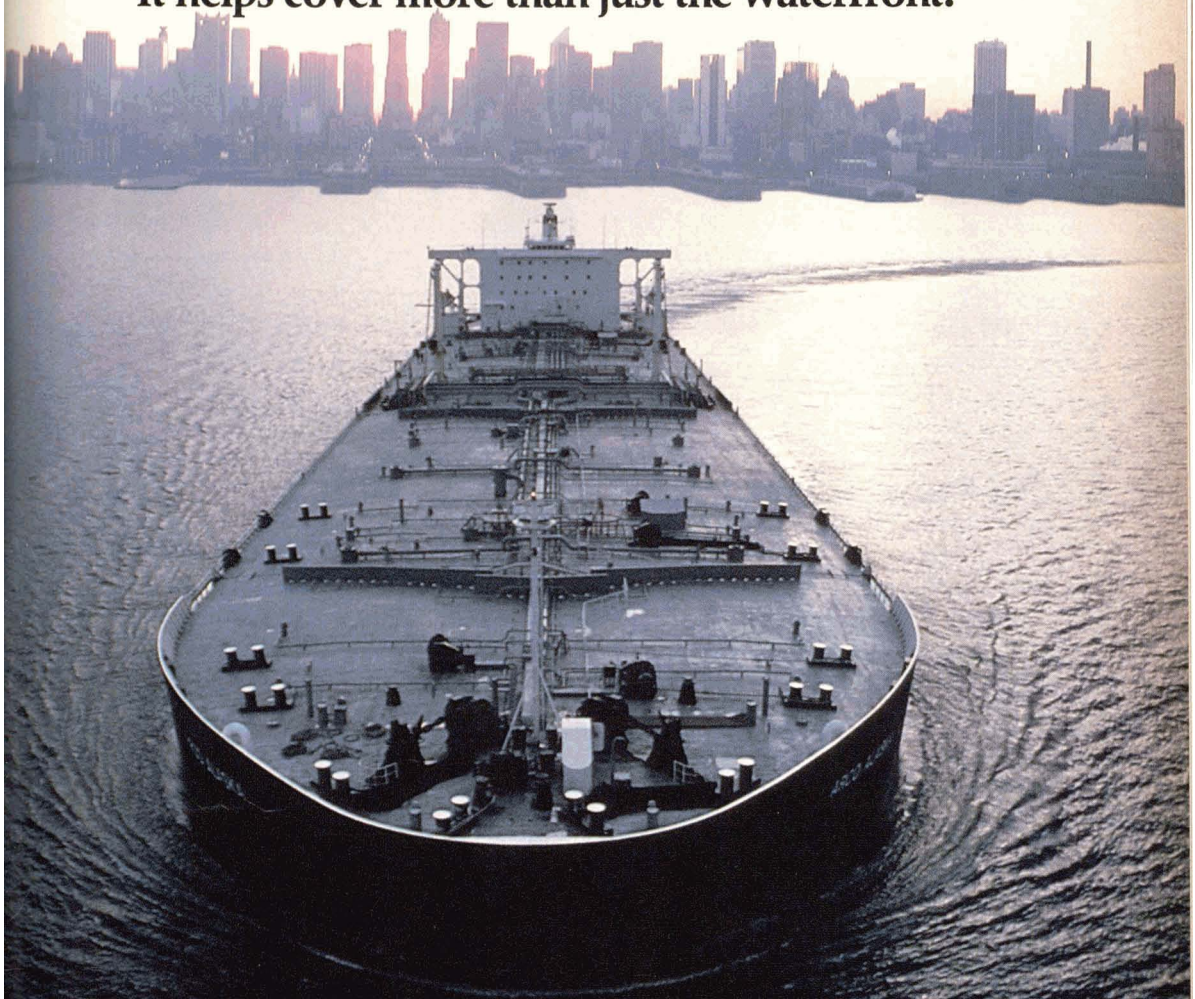

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Deryk Pawsey, of PNW, and James Geiger, of Southern, Are Nominated to Federation Officer Positions for 1986-87

Deryk R. Pawsey, British Columbia Area Manager of Rohm and Haas Canada Inc., Vancouver, B.C., has been nominated for the position of President-Elect of the Federation of Societies for Coatings Technology. Mr. Pawsey, currently Treasurer of the Federation and a member of the Executive Committee for five years, also serves on the Finance, Professional Development, and Heckel Award Committees. The 1984 recipient of the Federation's George Baugh Heckel Award, he was a six-term Chairman of the Paint Industries' Show Committee, was also active on the Federation's Technical Information Systems, Specifications, Corrosion, and By-Laws Committees, and the Editorial Review Board of the JOURNAL OF COATINGS TECHNOLOGY. In addition, he is a Trustee of the Coatings Industry Education Fund. Mr. Pawsey is a Past-President of the Pacific Northwest Society and served as Society Representative to the Federation's Board of Directors for five years. He received the Society's Outstanding Service Award in 1985. Educated in England, Mr. Pawsey has been with Rohm and Haas for the past 13 years.

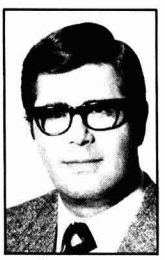
D.R. Pawsey

J.E. Geiger

Nominated for the position of Treasurer is James E. Geiger, founder and President of Sun Coatings, Inc., Largo, FL. Mr. Geiger is Chairman of the Federation's 1986 Annual Meeting Host Committee and is a member of the Board of Directors. In addition, he has served on the Federation's Educational, Finance, and Professional Development Committees. A Past-President of the Southern Society, he has chaired the Society's Finance and Nominating Committees. Mr. Geiger is a graduate of Northern Illinois University and has been in the coatings industry for 28 years. He founded Sun Coatings in 1971.

The current President-Elect, Carlos E. Dorris, of Jones-Blair Co., Dallas, TX, will assume the Presidency at the close of the 1986 Annual Meeting, November 7, in Atlanta, GA.

The Nominating Committee also submitted the names of the candidates for Board of Directors and Executive Committee positions.



K.F. Weitz

T.F. Johnson

Executive Committee

Society Representative to the Executive Committee—(Three-year term):

Kurt F. Weitz, Product Manager for Extender and Filler Pigments at Indusmin, Div. of Falconbridge, Toronto, Ont., Canada. Mr. Weitz served on the Federation's Roon Awards Committee for six years and was active on the Finance Committee. A Past-President of the Toronto Society, he also served as Society Representative for four years. Mr. Weitz is a graduate of the University of Toronto and has been employed with Indusmin for 18 years.

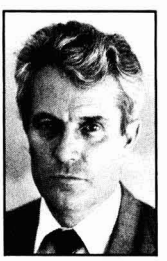
Board of Directors

Board of Directors as Past-President Member—(Two-year term):

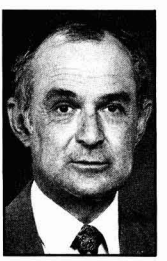
Terryl F. Johnson, Past-President of the Federation (1983-84) and the Kansas City Society. Mr. Johnson is Chairman of the FSCT Liaison Committee and a member of the Finance and Professional Development Committees. A former Trustee of the Paint Research Institute, he has served as Chairman of both the Finance and Nominating Committees. Mr. Johnson is a graduate of the University of Missouri and has been employed with Cook Paint and Varnish Co., Kansas City, MO, since 1947. His current position is Manager of Quality Assurance.

Board of Directors as Members-at-Large—(Two-year term):

Lloyd L. Haanstra, Past-President of the Los Angeles Society. Mr. Haanstra is the current Chairman of the A.F. Voss/*American Paint & Coatings Journal* Annual Meeting Awards Committee and a member of the Finance Committee. In addition, he has been active on the FSCT Paint Show and Membership Committees. The 1985 recipient of the Los Angeles Society's Outstanding Service Award, Mr. Haanstra chairs the Society's Environmental and Awards Committees. Educated in Europe, he has been in the coatings industry for 31 years and holds the post of Technical Director at Guardsman Chemicals, Inc., South Gate, CA.



L.L. Haanstra



R.R. Brown

Ronald R. Brown, Technical Service Group Manager-Coatings, with Unocal Chemical Div., Charlotte, NC. He is the current President of the Southern Society, and also serves on the Federation's 1986 Annual Meeting Host Committee. A graduate of Georgia Southern College, Mr. Brown has been associated with the coatings industry for 25 years, and serves on the Industry Advisory Committee at the University of Missouri-Rolla and Eastern Michigan University.

Elections will take place during the Board of Directors meeting on November 4, in Atlanta.

Portion of the 162 attendees at the Coatings Opening Session

Four-Day Symposium on Automotive Color Control, Co-Sponsored by FSCT, Attracts Over 450 Registrants

A total of 454 registrants took part in the Symposium on Automotive Color Control (SACC), held June 3-6 at the Michigan Inn, Southfield, MI, under the sponsorship of the Federation, Detroit Colour Council, and the Manufacturers Council on Color and Appearance.

Interest was high throughout as attendees (which included representatives from Canada, Sweden, and West Germany) crowded the lecture halls and workshops to learn about the new SAE Recommended Practice J1545 for determining color match acceptability of automotive components.

Recently announced by the Society of Automotive Engineers, "J1545" is the culmination of work carried out by an industry-wide committee formed by the Detroit Colour Council. The Recommended Practice specifies the procedures, instruments, and documentary standards to be used for color difference measurement of colored parts and materials supplied for the manufacture of highway vehicles.

It is expected that "J1545" will be widely adopted and will be useful for Statistical Process Control.

The Symposium combined general sessions and workshops with "hands-on" equipment demonstrations. Programming was specifically directed to coatings, soft trim (textiles), and plastics, with each addressed in separate, two-day overlapping segments (Coatings, June 3-4; Soft Trim, June 4-5; and Plastics, June 5-6).

Robert Feisel (Akzo Coatings America, Inc.), President of the Detroit Society for Coatings Technology, took part in the Opening Session of the Coatings segment, and delivered welcoming remarks on behalf of the Society and the Federation.

The format was the same for each segment, but the presentations focused on different areas to reflect the particular interest of each group.

A three-hour introductory session was devoted to color difference measurement, with a complete explanation of "J1545" and its implementation.

Lectures then followed on specific issues: Reference Standards for Color Control; Effect of Metamerism and Alternative Illuminant and Standard Observer; and the Statistics of Measuring.

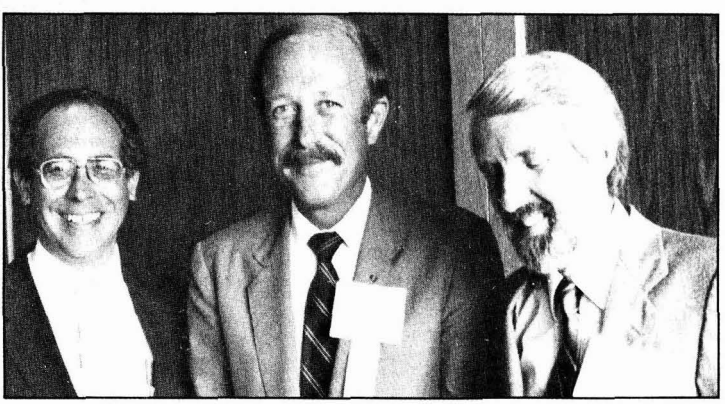
Additionally, the Coatings segment included a lecture on Multi-Angle Measurement of Metallic Colors.

The lectures were presented by members of the DCC/SAE Color Measurement Committee which developed "J1545."

At the workshops, registrants had the opportunity to measure provided samples and determine correlation of the various instruments for metameric and non-metameric samples.

Participating workshop exhibitors were: Applied Color Systems, Inc.; DIANO Color Group, Milton Roy Co.; Byk-Chemie USA, Inc.; Hunter Associates Laboratory; Macbeth Div., Kollmorgen Corp.; Minolta Co.; Pacific Scientific Co., Gardner/Neotec Div.; and Collaborative Testing Services.

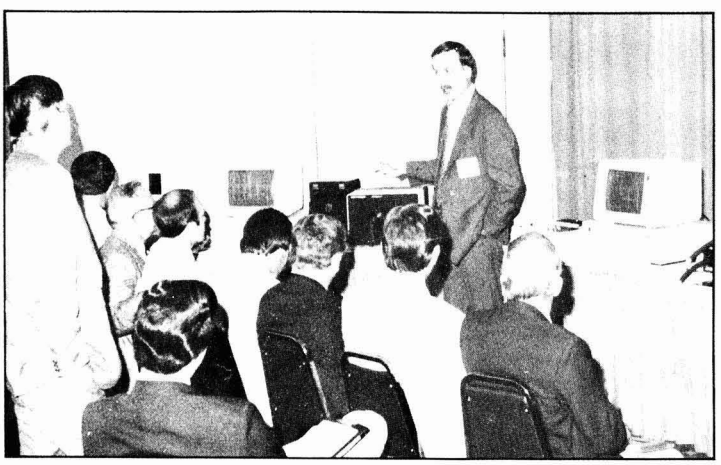
The closing session included a panel discussion on implementation of "J1545" and summary of the workshop visual-instrumental correlation study.



Among the Symposium speakers were Robert T. Marcus (Macbeth Div., Kollmorgen Corp.), Richard Harold (Hunter Associates Laboratory), and Rolf Kuehni (Mobay Chemical Corp.)

General Chairman James E. Grady (CIBA-GEIGY Corp.) and Program Chairman William V. Longley (Ford Motor Co.) flank Richard Schreiber (United Paint & Chemical Corp.), President-Elect of Detroit Society

Head table guests at the Coatings Opening Session were Detroit Society President Robert Feisel (Akzo Coatings America, Inc.), Detroit Colour Council President Jack Westerbeek (Matteson-Ridolfi, Inc.), and Ralph Stanziola (Industrial Color Technology), who delivered the featured lecture on color difference measurement



Workshop equipment displays gave registrants opportunity for "hands-on" demonstrations of instruments used with the new Recommended Practice J1545 for determining color match acceptability of automotive components

Workshop Chairman Charles Leete (Collaborative Testing Services, Inc.) discusses the visual-instrumental correlation studies at the closing implementation session

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Clarence J. Meyers
John K. Bice Co.
1418 Wabasso Way
Glendale, CA 91208

Loren B. Odell
416 Crestwood Dr.
Houston, TX 77007

Charles Oppermann
9848 S. Damen Ave.
Chicago, IL 60643

Lloyd A. Owen
1387 Hill Dr.
Largo, FL 33540

Edmund Peterson
Peterson Paint Co.
P.O. Box 311
Pueblo, CO 81002

Carlton H. Rose
One Sunset Rd.
Mountain Lakes, NJ 07046

William Rose
3360 Mathieson Dr., N.E.
Atlanta, GA 30305

Carroll M. Scholle
6530 N. Greenview Ave.
Chicago, IL 60626

Elias Singer
Troy Chemical Corp.
One Avenue L
Newark, NJ 07105

Herman J. Singer
300 Winston Dr.
Cliffside Park, NJ 07010

G.O. Stephenson
2241 Palestra #14
St. Louis, MO 63146

John G. Ulreich
1033 Ohio St.
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Committee Activities

ENVIRONMENTAL CONTROL

Revision of the Stayed Provisions of the Premanufacture Notice Rule Under Section 5 of the Toxic Substances Control Act

Summary of Action

This rule revises the four stayed provisions and other provisions of the premanufacture notice (PMN) rule issued in Section 5 of the Toxic Substances Control Act (TSCA).

Background

Under Section 5 of TSCA, any person who intends to manufacture or import a new chemical substance for commercial purposes must notify EPA 90 days before manufacture or import begins.

EPA issued the final PMN rule and notice form on May 13, 1983. It covers the scope and applicability of Section 5 requirements, the general procedures for submitting notices, information requirements, and EPA's procedures for processing information contained in the notices.

In September, 1983, EPA stayed the effective date of the exemption for research and development (R&D), the definition of "possession or control," and the requirement for data on related chemicals, and clarified other provisions of the PMN rule.

In December, 1984, EPA proposed revisions to these stayed provisions.

Description of Action

Small quantities of chemical substances manufactured solely for R&D are exempt from the PMN requirements if the manufacturer or importer notifies persons engaged in R&D of health risks associated with the substance, and evaluates certain information in its possession or control, or if the R&D is conducted in the laboratory, and uses prudent laboratory practices to control exposure. If the substance is distributed to other persons, the manufacturer or importer must provide written notice of the requirement that the substance be used only for R&D, and of any health risks associated with the substance. EPA generally prohibits the sale or commercial use of R&D substances and mixtures for non-R&D uses. It does, however, permit the sale of chemical substances containing R&D substances as impurities and articles incorporating R&D substances, if these products were produced in the course of legitimate R&D. It also permits disposal of R&D substances, and certain commercial methods of recycling of residual R&D substances, after R&D is complete.

Manufacturers and importers must retain certain records documenting compliance with the R&D exemption. There is a requirement to keep more detailed records if the substance is produced in quantities greater than 100 kilograms.

There is no requirement that PMNs include data on chemical substances and mixtures related in the course of manufacture to the new chemical substance which is the focus of the PMN.

The definition of "possession or control" includes data in the files of companies associated with the submitter company and agents of the PMN submitter. Only files of employees associated with the R&D, test marketing, production, or commercial marketing of the substance fall within the definition.

The revisions clarify the "export only" provisions of the rule, and the timing of the notification of commencement of manufacture.

Impact

Generally, the revisions to the PMN rule will impose negligible costs and burdens on industry over those already identified in the final PMN rule. Certain recordkeeping requirements will impose some incremental costs of $1,357,000 annually.

Joyce S. St. Clair,
Chairman

Coping with Government Regulations

by Joyce S. St. Clair*
Chairman, FSCT Environmental Committee

The following presentation was given to the ASTM D-1 Subcommittee on Paint and Related Materials during their meeting in Louisville, KY, on June 17, 1986.

Many of us in the paint and coatings industry, either directly or indirectly, must cope effectively with the myriad of proposed or final regulations forced upon our industry by Federal, state, or local governmental entities. The potential or real impact on the paint and coatings business becomes more apparent each passing week.

The following are my suggestions on developing a "coping mechanism" to effectively handle these foreboding regulations:

(1) Be informed on what is happening in your area, your state, your part of the country. Read environmental articles when they appear in your regular reading list of technical journals, as well as general industry periodicals. As you read an article about a "coming" regulation, ask yourself how this information will impact your company, or how will it impact one of your customers. Remember that your customer will turn to you for information and input and you should be prepared to answer his questions.

(2) Begin a networking system with your peers in other paint companies. In the environmental arena, the "competitive edge" probably does not apply. Regulating agencies are not selective about whose toes they step on. In terms of hazardous waste, air and water regulations, as well as product liability, development of adequate MSDS, and the "RIGHT TO KNOW," we are all in similar, if not the same, boats.

(3) Volunteer to work with your local Federation or Association Environmental Committees. If you absolutely cannot do that, show up regularly for FSCT or NPCA meetings and ask questions about what is happening. Give input with your own ideas and concerns.

(4) In terms of product liability and developing MSDS for your products, read the available toxicological information from your raw material suppliers. If you do not understand sections, or even the entire document, call your raw material supplier rep-

*Porter Paint Co., Coatings Div., P.O. Box 1439, 400 S. 13th St., Louisville, KY 40201

(Continued on page 20)


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IS AT YOUR DOOR.
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expanding NL's resins capabilities.
After 20 years of leadership in the European market, the Wolf is now at your door. WOLFKUR. Manufactured domestically by NL Chemicals to help you produce tough cross-linked coatings that provide outstanding protection and adhesion. WOLFKUR. Expanding the resin capabilities of NL. WOLFKUR. Highly reactive but with low toxicity and low viscosity. NL offers a wide range of WOLFKUR reactive polyamide and amidoamine curing agents. For more information clip the coupon or call (609) 443-2500.
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SRM Corporation Formed to Offer Superfund Aid

To provide assistance to those paint industry companies facing liability for hazardous waste cleanups under Superfund, Superfund Response Management, Inc. has been created. Headed by Timothy L. Harker, Esq., the newly formed corporation has been endorsed by the Executive Committee of the National Paint and Coatings Association, Washington, D.C., to assist its member companies.

According to Mr. Harker, SRM can provide paint companies with technical, legal and scientific ammunition that will help them limit their liability through more efficient negotiations with the Environmental Protection Agency, and reduce their costs by limiting the time and transaction costs involved in Superfund settlements.

Mr. Harker is a former Associate General Counsel for the Environmental Protection Agency. Over the past six years, he has acted as outside counsel to NPCA on several environmental issues and has represented a number of NPCA members in Superfund cases.

Companies that have contributed waste to the same site can form coalitions with SRM's help, and thus work more constructively to shape the outcome of negotiations, Mr. Harker explained. Transaction costs could also be limited, he added, because attorneys would not have to spend time identifying and screening needed technical experts.

Characterizing SRM's potential role as "turnkey management of Superfund problems," Mr. Harker noted that the new corporation will be able to provide expertise in such areas as geology, groundwater hydrology, civil engineering, incineration technology, risk assessment, and EPA cleanup criteria, as well as legal counsel. Companies can take advantage of whatever services they need and be billed accordingly.

Although SRM has been established as an entity separate from NPCA, the association is supporting the new organization with staff assistance and participation on its policy advisory board.

For more information on Superfund Response Management, contact Tim Harker, Superfund Response Management, Inc., 2021 K Street, N.W., Suite 310, Washington, D.C. 20006.

McWhorter, Witco Report Industry Safety Records Set

Recently, McWhorter, Inc., Carpentersville, IL, and Witco Corp., headquartered in New York City, celebrated new safety records for their respective production and processing facilities.

McWhorter, a subsidiary of Valspar Corp., completed 10 years, or 1.56 million man-hours, without a lost time accident. President Wally Meyer said, "While our safety record is not unique in the industry, we believe that our degree of employee participation is truly commendable."

Joining in the celebration were local officials, and representatives and federal and state government safety organizations.

Meanwhile, Witco Corp. reported a 20% decrease in lost time injuries in 1985 in the company's 80 plant, office and laboratory locations. The improved safety record was attributed to the increased visibility of top management, enforcement of safety rules and procedures, management commitment, and the development of written accident prevention plans.

Glidden to Construct New Powder Coating Plant

Glidden Coatings & Resins has announced the construction of a state-of-the-art plant to manufacture thermosetting powder coatings for original equipment manufacturers.

The plant will be built on the site of Glidden's liquid coatings and resins manufacturing complex in Huron, OH, and will include space for future growth in production lines. Completion of the plant is set for May 1987.

Du Pont Co. Forms New Automotive Unit

In a move designed to better serve the worldwide automotive industry, the Du Pont Company has restructured its resources to form a new industrial department, the Automotive Products Department. This new unit will combine the company's automotive materials businesses that account for $2 billion in annual sales.

Headquartered at Du Pont's Corporate Automotive Development Center in Troy, MI, the department will be headed by John P. McAndrews, Group Vice-President. Mr. McAndrews, who formerly headed the Finishes and Fabricated Products Dept., will relocate to Detroit.

Coping with Government Regulations (from page 18)

resentative. It is part of their business to know the answers, or at least point you in the direction of someone who does.

(5) If you do not understand a particular regulation which may impact your business, call the nearest regulating agency to your locale. I fully realize that this suggestion is rather easy to say and almost impossible to do. Speaking from experience, I have been amazed at the level of bureaucratic cooperation and help I have received when I FIRST say "I NEED YOUR HELP." Perhaps these agencies have not heard that comment before, but it has worked for me and I recommend trying this approach.

(6) Do not be lulled into complacency by thinking "my company is too small" or "the regulations are too big." This attitude, coupled with "they'll never find me" can lead to more problems than you could dream of—large fines for noncompliance, the very real possibility of jail terms, and being made an "example of" in your local newspapers.

In my opinion, if we (the paint and coatings industry) do not speak up AND out for ourselves, one of two things is likely to happen: (1) Our silence on the environmental issues surrounding us could be deemed to be silent agreement with whatever is being discussed or (2) Somebody else may decide to speak for us and we just might not like what they say. By that time, any rebuttal we might have would probably be too late—or too little.

Hence, despite the time and effort needed, it is much easier to take the lead than to be led. Remember that what is happening in another part of the country in our industry could be "playing in your local theatre soon." The key to coping effectively with governmental regulations is four-fold: *Be Interested, Be Informed, Be Involved, Be Committed* to *OUR* industry.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

64th Annual Meeting & 51st Paint Industries' Show

FSCT 1986

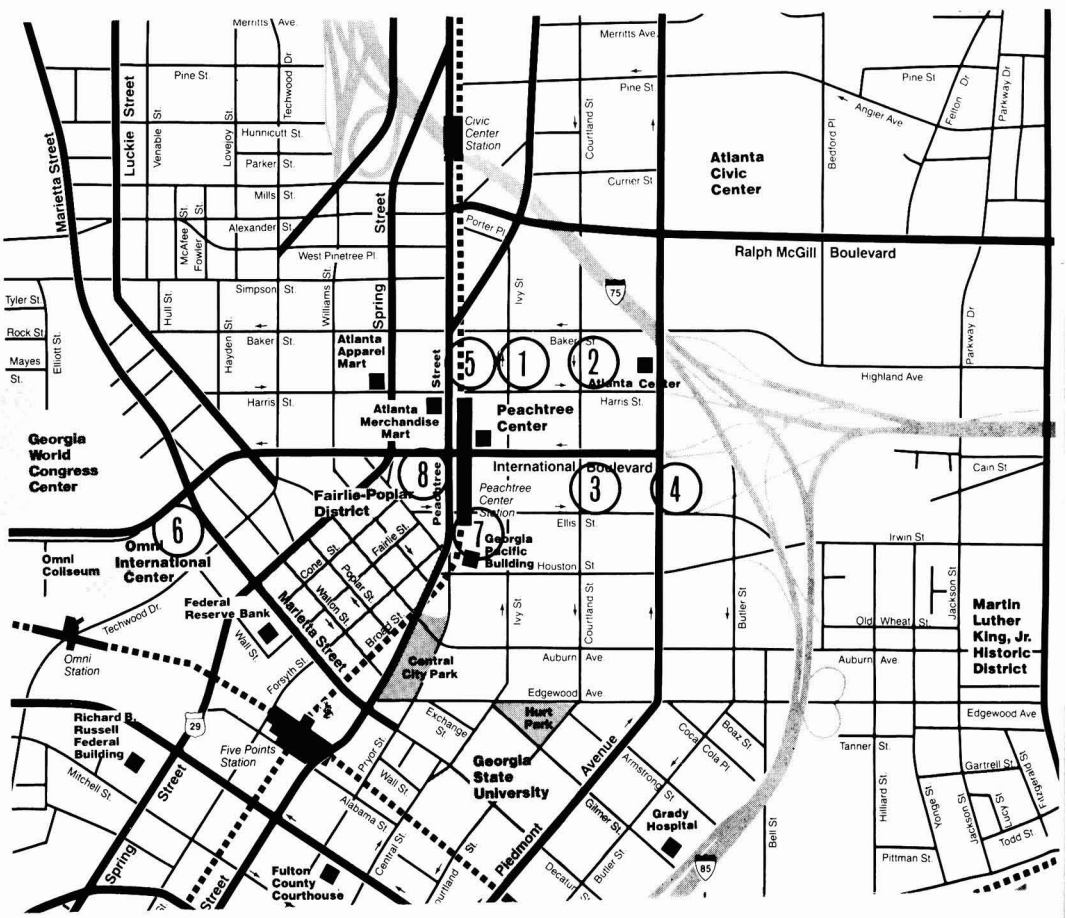
Housing and Advance Registration Forms

Georgia World Congress Center • Atlanta, Georgia
November 5, 6, 7, 1986

HOTEL ROOM AND SUITE RATES[1]

No. on Map	Hotel	Singles	Doubles	Suites
1.	**Marriott Marquis[2] (FSCT Headquarters)**	88/98/108 150 Concierge	108/118/128 170 Concierge	$275 & up
2.	**Hilton & Towers[3]**	82/92/102 135 Towers	102/112/122 155 Towers	250 & up
3.	**Marriott Downtown**	79	90	225 & up
4.	**Holiday Inn**	68	68	—
5.	**Hyatt Regency**	82/92/102	104/108/116	225 & up
6.	**Omni International**	88/98/108	108/118/128	250 & up
7.	**Ritz Carlton**	99/109	119/129	350 & up
8.	**Westin Peachtree Plaza**	80/90/100	90/100/110	250 & up

(1) All room rates are subject to an 8% City and Occupancy Tax.
(2) Requests for accommodations at the Marriott Marquis will be limited to six rooms per company. A parlor counts as one room.
(3) Reservations for the Atlanta Hilton will be accepted for arrival beginning Wednesday, November 5, only.
Note: Most hotels require deposits. Please read your confirmation carefully. If a deposit is required, please mail directly to the hotel.



FSCT 1986 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
GEORGIA WORLD CONGRESS CENTER, ATLANTA, GEORGIA
WEDNESDAY, THURSDAY, AND FRIDAY, NOVEMBER 5, 6, 7

APPLICATION FOR HOTEL ACCOMMODATIONS

MAIL TO: **FSCT Housing Bureau**
233 Peachtree St. NE #2000
Atlanta, GA 30043

Please indicate below the type of accommodations requested and choice of hotels. All reservations will be processed by the Housing Bureau of the Atlanta Convention & Visitors Bureau. Hotel assignments will be made in accordance with prevailing availability. The confirmation of your reservation will come to you directly from the hotel to which you have been assigned. Changes and cancellations—prior to October 5—must be submitted in writing to the Housing Bureau at the above address. After October 5, please direct all inquiries to the hotel (phone numbers in this brochure).

All reservations will be held until 6:00 p.m. and none can be guaranteed after October 5.

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:
1st
2nd
3rd
4th

NAMES OF ROOM OCCUPANTS AND DATES OF ARRIVAL/DEPARTURE

Type of Room	Name	Dates Arrive	Depart

Please Type Additional Reservations on a Separate Sheet and Attach to This Form

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

Name _____ Telephone _____

Company _____

Address _____

City _____ State or Province _____

Country _____ Mailing Code _____

Name of Credit Card and # _____ Exp. Date _____ Signature _____

Note: Requests for accommodations at the Marriott Marquis will be limited to six rooms per company. A parlor counts as one room. Reservations for the Atlanta Hilton will be accepted for arrival beginning Wednesday, November 5, only.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1986 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
GEORGIA WORLD CONGRESS CENTER, ATLANTA, GEORGIA
WEDNESDAY, THURSDAY, AND FRIDAY, NOVEMBER 5, 6, 7

The Combined Annual Meeting and Paint Industries' Show Is a Major Educational Activity of the Federation. This Significant Coatings Manufacturing Industry Event Consists of Three Days of Technical Program Sessions and Exhibits, Running Concurrently.

"COMPLIANCE AND QUALITY: RECOGNIZING THE OPPORTUNITIES"

The outstanding papers being readied for presentation at the Annual Meeting will be centered about this year's theme—"Compliance and Quality: Recognizing the Opportunities."

The theme focuses upon emerging technologies (such as water-based, high-solids, and powder coatings) which are helping the industry meet regulatory requirements. Increased awareness and understanding of potential physiological and toxicological effects of coatings and their raw materials have spurred development of these technologies, which are also responding to increased expectations of quality products, processes, methods, and attitudes.

Speakers will come from throughout the world of coatings science.

ANOTHER BIG PAINT SHOW WILL FEATURE PRODUCTS/SERVICES OF 225 EXHIBITORS

The Paint Industries' Show—biggest and best of its kind in the world—is an international show featuring attractive exhibitor displays devoted to a wide variety of raw materials, production equipment, containers, laboratory apparatus and testing devices, and services furnished to the paint and coatings manufacturing industry.

Key personnel from coatings manufacturers in the U.S., Canada, and several other countries attend annually. The Paint Show gives them the opportunity to learn of the latest developments in the industry and to discuss them with the top technical/sales staffs of the exhibitors. . . of which there will be more than 225 this year.

Show hours will be: Wednesday—11:30-5:30; Thursday—9:00-5:30; and Friday—9:00-3:00.

HOTELS AND RESERVATIONS INFORMATION: MARRIOTT MARQUIS TO BE HEADQUARTERS

Eight hotels in downtown Atlanta have reserved blocks of rooms for the Federation. A map showing the location of the hotels and a schedule of rates are included in this brochure. All room rates are subject to an 8% City and Occupancy Tax.

All reservations will be processed by the FSCT Housing Bureau, 233 Peachtree St. NE, Suite 2000, Atlanta, GA 30043.

Confirmations of reservations will come to you directly from the hotel to which you have been assigned. Changes and cancellations—prior to October 5—must be submitted in writing to the Housing Bureau at the above address.

After October 5, please direct all inquiries regarding reservations directly to the hotel, the phone numbers of which are (Area Code 404):

Marriott Marquis	521-0000	Atlanta Marriott	659-6500
Atlanta Hilton	659-2000	Holiday Inn	659-2727
Hyatt Regency	577-1234	Omni International	659-0000
Westin Peachtree	659-1400	Ritz-Carlton	659-0400

Requests for accommodations at the Marriott Marquis will be limited to six rooms per company. A parlor counts as one room.

Reservations for the Atlanta Hilton will be accepted for arrival beginning Wednesday, November 5, only. Any reservations requesting the Hilton prior to Wednesday will be assigned to another hotel.

Most hotels require deposits. Please read your confirmation carefully. If a deposit is required, mail it directly to the hotel.

The phone number of the FSCT Housing Bureau in Atlanta is: 404-521-6630. Telex 804357.

FEDERATION BOARD OF DIRECTORS WILL MEET TUESDAY AT MAR QUIS

The Board of Directors of the Federation will meet on Tuesday, November 4, at 9:00 a.m. in the Marriott Marquis Hotel. Luncheon is included.

1986 ADVANCE REGISTRATION

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1315 Walnut St., Philadelphia, PA 19107

C	Office Use Only
U	Date received _____
V	Amount $ _____
	Check No. _____

Please fill out this form and mail with a check in the correct amount (made payable to the FSCT) **to the Federation address shown above.** All checks must be payable in U.S. Funds. Any that are not will be returned. DEADLINE DATE FOR ADVANCE REGISTRATION IS OCTOBER 6. NONE WILL BE ACCEPTED AFTER THAT DATE.

A $10.00 charge will be made for cancellations received prior to October 6. No refunds will be made after that date.

INDUSTRY REGISTRATION FEES

A ☐ MEMBER $50.00

Please name the Federation Society in which you are a paid-up member:

_____
Federation Constituent Society

B ☐ NON-MEMBER $65.00

G ☐ SPECIAL FEE FOR RETIRED MEMBERS $25.00

_____
Federation Constituent Society

INFORMATION FOR REGISTRATION BADGE:

NICKNAME

FIRST NAME LAST NAME

BUSINESS AFFILIATION

STREET

CITY STATE *(U.S. only)*

MAILING ZONE COUNTRY (OTHER THAN U.S.)

BUSINESS CLASSIFICATION DATA FOR THE ABOVE REGISTRANT:

YOUR COMPANY (CHECK ONE BLOCK)

AA ☐ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants

BB ☐ Manufacturers of Raw Materials

CC ☐ Manufacturers of Equipment and Containers

DD ☐ Sales Agent for Raw Materials and Equipment

EE ☐ Government Agency

FF ☐ Research Testing Consulting

GG ☐ Educational Institution Library

HH ☐ Paint Consumer

JJ ☐ Other

YOUR POSITION (CHECK ONE BLOCK)

KK ☐ Management Administration

LL ☐ Manufacturing and Engineering

MM ☐ Quality Control

NN ☐ Research and Development

PP ☐ Technical Sales Service

QQ ☐ Sales and Marketing

RR ☐ Consultant

SS ☐ Educator/Student/Librarian

TT ☐ Other

SPOUSES REGISTRATION AND INFORMATION FOR REGISTRATION BADGE:

D ☐ SPOUSE $35.00

NICKNAME

NAME

ADDRESS

CITY STATE

MAILING ZONE COUNTRY (OTHER THAN U.S.)

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

H ☐ $25.00

TICKETS FOR FEDERATION LUNCHEON, FRIDAY, NOVEMBER 7 (@ $20.00)

Z ☐ NUMBER REQUIRED: _____
$20.00 EACH.

A CHECK IN THE AMOUNT OF:

$ _____

IS ENCLOSED

EXHIBITORS SIGNED UP FOR 1986 PAINT INDUSTRIES' SHOW

(As of July 1, 1986)

Aceto Chemical Co., Inc.
Advanced Coating Technologies
Advanced Software Designs
Air Products & Chemicals, Inc.
Alcan Powders & Pigments
C. M. Ambrose Co.
American Cyanamid Co.
American Hoechst Corp.
American Society for Testing and Materials
Analect Instruments
Angus Chemical Co.
Anker Labelers Corp.
Applied Color Systems, Inc.
Arco Chemical Co.
Aries Software Corp.
Armstrong Containers, Inc.
Ashland Chemical Co.
Atlas Electrical Devices Co.
AZS Corporation

B&P Environmental Resources
B.A.G. Corp.
BASF Corporation Chemicals Div.
Beltron Corp.
Berol Chemicals, Inc.
Blackmer Pump Div., Dover Corp.
C.W. Brabender Instruments, Inc.
Brain Power, Inc./BPI
Brinkmann Instruments
Brockway Standard, Inc.
Brookfield Eng. Labs., Inc.
BTL Specialty Resins Corp.
Buckman Laboratories, Inc.
Bulk Lift International, Inc.
Burgess Pigment Co.
Byk-Chemie USA

Cabot Corp., Cab-O-Sil Div.
Calgon Corp., Div. of Merck & Co., Inc.
Canada Talc Ltd.
Cargill, Inc.
Caschem, Inc.
Celanese Specialty Resins
CEM Corp.
Chemical & Engineering News
American Chemical Society
Chicago Boiler Co.
CIBA-GEIGY Corp.
Clawson Tank Co.
Coatings Magazine
Color Corp. of America
Colorgen, Inc.
Columbian Chemicals Co.
Commercial Filters
Consolidated Packaging Machine
Continental Fibre Drum Co.
Cook Resins & Additives
Cosan Chemical Corp.
Coulter Electronics, Inc.
Cray Valley Products, Inc.
Crosfield Chemicals
Cuno Industrial Products
Custom Fibers International
Custom Metalcraft, Inc.

Daniel Products Co.
Data Color
Datalogix Formula Systems, Inc.
Day-Glo Color Corp.
Degussa Corp.
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Diagraph Corp.
Diamond Shamrock Chemicals Co.
Process Chemicals Div.
Disti, Inc.
Dominion Colour Co.
Dow Chemical USA
Dow Corning Corp.
Draiswerke, Inc.
Drew Chemical Corp.
DSET Laboratories, Inc.
Du Pont Company

Eastern Michigan University
Eastman Chemical Products, Inc.
Ebonex Corp.
Eiger Machinery, Inc.
Elektro-Physik, Inc.
Elmar Industries, Inc.
EM Industries, Inc., Pigment Div.
Engelhard Corp.
Epworth Manufacturing Co., Inc.
Ericksen Instruments, Inc.
Exxon Corp.

Fawcett Co., Inc.
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Fillite USA, Inc.
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Filterite
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H.B. Fuller Co.

Georgia Kaolin Co., Inc.
Globe Trading Co.
Goodyear Tire & Rubber Co.
Gorman-Rupp Co.
W.R. Grace & Co.
Davison Chemical Div.
Grefco, Inc., Dicaperl & Dicalite Depts.

Haake Buchler Instruments, Inc.
Halox Pigments, Div. of Hammond Lead Products
Harshaw/Filtrol Partnership
Henkel Corp.
Hercules Incorporated
Heubach, Inc.
Hilton-Davis Chemical Co.
Hitox Corp. of America
Hockmeyer Equipment Corp.
Hoover Group
J. M. Huber Corp.
Hunter Associates Laboratory

ICI Americas, Inc.
Ideal Mfg. & Sales Corp.
Illinois Minerals Co.
Indusmin
Industrial Finishing Magazine
Inolex Chemical Co.
Itasco Industries Div., I.W.I., Inc.

S. C. Johnson & Son, Inc., Johnson Wax

Kenrich Petrochemicals, Inc.
Kent State University
Kinetic Dispersion Corp.
King Industries, Inc.
Kiss Packaging Products
KTA-Tator, Inc.

Letica Corp.
Liquid Controls Corp.
Logicom, Inc.
The Lubrizol Corp.

Macbeth Div., Kollmorgen Corp.
Magnesium Elektron, Inc.
Manchem, Inc.
Manville
Marco Scientific, Inc.
McCloskey Corp.
McWhorter, Inc.
The Mearl Corp.
Mettler Instrument Corp.
Micro Powders, Inc.
Micromeritics Instrument Corp.
Mid-States Eng. & Mfg. Co.
Miller Paint Equipment, Inc.
Milton Roy Co.
Mineral Products Corp.
MiniFibers, Inc.
Minolta Corp.
University of Missouri-Rolla
Mitech Corp.
Mobay Chemical Corp.
Modern Paint & Coatings
Morehouse Industries, Inc.
Mozel Chemical Products Co.
Myers Engineering

Nat'l. Assoc. of Corrosion Eng.
National Paint & Ctgs. Assoc.
Netzsch Incorporated
Neupak, Inc.
Neville Chemical Co.
NL Chemicals/NL Industries, Inc.
North Dakota State University
Nuodex/Huls
NYCO

O'Brien Industrial Equip. Co.
Ottawa Silica Co.

P. A. Industries
Pacific Micro Software Eng.
Pacific Scientific Co., Gardner/Neotec Div.
Paint & Coatings Industry Magazine
Pennsylvania Glass Sand Corp.
Permuthane, Inc.
Pfaudler Co.
Pfizer Pigments, Inc.
Phillips 66 Co./Catalyst Resources, Inc.
Pico Chemical Corp.
Plastican, Inc.
Poly-Resyn, Inc.
Polyvinyl Chemical Industries
PPG Industries, Inc.
Premier Mill Corp.
Progressive Recovery, Inc.
Purnell International

The Q-Panel Co.

Raabe Paint Co., Inc.
Red Devil, Inc.
REECO
Reichhold Chemicals, Inc.
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Rhone Poulenc, Inc.
Rohm and Haas Co.
Roper Pump Co.
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Sandoz Chemicals Corp.
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SEMicro Corp.
Serac, Inc.
Shamrock Chemical Corp.
Shell Chemical Co.
Sherwin-Williams Chemicals
Silberline Manufacturing Co.
South Florida Test Service, Inc.
Southern Clay Products, An ECCA Company
Univ. of Southern Mississippi, Polymer Science Dept.
Spartan Color Corp.
A. E. Staley Manufacturing Co.
Steel Structures Painting Council
Suga Test Instruments Co.
Sun Chemical Corp., Colors Group
Sylvachem Corp.

Tammsco, Inc.
Tego Chemie Service GmbH
Tekmar Co.
Thiele Engineering Co.
Tokheim Corp., Fluid Products Div.
Toyo Aluminum K.K.
Troy Chemical Corp.

Union Carbide Corp.
Union Process, Inc.
United Catalysts, Inc.
Universal Color Dispersions
Unocal Chemicals Div., Unocal Corporation

R. T. Vanderbilt Co., Inc.
Viking Pump—Houdaille, Inc.
Virginia Chemicals, Inc.
Vorti-Siv Div. M&M Machine

Wacker Chemical Co.
Warren-Rupp-Houdaille, Inc.
Washtech Systems, Inc.
Wilden Pump & Eng. Co., Inc.
Witco Corp.

Zeelan Industries, Inc.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Spring 1986 Board of Directors Meeting

Thirty-five members and 24 guests attended the Spring Meeting of the Board of Directors of the Federation of Societies for Coatings Technology on May 16, 1986, in Pittsburgh, PA.

The following were in attendance:

Officers

President . . . . . William Mirick
President-Elect . . . . . Carlos Dorris
Treasurer . . . . . Deryk R. Pawsey

Society Representatives

Baltimore . . . . . Joseph Giusto
Birmingham . . . . . Raymond B. Tennant
Chicago . . . . . Fred Foote
C-D-I-C . . . . . Lloyd Reindl
Cleveland . . . . . Fred G. Schwab
Dallas . . . . . William Wentworth
Detroit . . . . . Gary Van DeStreek
Golden Gate . . . . . Barry Adler
Houston . . . . . Donald Montgomery
Kansas City . . . . . Norman Hon
Los Angeles . . . . . Jan P. Van Zelm
Louisville . . . . . James Hoeck
Mexico . . . . . Antonio Pina
Montreal . . . . . Horace Philipp
New England . . . . . Daniel Toombs
New York . . . . . Saul Spindel
Northwestern . . . . . Richard L. Fricker
Pacific Northwest . . . . . Carlton R. Huntington
Philadelphia . . . . . Carl W. Fuller
Piedmont . . . . . James N. Albright
Pittsburgh . . . . . Raymond Uhlig
St. Louis . . . . . Thomas Fitzgerald, Sr.
Southern . . . . . Berger Justen
Toronto . . . . . Kurt F. Weitz
Western New York . . . . . Thomas Hill

Other Members

Joseph A. Bauer . . . . . Louisville
Richard M. Hille . . . . . Chicago
James E. Geiger . . . . . Southern
J. Richard Keifer . . . . . Philadelphia
J. C. Leslie . . . . . Kansas City
John A. Lanning . . . . . Louisville
Michael W. Malaga . . . . . Cleveland

Guests

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

Federation Committee Chairmen Percy E. Pierce and Joseph A. Vasta.

Chuck Reitter, Editor, *American Paint & Coatings Journal*.

The following Society Officers, who attended their meeting the previous day: R. Edward Bish (Cleveland); John H. Daller (Pacific Northwest); C. Lewis Davis (Southern); Ray DiMaio (Los Angeles); Timothy Donlin (Golden Gate); Gerry Gough (Birmingham); James Harrell (Houston); Kenneth Hyde (Louisville); Jeffrey Johnson (Rocky Mountain); James Judlin (Houston); Helen Keegan (Baltimore); Kevin Mulkern (New England); Thomas L. Peta (Philadelphia); and Gail Pollano (New England).

Staff

Frank J. Borrelle, Executive Vice-President; Thomas A. Kocis, Director of Field Services; Rosemary Falvey, Director of Meetings; Kathryn A. Ferko, Assistant to the Treasurer; Patricia D. Viola, Managing Editor; and Robert F. Ziegler, Editor of *Journal of Coatings Technology* and Executive Secretary.

In Memoriam

A moment of silence was observed in memory of FSCT Past-President Harold B. Gough (1966-67), who died in January 1986.

Reports of Officers And Staff

PRESIDENT MIRICK

I am pleased to report that the Federation is well within its budget for 1986 and is in excellent financial shape.

After the January Executive Meeting it was my pleasure to announce the appointment of Robert F. Ziegler to the position of Executive Secretary. He will assist Executive Vice-President Frank Borrelle in staff management of the increasing business affairs and activities of the Federation.

The highlights of being President are the visits to the Societies and their regional meetings. To date, it has been my privilege to meet with the Los Angeles, Louisville, New England, and Rocky Mountain Societies. Also, Mary and I have attended the Pacific Northwest, Southern, and Southwestern regionals. The hospitality at each has been outstanding.

Program Chairman Percy Pierce has arranged an excellent technical program with the theme, "Compliance and Quality: Recognizing the Opportunities," for the Annual Meeting in Atlanta. All indications point to another record-breaking meeting.

WILLIAM MIRICK,
President

PRESIDENT-ELECT DORRIS

This year has been gratifying to learn first-hand how important the Federation is to the lives of our members. It also has been great to witness the advancement and sharing of knowledge through educational and technical programs.

I have attended the following activities on behalf of the Federation: (1) Investment Committee; (2) Finance Committee; (3) Executive Committee; (4) Detroit and Northwestern Societies' meetings; (5) Manufacturing Committee; and (6) Southwestern Paint Convention.

The recruitment of 1986-87 Federation Committee Chairpersons is progressing on schedule. Our success in the Federation is very dependent on the effective functioning of these committees.

CARLOS E. DORRIS,
President-Elect

TREASURER PAWSEY

My activities as Treasurer have been to attend the January Investment-Finance-Executive Committee meetings and the Professional Development Committee meeting in March.

Investment Committee—The Federation's investment portfolio, thanks to the prudent financial design of present and past Investment Committee members, has reached a size which can be described as healthy for an organization of our size. We have assembled a good balanced portfolio of fiscally sound equities and bonds.

Finance Committee—This year's budget of $1.925 million is again a balanced one. Kudos are due to the Federation staff for their sound fiscal management of our resources.

Professional Development Committee—This important committee has a particularly difficult role to play in our organization. Much thought and work has already been put into developing an action plan which will enable the committee to fulfill its mandate.

Federation Finances—All accounts year to date are operating on or within budget.

Coatings Industry Education Fund—Apart from interest accumulation there has been no activity with this fund year to date.

DERYK R. PAWSEY,
Treasurer

Board members in attendance included (left to right): Lloyd Reindl (C-D-I-C); Fred Foote (Chicago); and Raymond B. Tennant (Birmingham)

EXECUTIVE VICE-PRESIDENT BORRELLE

All Federation activities in 1985 were successful, making it another good year. The Paint Show was the largest and total Federation income for the year reached a new level. As the organization grew, so did its headquarters office—from 4,000 to a completely-renovated 7,000 sq. ft.

1986 BUDGET

In January, the Finance and Executive Committees approved a budget of $1,925,000, a new high. The allocations are:

Income—Publications—35%; Annual Meeting and Paint Show—50%; Membership Dues—7%; Educational Activities—5%; and Miscellaneous—3%.

Expense—Headquarters Office/Administration—37%; Publications—28%; Annual Meeting and Paint Show—19%; Educa-

Guests attending the meeting included New England Society Officers for 1985-86: Kevin Mulkern (Treasurer) and Gail Pollano (Secretary)

tional Activities—8%; Officers/Board/Committees—7%; and Miscellaneous—1%.

Publications

JCT—Total pages published in 1985 were 1,225, compared to 1,193 in 1984. In spite of the fall-off in advertising pages in 1985, income did exceed the budget.

Sometime this year, we will begin mailing the JCT in poly bags. We have been wanting to employ this protective wrap for some time. The cost is now reasonable.

Year Book—The 328-page edition was mailed on March 14. Beginning with the 1987 edition, all copies will be bound with plastic spiral comb. The cost has dropped, and more importantly, so has the production time.

Series Units—Three manuscripts in the new *Series on Coatings Technology* will be published as soon as possible—"Film Formation," "Introduction to Polymers and Resins," and "Radiation Cured Coatings."

Other Publications—The Federation's activities brochure has been updated and mailed to the Board and Society Officers. The Infrared Book, Dictionary, and Pictorial Standards Manual continue to sell at a steady pace.

Membership Services

Membership figures reached a new milestone in 1986—7,000. Fourteen Societies showed increases. The largest were: Northwestern (34); Detroit (30); Golden Gate (30); Montreal (29); Louisville (22); Toronto (20); Dallas (18); and St. Louis and Los Angeles (16 each). The biggest gains, percentage-wise, were by Dallas, Northwestern, and St. Louis.

The 50-year club has grown to 35 members.

Annual Meeting and Paint Show

The 1985 AM&PS was a great success. Registered attendance (6,300) was the second highest. The "Big 50" Paint Show set a new record with 247 exhibitors in 55,800 net sf—10,000 more than the 1984 Show.

Plans for the 1986 AM&PS are moving along smoothly. The Paint Show is closing in on the 1985 numbers. The Show has grown so, that 1½ additional hours of exhibit time will be provided this year.

Committee Liaison

Staff is pleased to coordinate the activities of committees and it is encouraging that several are meeting this year: Corrosion, Educational, Finance, Investment, Heckel Award, Manufacturing, Mattiello Lecture, Planning, Program (Annual Meeting), Professional Development, Publications, and Technical Advisory. The national meetings of Society Education and Technical Chairmen will also be held again in 1986.

Proficiency Testing Program

This lab program—administered by Collaborative Testing Services—is in its second successful year.

Spring Week

The third "Spring Week" will take place mid-May in Pittsburgh. The first event will be the seminar on "Special Purpose Coatings." The Society Officers and Board of Directors meetings follow.

Sincere thanks are extended to Ray Uhlig, his committee, and the Pittsburgh Society for arranging the spouses' and other host activities. The Pittsburgh hospitality and cooperation have been just great. Thanks, too, to Mobay Chemical Co. and Eastman Chemical Products, Inc. for hosting the receptions.

SACC

The Federation, the Detroit Colour Council, and the Manufacturers Council on Color and Appearance are sponsoring a June Symposium on Automotive Color Control, in Southfield, MI. It looks to be a great success. The program is endorsed by our Detroit Society and the ISCC.

Audio/Visual

The VCR tape on Laboratory Test Procedures has been added to our library.

Federation Office

We were pleased to host the meetings of several committees in the new and enlarged headquarters office. When in downtown Philadelphia, members are most welcome to see the new quarters, of which the Federation can be very proud. The photos of 18 Society cities are on display.

Officer/Staff Visits

Officer/Staff visits so far this administrative year have been to the monthly meetings of: St. Louis, Rocky Mountain, Los Angeles, Louisville, New York, New England, Detroit, and Northwestern; and to the Southern annual meeting and Southwestern Paint Convention.

Representing their Societies were (left to right): Gary Van DeStreek (Detroit); William Wentworth (Dallas); and Fred G. Schwab (Cleveland)

Society Representatives (left to right): Norman Hon (Kansas City); Donald Montgomery (Houston); and Barry Adler (Golden Gate) attended the meeting

STAFF

Two persons have been added to staff since my last report: Meryl Cohen, as a Clerk/Secretary, and Michael McHale, as the successor to Kathryn Ferko, the Assistant to the Treasurer, who will retire on June 30.

Kate has been a valuable member of the staff for 12 years and I thank her most sincerely for her good work, dedication, friendly spirit of cooperation, and the excellent care she gave to Federation financial matters and "the books." It has been a pleasure and privilege for me to have been associated with her. I wish her good health and happiness in her retirement at the Jersey shore.

FRANK J. BORRELLE,
Executive Vice-President

At the conclusion of the Board meeting, Mr. Borrelle announced that he will retire from the Federation on October 30, 1987.

DIRECTOR OF FIELD SERVICES KOCIS

Major efforts have been directed to committee liaison and support and, as noted, there has been much recent activity in this area.

COMMITTEE LIAISON

Program—Close contact is being maintained with the Program Steering Committee, which met in St. Louis during the Annual Meeting and again in Chicago on November 22; as the program is developed and speakers are selected, staff will coordinate arrangements.

Early indications point to an abundance of submissions which should provide a full complement of quality presentations keyed to this year's upbeat theme, "Compliance and Quality: Recognizing the Opportunities."

Technical Advisory—Committee met with Society Technical Committee Chairmen on October 29–30, in Madison, WI. Focus of discussions was review of Society projects underway and suggestions for work that might be undertaken. Compilation of reports on Society Technical Committee activities was published in March JCT.

A highlight of the Madison meeting was a tour of the U.S. Forest Products Laboratory, and the opportunity to visit with staff scientists there. They expressed a great deal of interest in establishing an ongoing liaison with technical members of the coatings industry; as a result means are currently being explored for developing Federation participation in a joint coatings/wood industry committee.

The TAC subsequently met on April 15, in New York, to review activities and formulate plans for this year's Fall meeting with Society Technical Committee Chairmen.

Manufacturing—Committee met on March 24, in Chicago, to review current activities and consider additional areas of involvement. A major agenda item was development of a committee-sponsored session for the Annual Meeting program. Selected for presentation was the topic of accurate and productive handling of raw materials and finished goods.

The committee is also planning a tour in conjunction with Annual Meeting, which would be held on Tuesday, November 4. Attendance would be limited to Steering Committee members and Society Manufacturing Committee members.

A list of suggestions for slide-tape programs on manufacturing topics, which would be added to current Federation A/V series, is being compiled for distribution to Society Chairmen. These programs have been a source of interesting project work and have been well received in the industry as training aids.

Educational—Initial meeting of reorganized Steering Committee was held in headquarters office on February 19. Discussions featured: development of more detailed criteria for allocating funds for scholarship grants and compiling more data on coatings programs at schools receiving these funds and on the students awarded grants, to provide a better basis for evaluating each school's requests; drafting of guidelines for implementing the Southern Society A. L. Hendry Award competition, which will be initiated in 1986, for Award presentation to winners at the Annual Meeting in Atlanta; laying plans for Spring meeting with Society Educational Committee Chairmen.

Also discussed was how the Federation might best undertake an educational program at the national level, to redirect the current, somewhat fragmented efforts into more cohesive and structured activities; Committee plans to address this more fully at a subsequent meeting, tentatively scheduled for June.

Committee met in Atlanta, on April 22, with Society Educational Committee Chairmen and representatives from schools receiving FSCT scholarship funding. Included in discussions were: reports on the coatings programs at the FSCT-funded schools; updates on Society educational activities (which will be published in a forthcoming issue of JCT); and discussions of suggested programs at the local and national level—including recommended development of a career promotion program to acquaint students with opportunities in the coatings industry.

Corrosion—Committee will meet in headquarters office on May 9.

From left to right: Antonio Pina (Mexico); James Hoeck (Louisville); and Jan P. Van Zelm (Los Angeles)

Symposium on Automotive Color Control

Federation is co-sponsoring, along with Detroit Colour Council and Manufacturers Council on Color and Appearance, a Symposium on Automotive Color Control (SACC), in Southfield, MI, on June 3-6. The Symposium, which has been endorsed by the Detroit Society and the Inter-Society Color Council, will feature paper presentations, workshops, and "hands-on" equipment demonstrations to acquaint participants with new SAE Recommended Practice for determining color match acceptability of automotive components. The Symposium will be presented in two-day overlapping segments for Coatings (June 3-4), Soft Trim (June 4-5), and Plastics (June 5-6). FSCT staff is responsible for promotion and on-site needs for the event, and all advance arrangements have been accommodated.

Miscellaneous

Annual update on "Talks Available" being readied for publication.....Staff support provided for Spring Seminar on Special Purpose Coatings.....Liaison and support provided for activities of Roon Awards, Professional Development, Environmental Control, AP&CJ Awards, and MMA Awards Committees.....Assisting Advisory Board in development of new *Series on Coatings Technology;* three titles currently being readied for publication, with expectation of another three or four to be available by year's-end.....Participated in FSCT booth display at Corrosion Show in Houston, March 17-21.

Thomas A. Kocis,
Director of Field Services

TECHNICAL ADVISOR BROWN

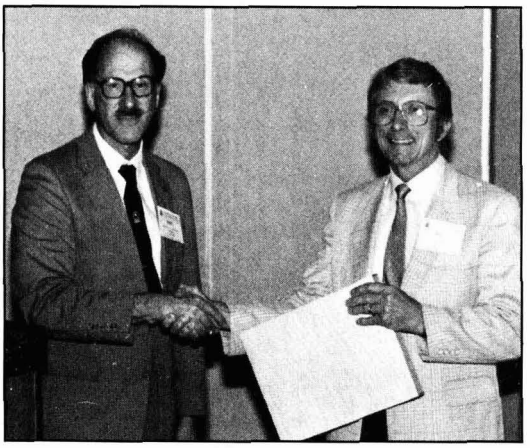
Special Purpose Coatings Seminar

We have recruited an excellent roster of speakers to discuss the many types of coatings included in the "Special Purpose" category. Of the three groups which the U.S. Census Bureau uses to report American paint production figures, Special Purpose Coatings are the fastest growing and probably the most profitable. Their percentage of growth in recent years far surpasses that of either Architectural or Product Finishes (OEM).

Many interesting discussions await those who attend. Presentations on Heavy Duty Maintenance Coating Systems for the protection of petroleum refineries and petrochemical plants, ships and off-shore structures, pulp and paper mfg. plants, bridge maintenance, and other end uses will be given. Special coatings such as Automotive Refinish, Fire Retardant, Traffic, Roof, and Aerosols will be discussed. An expert in this field will also explain the operation of conducting an inspection and evaluation of the finished paint job.

Paint Industry Liaison With the Wood Industry

At the meeting of the Technical Advisory Committee and Society Technical Committee Chairmen in Madison, WI, last October, the group toured the Forest Products Laboratory (U.S. Dept. of Agriculture), and heard a talk by Dr. William Feist who is in charge of paint research at FPL. The interest shown by both our members and by Dr. Feist in establishing a liaison group between the wood and paint industries prompted me to write a proposal for forming such a joint committee. Permission to pursue this endeavor was given by the Executive Committee. Saul Spindel, TAC Chairman, and I met in Washington, D.C., February 26, 1986 to explore the matter with Gerry Prange, V.P. of the National Forest Products Association. Mr Prange stated that the wood industry and NFPA are interested in establishing liaison with FSCT.



Horace Philipp, Chairman of the Membership Services Committee, presented a Certificate of Appreciation to the Dallas Society, represented by William Wentworth, in recognition of a 16.1% increase in Society membership. The Northwestern and St. Louis Societies also received certificates recognizing their membership recruitment efforts

The establishment of such a joint committee is still in the formative stage. It was most recently discussed at a meeting of the Technical Advisory Committee in New York City, April 15, 1986. I believe that a liaison group can benefit both industries by seeking to educate each other regarding the properties of paint products and wood substrates. It can also aid in guiding Dr. Feist in conducting more effective research relating to the painting and staining of wood substrates.

Mildew Research

The exterior exposure of paint panels to determine resistance to mildew growth has been progressing for about 2½ years. Eight Society Technical Committees have been involved in this work. Many of the exposure panels are now deteriorating due to cracking and flaking of the paint film, and can no longer be effectively evaluated for mildew resistance. The paint panels, exposed in several areas of the country, have not all been out for the same length of time, however.

Following more than two years of exposure we had reports, for the first time, that paints made from the "active" polymer were showing less mildew growth than the "control" paint and even less than a commercial mildew-resistant paint. These reports were received from the Southern and Los Angeles Societies. This *may* be an indication that the "active" polymer paint has weathered sufficiently to allow the mildewcide to leach out and become effective as a mildew growth retarder in the paint film.

The Southern Society is encouraged by the results of their exposure work and is providing funds for their Technical Committee to continue research along these lines. I arranged for the Glidden Co. to send the 12 pounds of PCP acrylate monomer they had left to the Southern Society last November. This is the same monomer used to prepare the "active" emulsion polymer which was employed to make the paints used in our current exposure work. Russell Horne, Technical Committee Chairman of the Southern Society, has informed me that they have two companies currently working to prepare stable emulsion polymers from the monomer received from Glidden. Once they have prepared stable polymers, there are six paint companies who have volunteered to formulate exterior paints. Once stable paints are developed, panels will be made and exposed at various locations. The Southern Society considers the mildew

Society Representatives (left to right): Horace Phillip (Montreal); Daniel Toombs (New England); and Saul Spindel (New York)

problem to be one of their most important in the field of exterior architectural paints.

Federation Proficiency Testing Program

This program has now been in operation for almost two years. Based on suggestions received from a questionnaire I sent to all cooperators last summer, I have added some new tests to the program and the format has been altered to allow the same test to be conducted twice during the year on different paint samples. This enables participants to determine if their testing proficiency has improved.

The program presently includes participating laboratories of paint manufacturers, raw material suppliers, commercial testing organizations, state and local government agencies who use paint, and other interested organizations. Test results have convinced me that the program is valuable and is needed by our industry. The testing proficiency of laboratories who have been in the program for some time is showing definite improvement. Results from the performance of tests like density, dispersion, non-volatile content, flash point, etc., are showing reasonably good reproducibility. The performance of tests like water content, abrasion resistance (Taber), viscosity, gloss (wet sample), and volatile organic content (VOC) indicate a need for great improvement. Test results of cooperators using the same paint show a wide range of deviation.

We have received a number of comments which indicate that the program has helped to discover off-standard laboratory equipment and careless work by technicians. Some companies with several plants find the program helpful in assessing the performance of their many quality control laboratories. The program is needed and it is not expensive—I'm disappointed that more paint manufacturing companies have not joined the program. The new brochure describing the third year's program will be available soon and can be obtained from Federation Headquarters.

Federation Committees

I have been involved in the meetings and work of the following Federation committees: Technical Advisory, Educational, Manufacturing, Professional Development and Corrosion. The work of these groups is important to the future success of the Federation and to the technical and manufacturing operations of the entire paint and coatings industry.

Royal A. Brown,
Technical Advisor

Review of Actions Of Executive Committee

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

The actions of the Executive Committee (at meetings of October 10, 1985 and January 31, 1986) were included with the minutes mailed previously to Board Members. The actions at the May 15, 1986 meeting of the Executive Committee were presented to the Board during the present meeting.

The actions of the committee presented to the Board of Directors are given below. All were approved.

October 10, 1985

Environmental Control Committee—That Lloyd Haanstra, of the Los Angeles Society, be contacted and asked to define the West Coast environmental problems and to spell out in detail what the West Coast Societies want the Federation to do.

Professional Development Committee—That a member of staff attend all meetings and that the dates of Spring Week 1986 be avoided when scheduling the short courses on Statistical Process Control.

Planning—That the Chairman provide a list of committee projects, in order of their priority, and a progress report on Federation Awards.

By-Laws Committee—That the committee consider whether or not the By-Laws should stipulate that the Federation President shall appoint all Committee Chairmen.

Committee Appropriations—That the $50,100 be appropriated to Federation Committees (67700) in 1985-86; $9,000 to the Educational Committee (75000); and $40,000 to the Professional Development Committee (68000).

Southern Society Memorial Award—That the recommendation of the Planning Committee (cash awards for theses) be approved, provided that it is also accepted by the Southern Society.

50-Year Members—That those who attend the AM&PS be offered complimentary registrations and complimentary luncheon tickets.

Past-Presidents—That those who attend the AM&PS be offered reimbursement of transportation expense, complimentary registrations and complimentary luncheon tickets.

Annual Business Meeting—That the time of this closing day meeting at the 1986 AM&PS be changed to the morning.

Federation Officers (left to right): William Mirick (President) and Deryk Pawsey (Treasurer)

From left to right: Past-President Mike Malaga (Cleveland); John Lanning (Louisville); and J. Richard Kiefer (Philadelphia)

Certificates of Membership—That the proposal of the Houston Society for a revised certificate of Federation/Society membership be considered by staff and the Membership Services Committee.

Technical Advisor—That the services of Royal A. Brown as Federation Technical Advisor be continued from January through December 1986.

JANUARY 31, 1986

That the estimated statement of income and expense for 1985 be approved. (Income—$1,944,700; Expense—$1,662,352).

That Robert F. Ziegler, a member of staff for ten years, be appointed Executive Secretary to assist Executive Vice-President Frank J. Borrelle.

That the West Coast Societies' request for an environmental expert on staff be tabled, pending an opinion from legal counsel (re the Federation Constitution) and discussion with NPCA.

That the Corrosion Committee submit a detailed proposal regarding any planned project and that it be advised of the limits of its jurisdiction.

That the request from Case Western Reserve CASC to establish a Federation fellowship there be respectfully denied.

That publication of the new Series on Coatings Technology begin as soon as possible—skipping #1 if necessary.

That the Mathematics and Statistical Methods Award proposed by Messrs. Prane and Hill not be given Federation status.

That the investigations continue re the New York Society's request for a Federation program of life/health insurance for members.

That the Federation support establishment of a joint committee between the Federation and the National Forest Products Assn. and that Messrs. Spindel and Brown meet with NFPA staff in D.C.

That the Louisville and St. Louis Societies be thanked for inviting the Federation to hold the 1995 AM&PS in their respective cities.

That the Federation's position re the International Coordinating Committee's Book on Paint History be that the net proceeds be divided equally among the members of the ICC.

That the Operating Budget for 1986 be approved. (Income—$1,925,000; Expense—$1,901,900).

MAY 15, 1986

That there be a clearer delineation of duties of the Educational and Professional Development Committees.

That the Executive Committee support the concept of a Federation-sponsored insurance program as an additional service for members, provided that the Federation's involvement is minimal.

That the Baltimore Society be thanked for its invitation to host the 1994 or 1995 AM&PS in that city.

That the policy applicable to the Birmingham Club's attendance at Federation meetings (with transportation expense reimbursed) be amended by substituting the Society Officers meeting for the Educational Chairmen's meeting.

That the nomination of Lewis P. Larson for Federation Honorary Membership be approved and referred back to the CDIC Society for membership vote.

That there be no Union Carbide Award this year.

That retirees from Federation staff be permitted to remain on the staff Blue Cross/Blue Shield medical program at their own expense.

That the Pittsburgh Society's request for matching funds be referred to the Coatings Industry Education Fund.

That the two requests of the Manufacturing Committee re the Golden Impeller Award and a collection of reprints be approved.

By-Laws

ADOPTED
Dues Change for Society Honorary Members

The following amendment to By-Laws Article VIII was approved.

WHEREAS under the current dues structure a Society Educator or Retired Member (annual Federation dues of $10.00) could be elected as a Society Honorary Member with the resultant increase in dues to $20.00, a penalty of $10.00 incurring in the process, be it

RESOLVED that By-Laws Article VIII Sections A and D be amended as follows:

Article VIII
Dues

A. ACTIVE AND ASSOCIATE MEMBERS

Each Constituent Society shall pay to the Federation office annual dues of twenty dollars ($20.00) in U.S. funds per capita

President Bill Mirick (right) and Executive Vice-President Frank J. Borrelle presented a Certificate of Appreciation to Kathryn Ferko, of the Federation staff, who retired after 12 years of service

for each Active and Associate Member of the Constituent Society.

D. RETIRED AND SOCIETY HONORARY MEMBERS

Each Constituent Society shall pay to the Federation office annual dues, equal to one-half the amount established for Active Members, for each Retired and Society Honorary Member of the Constituent Society.

ADOPTED
Revisions in Procedure for Nominating An Individual for Federation Honorary Membership

The following amendment to By-Laws Article I was approved.

WHEREAS the Federation Executive Committee has requested that the procedure for the nomination and election of Federation Honorary Members be revised, be it

RESOLVED that the following By-Law be amended as follows:

BY-LAWS ARTICLE I
Membership

A. CLASSES OF MEMBERSHIP

(3) Federation Honorary Membership: Any member or former member of a Constituent Society who has rendered signal service to the Federation or the industries served by the Federation in such a manner as to aid the accomplishment of the Objectives of the Federation, may be eligible for Federation Honorary Membership. Federation Honorary Members shall be elected by the Board of Directors and shall be entitled to receive all Federation publications regularly circulated to Active Members.

Nominations

The Nominating Committee placed the following persons in nomination for office with terms to become effective November 7, 1986:

President-Elect: Deryk R. Pawsey, of Pacific Northwest Society (Rohm and Haas Canada Inc.). One-year term. He is currently Treasurer.

Treasurer: James E. Geiger, of Southern Society (Sun Coatings, Inc.). One-year term.

Board members (from left to right): Richard L. Fricker (Northwestern); Carlton R. Huntington (Pacific Northwest); and Carl W. Fuller (Philadelphia)

Executive Committee: Kurt Weitz, of Toronto Society (Industrial Min, Div. of Falconbridge). Three-year term.

Board of Directors (Members-at-Large): Ronald Brown, of Southern Society (Unocal Chemicals Div.); Lloyd Haanstra, of Los Angeles Society (Guardsman Chemicals). Two-year terms each.

Board of Directors (Past-President Member): Terryl F. Johnson, of Kansas City Society (Cook Paint & Varnish Co.). Two-year term.

There were no nominations from the floor.

Elections will take place during the Board of Directors meeting on November 4, 1986, in Atlanta.

Members of the Nominating Committee are: Past-President A. Clarke Boyce, and Society Representatives Barry Adler, Carl Fuller, and Thomas Hill.

JOSEPH A. BAUER,
Chairman

Society Business

BALTIMORE SOCIETY INVITATION

The Baltimore Society has extended an invitation to the Federation to hold its 1994 or 1995 Annual Meeting and Paint Industries' Show in its city. The Federation appreciates this offer and will give it full consideration. A similar invitation was sent to NPCA.

BOSTON STONE

Mr. Toombs reported that the study of the Boston Stone has been completed and that an article is being prepared for publication in the JOURNAL OF COATINGS TECHNOLOGY.

INSURANCE PROGRAM FOR MEMBERS

Responding to a New York Society request to investigate the possibility of sponsoring an insurance program for members, the Federation submitted a proposal to the Board from its insurance agent, Financial Design Consultants, Inc., of St. Louis. Its representative, Robert Carron, reviewed the proposal at the meeting.

The basic points of the program are:

(1) Insurance carrier is Life Insurance Co. of New York (a CIGNA Co.).

(2) Four types of coverage: a. Accidental Death and Dismemberment; b. Hospital Indemnity; c. Term Life; and d. Disability.

(3) Federation's only involvement would be the association of its name and mail and print promotion.

[A motion made, seconded, and passed, approved the concept of this new Federation membership service, and authorized the Executive Committee to continue discussions toward implementation.]

Old Business

ASSISTANCE FROM STAFF
ON ENVIRONMENTAL ISSUES

Continuing discussions which began at the October 6, 1985 meeting, Mr. Adler made a motion, seconded by Mr. Van Zelm, to the effect that the Federation direct either a new or a current staff member to coordinate the dissemination of information and developments in the coatings industry with regard to environmental and hazardous waste regulations, for the benefit of the Societies and their individual members.

[The motion was passed by the Board.]

From left to right: Joseph Giusto (Baltimore); James E. Geiger (Southern); Richard M. Hille (Chicago); and Federation Past-President Joseph A. Bauer (Louisville)

[At a session following the meeting, the Executive Committee indicated that a current staffer will begin to assist in the areas indicated, in close cooperation with the Federation's Environmental Control Committee. The staffer will also be available to attend significant meetings upon request. One of the initial steps will be to query the current 17 Society Environmental Control Committees in the hope of setting up an information network.]

SPRING WEEK 1987

The Federation and the Pacific Northwest Society will present Spring Week 1987 from April 28-May 2, at the Westin Hotel in Seattle. The schedule of main events will be:

Tues., Apr. 28	— FSCT Society Officers Reception
Wed., Apr. 29	— FSCT Society Officers Meeting; FSCT Board of Directors Reception
Thurs., Apr. 30	— PNW Society Golf; FSCT Board of Directors Meeting; PNW Society Evening Activity
Fri., May 1	— Seminar on "Coatings for Wood Substrates"; PNW Society Spouses' Program
Sat., May 2	— Seminar continues; PNW Society Sports Competition; Closing Dinner-Dance

Committee Reports

CORROSION

The last meeting of this committee was held during the Federation Annual Meeting in St. Louis, October 1985.

During that meeting three major projects were taken under consideration, and discussed in depth: to survey accelerated test methods, to consider the possibility of providing a corrosion publications award, and lastly, to provide the Federation membership with a corrosion services guide.

The survey of accelerated test methods would be performed by a commercial enterprise on a fee basis, and provide information as to test methods and procedures, equipment, and without delving into any details, information for the evaluation and correlation of data thus obtained.

Since the pursuit of such a project involves Federation policy, and Federation funds, it was presented to the Executive Committee at its January meeting. Since then it was referred back to the committee for an in-depth study of the details, refinement of the goals sought, and an estimate of the financial expenditures the Federation would incur.

The proposal to provide an incentive award for a "best" paper published was deemed to have merit, but since again Federation policy was involved the feeling was expressed that any funds so committed should be provided by the Federation, rather than be solicited from industry. Again, the committee is charged with the refinement of such a proposal, and the task of resubmittal together with a budget proposal.

The last item, to provide a corrosion services guide, was regarded as possibly being dangerously commercial, since listees could conceivably use this service for business gains. On this basis the Executive Committee voiced firm opposition.

The Corrosion Committee is slated to meet at Federation headquarters in May. A major point on its agenda is the action it must take regarding the opinions previously expressed.

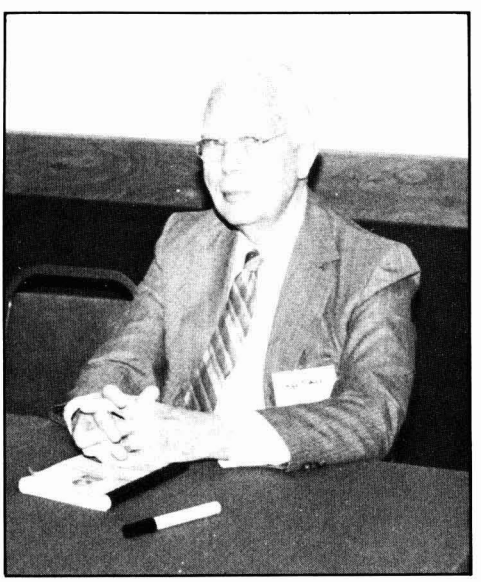
It is also the intention of this committee to take advantage of several opinions expressed during the October meeting of the Technical Advisory Committee, at which representatives from several Societies indicated their committees are pursuing projects in the area of corrosion protection.

Significant strides have been made in fortifying liaison with the Steel Structures Painting Council (SSPC), and in an ancillary way a fairly good contact has been established with the International Standards Organization (ISO), which in turn keeps the National Association of Corrosion Engineers (NACE) apprised of its actions.

ALEXANDER A. CHASAN,
Chairman

EDUCATIONAL

The Educational Steering Committee recommended (and the Executive Committee approved) the awarding of a total of $32,000 in scholarship funds to the following schools that grant undergraduate and graduate degrees in coatings technology: University of Detroit; Eastern Michigan University; Kent State University; University of Missouri–Rolla; North Dakota State University; and University of Southern Mississippi.



Federation Past-President (1951-52) Hiram P. Ball attended the meeting

Representing the Toronto Society was Kurt F. Weitz; the Western New York Society was represented by Thomas Hill

Additionally, the committee has developed a more definitive criteria for granting future scholarship funds, to better determine the success of a school in attracting good students who subsequently enter the coatings industry. We will thus have the basis for selecting those schools deserving of maximum support, and be assured that Federation scholarship funds are being used to best advantage.

To also assist in this regard, the committee plans to hold its meetings, when feasible, near one of the schools receiving scholarship grants, to visit the campus and chat with students and faculty; this will help give us a better assessment of the effectiveness of our grants, as well as determine the needs of each school.

In another area, the committee is focusing on the desirability of developing a career promotion program, to acquaint students with the many opportunities in the coatings industry; this could include a video tape presentation, similar to the motion picture produced by the Federation some years ago, which would also be used to acquaint the general public with coatings technology.

Discussions have been held with Battelle Memorial Institute (Columbus) regarding production of a video tape; a visit to their facilities confirmed their capabilities for undertaking such a project, and they have been asked to submit a proposal for doing so, for consideration.

To supplement this program, retired Federation members could be recruited to visit schools where the video tape would be shown, to provide additional commentary and answer questions.

The Steering Committee met with Society Educational Committee Chairmen and representatives from schools receiving Federation scholarship grants on April 22, in Atlanta. This annual event helps those attending to share experiences and recommendations for improved communications, and the meeting was marked by spirited and stimulating discussions. It is obvious that our Societies are engaged in effective educational programs, and that many of them also provide funding to assist efforts at schools in their areas.

Joseph A. Vasta,
Chairman

ENVIRONMENTAL CONTROL

Since November, 1985, this committee has published in either the Journal of Coatings Technology or *The American Paint Journal* (or both), the following information for Federation membership:

(1) OSHA Proposes Dropping Formaldehyde Exposure Limits;

(2) Underground Storage Tanks, EPA Notification Deadline May 8, 1986;

(3) RCRA Manifesting Film Available from EPA;

(4) EPA Studying Effects of Acid Rain on Exterior Paints and Need Our Help;

(5) OSHA Proposed Rulemaking to Expand Employee Coverage of "Right to Know."

Frequent discussions with Federation membership throughout the country reconfirm our previously stated purpose of "dissemination of timely and accurate information to FSCT membership regarding those proposed or enacted regulations which will impact our ability to conduct our business."

Joyce Specht St. Clair,
Chairman

HECKEL AWARD

The Heckel Award Committee began its deliberations to choose a suitable candidate in February 1986. The committee was polled by letter for suitable nominations and a slate of promising candidates was assembled. A meeting of the committee was held on April 14 at Federation headquarters in Philadelphia. The George Baugh Heckel Award nominee was selected by the committee and the award will be presented at the Annual Meeting in Atlanta.

Percy E. Pierce,
Chairman

MANUFACTURING

The Spring Meeting of the Manufacturing Committee was held in Chicago, March 1986. Committee membership was well represented in both attendance and enthusiasm, and was especially gratified with the participation of FSCT President-Elect, Carlos Dorris.

Following up a brief meeting held at the 1985 Annual Meeting, the committee continues to discuss ways to improve the Manufacturing Programs at each Annual Meeting. It was agreed to present suitably inscribed plaques to each speaker, and to solicit a program critique and suggestions for future programs through a survey card distributed to the audience. Additionally, the logistics and economics of audio or visual taping of the programs will be studied.

The Golden Impeller Award presented by Morehouse Industries at the Annual Meeting during the Manufacturing Program, was a topic of significant discussion. The committee is recommending to the FSCT Executive Committee that certain changes be requested of Morehouse in terms of the selection process and the presentation procedure.

In keeping with the 1986 Annual Meeting theme, the committee chose to pursue a presentation dealing with the accurate and productive handling of raw materials and finished goods. Load cells, mass metering, filling by weight, semi-bulk handling, and bar coding will be discussed by suppliers and users under the general heading of "Productive Alternatives for Improving Materials Control."

The committee continues to encourage manufacturing activity at the Society level by suggesting and coordinating the production of new audio/visual programs, which act as excellent focus projects, and are well received as educational tools by the Coatings Industry. Through the FSCT staff, a listing of manufacturing talks and speakers of proven quality will be made available to Society Program Chairmen. Additionally, the committee is seeking the approval of the Executive Committee to

pursue the feasibility of establishing a periodical reprint subscription service, to provide coatings manufacturing personnel a singular reference source for educational material specific to their discipline.

The Manufacturing Committee wishes to express its sincere gratitude to the Federation staff and most especially Tom Kocis for invaluable assistance, support, and advice. I wish to add my personal appreciation to the most recent Manufacturing Committee Chairman, Richard Max, whose support and continued service together with the enthusiasm of the entire committee, have significantly aided me in the first few months of Chairmanship of this productive committee.

RICHARD M. HILLE,
Chairman

MEMBERSHIP SERVICES

With the receipt of Constituent Society membership figures based on the 1986 *Year Book*, the total membership of the Federation stands at 7,038, a proud record in its history. More than half of the Societies showed gains in membership. The three largest will receive Certificates of Appreciation—Dallas (+16.1%), Northwestern (+15.4%), and St. Louis (+14.2%). The committee will endeavor to encourage and assist those Societies who recorded losses in members last year.

Latest attendance lists of coatings courses at North Dakota, Missouri, Eastern Michigan, as well as local symposia & seminars, have been requested for names of non-member registrants. Repeated requests for registration lists from regional meetings, e.g., Southern, Southwestern, and Pacific Northwest, have met with no response. These are positive areas for future membership prospects and should not be ignored.

Finally, it would be a boon to the industry if more university educators as well as contributing authors to the JCT were FSCT members.

HORACE PHILIPP,
Chairman

PAINT HISTORY

With the exception of the Chairman, there is no working Paint History Committee, and no real activity has taken place.

I have been cooperating with Jacques Roire, of Paris, and a Past-President of both FATIPEC and its French Association member. Mr. Roire, and his associates, have embarked upon the ambitious assignment of writing a book on Paint History, under the auspices of the International Coordinating Committee, of which the Federation is a member.

Until volunteers are found to serve on a Federation Paint History Committee, there is very little that I can do on my own.

JOSEPH H. BOATWRIGHT,
Chairman

PROFESSIONAL DEVELOPMENT

Since our last report, the Professional Development Committee has suffered a number of procedural problems which have prevented us from moving forward as rapidly as anticipated in our selected areas. These problems have been corrected and we are on our way again. We have met once since our last report.

The membership survey conducted at the Annual Meeting received a disappointing (though expected) response of about 130. Of encouragement, though, was the demographic information which appeared to be quite close to that extracted from the JCT audit of subscribers approximately one year ago. The vast majority of respondents were characterized as follows:

(1) Active members;
(2) Manufacturers of paint;
(3) Holders of technical positions;
(4) Supervise others;
(5) Prefer workshop/lecture types of continuing education courses.

James N. Albright (right) represented the Piedmont Society and Raymond Uhlig represented the Pittsburgh Society

Based on what we learned from this venture, we have developed an improved one-page questionnaire. This has already been sent out in a blanket mailing to all Federation members. Given a decent response in the next month, we should be able to develop the necessary information regarding the makeup of our membership to allow us to draft programs which address their desires and needs.

Developing an SPC course has proven to be more involved than we originally anticipated. At this point, we have succeeded in identifying a number of candidate groups to conduct such a course for the FSCT. We will be reviewing these options and making our final selection at our next committee meeting. Our goal is to develop a course which is unique to the Federation, and specifically focused on batch process manufacturing. The course will be two days in length, with a minimum of three offerings of the course at widely placed geographical locations. The course will be of a survey nature, but with enough substance to take home to one's employer to judge the value of statistical process control in one's own company. It will also contain enough substance to allow people to take the next step in implementing such a program should they so desire. The cost of the course was necessarily left open at this time, since the specific choices made at our next meeting will largely determine that value.

Follow-up publicity to our selection will include interviews with the selected SPC instructor in various journals, publicity through the FSCT Manufacturing Committee, publicity at the Annual Meeting (possible presentation), JCT editorial/article, and direct mail.

The issue of a problem-solving forum in the JCT has been taken up with the Publications Committee.

A bit of a controversy arose during our deliberations regarding the role of the Professional Development Committee within the Federation versus that of the Educational Committee and possibly others. It was the consensus of this committee that the FSCT Executive Committee and/or Board should clarify the respective roles of their committees in order to prevent the inefficiencies which would necessarily result from needless du-

plication. This committee recommends that its role be focused on the continuing education of the membership of the Federation (i.e., people already in our industry). This could distinguish it from educational efforts related to qualifying people for entry into our industry, and from joint industry/university programs.

As we conclude our first year in existence, I am pleased to report that this committee is, indeed, off and running. We have taken a number of discreet action steps which will manifest themselves in programs of observable value to the membership in the very near future. I am gratified and encouraged by the continued enthusiastic support and participation of the members of this committee. I look forward to a clarification of the role of this committee within the Federation structure, so that we may even more effectively serve the Professional Development needs of our membership.

F. Louis Floyd,
Chairman

ANNUAL MEETING PROGRAM

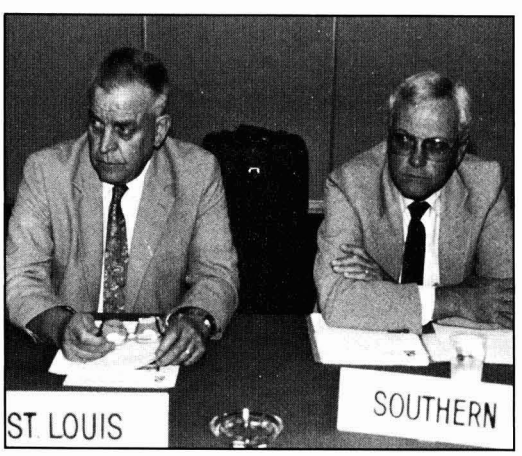
A meeting of the Annual Meeting Program Committee was held in Cleveland on November 22, 1985. The theme for the Annual Meeting, "Compliance and Quality: Recognizing the Opportunities," was developed along with plans for program subject matter to support the theme.

Tom Kocis has capably handled the advance publicity, call for papers, coordination of various sources of technical papers, correspondence to authors, etc. As a result of his and the committee's efforts we currently have commitments for 12 outside papers, five Roon Award papers, two overseas papers, four color symposium papers, and five powder coating symposium papers. These numbers will probably change but with the addition of Society papers, a Manufacturing program, and the Mattiello Lecture, the technical program for the Annual Meeting looks good.

Percy E. Pierce,
Chairman

PUBLICATIONS

A meeting of the Publications Committee was held on April 15, 1986 at the Federation Office, Philadelphia. The following were discussed:



In attendance were Thomas Fitzgerald, Sr. (St. Louis) and Berger Justen (Southern)

(1) The "Safety Net" column proved to be impractical, probably due to reluctance of individuals to report accidents and the difficulty to clear sensitive information for publication in the *JCT*.
(2) "Open Forum" and "Humbug from Hillman" continue to be popular features in the *JCT*.
(3) The Crossword Puzzle submitted by Earl Hill will continue in the *JCT*.
(4) Other features which may be added include a Computer Column. Dr. Darlene Brezinski pointed out the difficulties in developing a column in a rapidly-changing field. The committee will refer this to the Professional Development Committee.
(5) A suggestion to write an article favorable to the Coatings Industry will require further study.
(6) Membership of the Educational Review Board and review procedures were discussed.
(7) A letter from Louis Floyd suggested a Problem Solving column for the *JCT*. The committee suggested we send it back to the Professional Development Committee for more details to provide a monthly column in the *JCT*.
(8) Roon Award papers will be reviewed by the Editorial Review Board after the Roon Committee completes their review. Roon announcements should be made in early summer to encourage more participation in the following year.
(9) The Federation *Series on Coatings Technology* has three completed manuscripts and three others expected shortly. Publication of the first units will begin this year.
(10) Technical paper supply is adequate.
(11) The Chairman expressed his sincere thanks to the members of the committee for their dedicated efforts on behalf of the Federation.

Thomas J. Miranda,
Chairman

ROON AWARDS

The Roon Awards competition for 1986 has received declarations from seven participants indicating their intentions of submitting eight papers by the deadline.

Indications are that these papers will generate a high level of interest throughout the Federation membership.

Past experience indicates that a December news release inviting papers for the next year's competition has resulted in a time problem for potential authors. Consequently, we are planning to move the initial invitation from December back to June of the preceding year. We feel that this will create additional papers for the competition as well as maximize the quality of the submissions.

Philip W. Harbaugh,
Chairman

TECHNICAL ADVISORY

The Technical Advisory Committee (TAC) met with representatives of 18 Society Technical Committees in October 1985, Madison, WI. A complete report of the proceedings of the meeting appeared in the March 1986 *JCT*.

In addition, the TAC reviewed the Consumer Guide to Exterior Flat Latex Paints, developed by the Southern Society and recommended to the Board of Directors that the document be returned to the Society for review.

During the course of the meeting in Madison, representatives of the Forest Products Laboratory (FPL) spoke about an Adviso-

ry Committee of paint experts that formerly assisted FPL in developing its paint research programs. The advisors were from NPCA. However, the committee was disbanded in 1980. FPL asked for help and the TAC, in conjunction with Roy Brown and Federation staff (Tom Kocis), are exploring a process in which the Federation can assist the wood industry in its research program.

The members of the TAC for 1986-87, in addition to the Chairman, are: Jan Grodzinski, of S.C. Johnson & Son Ltd.; Richard E. Max, of Standard Coating Corp.; Colin D. Penny, of Hampton Paint Mfg. Co., Inc.; Gerry K. Noren, of DeSoto, Inc.; and V.C. (Bud) Jenkins, of Ellis Paint Co.

This group met on April 15 to plan the fall meeting of the committee. A tentative date and site has been established.

As Chairman, and on behalf of the other members of the TAC, I would like to express sincere appreciation to Stanley LeSota, of Rohm & Haas Co., who, after many years of service, resigned his position on the committee because of the pressure of other commitments. Stan has been an asset to our committee and we shall miss his counsel.

SAUL SPINDEL,
Chairman

TECHNICAL INFORMATION SYSTEMS

The TISCO is currently devising an alpha-numeric subject classification system which will be suitable for the computerized Subject Index of the JOURNAL OF COATINGS TECHNOLOGY.

HELEN SKOWRONSKA,
Chairman

DELEGATE TO NPCA SCIENTIFIC COMMITTEE

The most recent meeting of the NPCA Scientific Committee was held in November 1985, Washington, D.C. The Federation was represented by the Delegate as well as Roy Brown and Tom Kocis.

The following topics were discussed:

PROGRAM: The 1986 Spring meeting will include a tour of Ryland Homes plant (manufacturers of modular homes). There also was interest in special presentations on general topic of New Coatings Technology, including a meeting to tie-in with FSCT Professional Development Committee Seminar on Statistical Process Control, if the timing is feasible.

EDUCATION: This subcommittee has been disbanded.

RAW MATERIALS INDEX: Updated semi-annually, each section of the Index is completely revised every five years; NPCA staff is being assigned industry support people with appropriate expertise to review the various sections and to upgrade quality.

RESEARCH: Overview on activities of Center for Adhesives, Sealants and Coatings (CASC), at Case Western Reserve University was presented by Alex Ross, of Spencer Kellogg, who is on CASC Advisory Board. CASC now has 24 industry sponsors (with waiting list); fee raised from $15,000 to $20,000 annually. Participants reportedly are satisfied with results to date, though most of current activity focuses on sealants and adhesives.

The Federation report was given by Roy and me. I advised of the new FSCT officers for 1985-86, detailed the evolution of PRI to the Coatings Industry Education Fund, and provided an overview on the plans of the Professional Development Committee. The interest expressed by the representatives of the Forest Products Laboratory and several forest products firms in reactivating liaison with the coatings industry was also discussed as well as the Federation's interest in developing such a program.

Roy presented an update on the work being done by the Societies on the testing of the paints produced from the PCP polymer developed by the PRI-sponsored Mildew Consortium, and also discussed the Proficiency Testing Program and the Spring Seminar on Special Purpose Coatings.

An entire morning was devoted to discussions of regulatory matters; including presentations by Dr. F.B. Thomas, of Shell Chemical (Toxicity Issues Related to Solvents and Other Coatings Materials) and Dr. L.S. Spurlock, of Chemical Manufacturers' Association (Review of CMA's Special Programs), along with update reports by various NPCA staffers. Major focus was on impending first-phase deadline (November 25) for complying with OSHA requirements for labeling containers of hazardous substances and distributing Material Safety Data Sheets to customers.

At a luncheon, hosted by NPCA, Roy was presented with a plaque, honoring him for his many years of service to the Scientific Committee while a member of the NPCA staff.

NPCA Executive Director Larry Thomas spoke briefly, providing some general comments about NPCA activities, including trying to do a better job in government relations at the state and local level, and in working more closely with EPA, OSHA, and other federal agencies re pending regulatory considerations. Also, NPCA will attempt to develop a strong communications effort for dealing with the media, along with pursuing consumer education on health hazards in dealing with paint products.

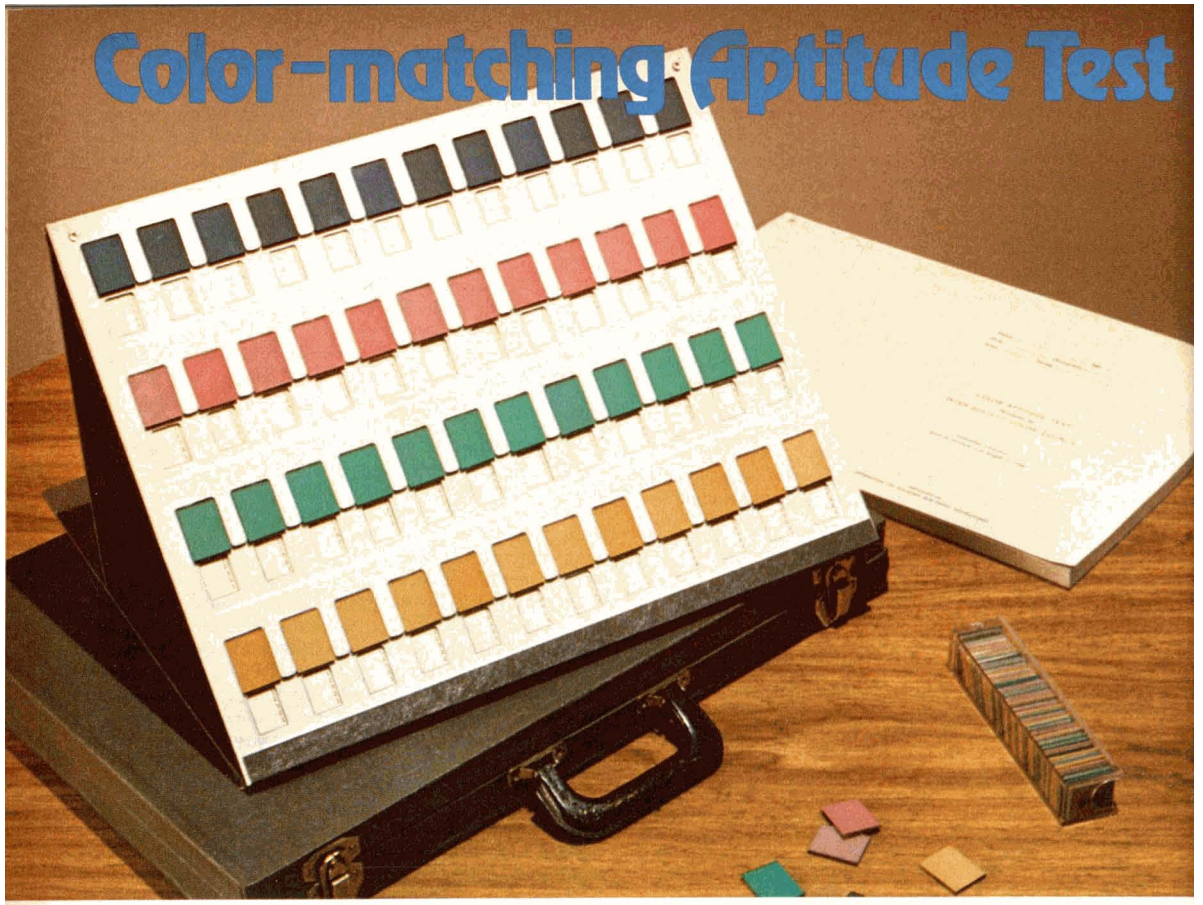
This was the final meeting chaired by Len Afremow, of Midland Div., Dexter Corp. He will be succeeded as Chairman by Wally Krason, of The Enterprise Cos.

SAUL SPINDEL,
Delegate–Scientific Committee

NEXT MEETING

The next meeting of the Federation Board of Directors will be held on Tuesday, November 4, 1986, 9:00 a.m., at the Marriott Marquis Hotel in Atlanta, GA.

Color-matching Aptitude Test



Color-matching Aptitude Test Set was created by the Inter-Society Color Council and sponsored by the Federation. It is in world-wide use as a means for estimating color-matching skill. The 1978 edition contains minor refinements over the previous editions (1944, 1953, 1964), and these bring it closer to the original ISCC plan, making it a still more successful tool for evaluating color-matching skill.

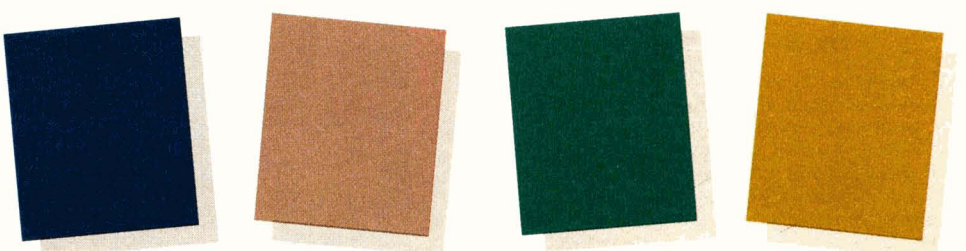
The basic aim of the Test is to provide an objective measure that will aid in determining an individual's ability for performing color-matching tasks accurately. Changes in a person's color-matching skill may occur over a period of time, improving due to training, experience, and motivation, or lessening when removed from practice, or as a result of health disorders. Retesting at regular intervals will provide an indication of any such changes in an individual's ability.

The Test is not designed to indicate or measure "color-blindness" (anomalous color vision). Special tests designed for this purpose should be used.

The Color-matching Aptitude Test Set consists of a carrying case, an easel on which are mounted 48 color chips, a dispenser which holds 48 matching chips, score sheets, and a scoring key.

Brochure available upon request. Price: $400.

Orders must be prepaid. U.S. and Canada—Add $10.00 shipping. All others—Add $50.00 shipping.



Federation of Societies for Coatings Technology
1315 Walnut Street, Suite 830, Philadelphia, Pa. 19107 (215) 545-1506

Correlation of Results From 'Color-matching Aptitude Test' Scores

Birmingham Paint, Varnish and Lacquer Club
Technical Committee

Data from tests performed by several organizations using the 1978 version of the Color-matching Aptitude Test Set were collated and compared with similarly collected data for the 1964 version of the test. Small but significant differences in the mean individual color row scores were noted between the versions, although the total scores in each case gave a normal Gaussian distribution. This enables a revised interpretation of scores to be drawn up for the 1978 test version. An age-dependence for mean scores was also observed, with the best mean scores being achieved by examinees in the 25-29 age group.

INTRODUCTION

In 1979, the Birmingham Paint Varnish and Lacquer Club (BPVLC) set up an agency for the sale in the United Kingdom of publications of the Federation of Societies for Coatings Technology (FSCT). Being the only Federation constituent body located outside continental North America, the BPVLC was uniquely situated to encourage sales of the many FSCT educational and vocational productions. Among these items was the well-established Color-matching Aptitude Test (CAT) in its most recent, 1978, edition. Within a relatively short time, the Club sold nine of these sets in the U.K., both within and outside the paint industry.

Members of the Club's Technical Committee realized that potentially they were in a very favorable position to undertake a study of correlation with this test series. A subcommittee therefore was established with the objective of attempting to make a cooperative study of test results, and establishing means, etc. Sufficient interest and data were made available to enable this project to be pursued. For convenience, this subcommittee was titled CATSUB.

Subsequently, it was established that a similar investigation in North America had been shelved after some initial work because of the difficulties of obtaining a sufficient number of test results. What work had been done did suggest that minor, but significant, variations in scores were being obtained with the 1978 Test Set in comparison with the 1964 Set. This data was made available to the Birmingham group.

HISTORY OF CAT

The Color-matching Aptitude Test has a well-documented history. In 1940, the Inter-Society Color Council (ISCC) realized that a test was needed to provide an objective measure to aid in the determination of an individual's ability to perform color matching tests accurately, and an experimental version of the test was produced in 1944.

This proved to be successful and, with financial support from the FSCT, a second edition was released in 1953 and a third edition in 1964. Because of continuing sales, and the exhaustion of the stocks of the colored chips used in the set, it became necessary to prepare a fourth edition of the test, which was released in 1978. The ISCC claims that this edition "incorporates only minor refinements which bring it closer to the original plan and should make it a still more successful test for evaluating color-matching skill." It is to be noted that the test name was changed from Color Aptitude Test to Color-matching Aptitude Test for this 1978 edition.

There have been many papers explaining the use of the test. In the early years, several papers by Dimmick [1-3] are notable, since he was the prime mover in the development of the test. The use of the test in the United King-

Presented at the Annual Meeting of the Federation of Societies for Coatings Technology, in St. Louis, MO, on October 8, 1985.

Table 1—1978 Test Data Total Scores

Source	No. of Examinees M	F	Mean Scores B	R	G	Y	Total
U.K. 1	29	29	19.07	16.29	14.53	18.71	68.60
U.K. 2	13	0	19.08	17.31	16.92	22.85	76.15
U.K. 3	32	7	19.69	16.97	13.64	18.59	68.90
U.K. 4	13	3	19.38	20.31	16.12	21.31	77.13
U.K. 5	9	2	21.09	20.18	15.00	22.35	78.82
U.K. 6	32	1	19.12	15.82	15.94	21.09	71.97
Total U.K.	128	42	19.38	17.06	14.96	19.95	71.36
U.S.	39	10	20.18	16.43	16.16	20.12	72.90
Total U.K.+U.S.	167	52	19.56	16.92	15.23	19.99	71.71

dom was described by Hess,[4] Tilleard,[5] and Adams.[6] It would appear that there has been little, if any, published work recently, so the present investigation perhaps is of value in bringing the test to the notice of a new generation of colorists. Although instrumental techniques have advanced both in accuracy and in speed of working over the 40-year life span of CAT, visual color assessments are still important in commercial and industrial life, and the continuing sale of CAT confirms that it is still desirable to make assessments of visual skills.

DESCRIPTION OF THE TEST

The test set comprises an easel with 48 fixed color chips, a dispenser with 48 corresponding loose chips, together with scoring sheets, a scoring chart, and a carrying case. When erected, the easel stands at 45° to the horizontal. The 48 chips are arranged in four color rows, and within each row the chips differ from one another by small saturation steps, with the lightness (Munsell Value) and hue being kept constant. In the 1978 Test Set, the hues are approximately Munsell 10B, 7.5RP, 5BG and 2.5Y. For convenience, these hues are described as Blue, Red, Green, and Yellow, respectively. The Munsell Values, although constant for each color series, are situated between 2.8 and 4.6. (The data advised with the set is not correct on these points for the current edition.) Within each color row, the saturation range between the extremes is approximately two Munsell chroma steps, and the

Table 3—Analysis of Color Row Scores, 1978

	B	R	G	Y
29	—	1	—	1
28	4	0	—	4
27	2	1	—	8
26	6	4	—	5
25	8	4	0	11
24	12	3	2	19
23	21	3	4	18
22	14	19	4	19
21	16	12	16	20
20	24	13	13	14
19	33	18	12	19
18	17	26	17	19
17	16	18	13	22
16	13	22	26	8
15	12	15	15	9
14	10	13	21	7
13	6	9	23	4
12	1	9	19	8
11	4	11	5	2
10	0	10	10	2
9	0	1	6	0
8	0	3	8	0
7	0	0	0	0
6	0	2	2	0
5	0	1	2	0
4	0	1	0	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	1	0
Mean	19.56	16.92	15.23	19.99
Variance	13.59	19.52	17.06	16.96
S.D.	3.69	4.42	4.13	4.12

Table 2—1978 Data, Histogram of Total Scores

Score Range	U.K. 1	U.K. 2	U.K. 3	U.K. 4	U.K. 5	U.K. 6	All U.K.	U.S.	Total
105-111	—	—	—	—	—	—	—	—	
100-4	—	—	—	—	1	—	1	—	1
95-9	—	—	—	1	—	—	1	2	3
90-4	1	—	—	2	1	—	4	2	6
85-9	4	2	1	2	2	3	14	3	17
80-4	2	5	3	2	3	6	21	8	29
75-9	6	2	10	2	—	3	23	4	27
70-4	15	1	6	2	1	9	34	13	47
65-9	12	1	6	4	1	4	28	6	34
60-4	8	1	6	—	1	5	21	6	27
55-9	6	1	4	—	1	3	15	3	18
50-4	3	—	2	1	—	—	6	1	7
45-9	—	—	—	—	—	—	0	1	1
40-4	—	—	1	—	—	—	1	—	1
35-9	—	—	—	—	—	—	0	—	0
30-4	1	—	—	—	—	—	1	—	1
25-9	—	—	—	—	—	—	0	—	0
Below 25	—	—	—	—	—	—	0	—	0
Mean	68.60	76.15	68.90	77.13	78.82	71.97	71.36	72.90	71.71
Variance	106.92	87.51	88.50	146.61	150.51	78.15	114.73	116.05	115.43
S.D.	10.34	9.35	9.41	12.11	12.27	8.84	10.71	10.77	10.74

Table 4—1964 Test Data

Source	No. of Examinees M	F	Scores (Mean) B	R	G	Y	Total
U.S.	39	10	17.57	18.61	17.84	16.94	70.96
U.K. 3	18	0	21.06	18.83	15.67	16.89	72.44
U.K. 7	46	0	22.20	20.26	18.52	18.30	79.28
Total	103	10	20.01	19.32	17.77	17.49	74.58

Table 5—1964 Test Data, Histogram of Total Scores

Score Range	U.S.	U.K. 3	U.K. 7	Total
105-111	—	—	—	0
100-4	1	—	—	1
95-9	1	1	—	2
90-4	1	1	5	7
85-9	3	1	10	14
80-4	5	2	9	16
75-9	8	1	7	16
70-4	11	4	10	25
65-9	7	4	3	14
60-4	3	2	1	6
55-9	4	1	—	5
50-4	2	1	1	4
45-9	1	—	—	1
40-4	—	—	—	0
35-9	1	—	—	1
30-4	1	—	—	1
25-9	—	—	—	0
Below 25	—	—	—	0
Mean	70.96	72.44	79.28	74.58
Variance	189.14	131.80	78.72	150.47
S.D.	13.75	11.48	8.87	12.27

Table 6—Analysis of Color Row Scores, 1964

	B	R	G	Y
29	—	0	—	0
28	4	0	—	0
27	4	2	—	1
26	5	3	—(1)	2
25	5	2	4	3
24	7	8	2	1
23	10	5	7	7
22	12	15	5	5
21	15	7	7	6
20	9	16	10	13
19	8	16	15	12
18	6	7	15	8
17	5	12	13	10
16	3	1	9	9
15	1	6	5	12
14	5	3	5	4
13	3	4	2	5
12	7	2	3	5
11	0	2	3	1
10	0	1	2	6
9	0	0	2	1
8	1	0	1	1
7	2	1	0	0
6	1	0	1	1
5	0	0	0	0
4	0	0	1	0
3	0	0	0	0
2	0	0	0	0
1	0	0	0	0
0	0	0	0	0
Mean	20.01	19.32	17.77	17.49
Variance	23.23	14.38	16.89	17.84
S.D.	4.82	3.79	4.11	4.22

mean chroma difference step is of the order 0.12 Munsell units of chroma for the scoring chips.

It is important to note that although the CIE chromaticities for the red and green rows lie nearly parallel to protan and deutan confusion lines, CAT cannot be used to diagnose color deficiency. It is recommended that a pseudo-isochromatic plate test for color deficiency be used for this purpose since this is accomplished in less than five minutes and, in most cases, is reliably conclusive.

The chips in each row are separated by a one-half inch gray background; they are not arranged in order of saturation but in such a manner that there is a perceptible difference between adjacent chips. When arranged in correct saturation sequences, the differences can be observed as quite small, so even an experienced colorist will be unlikely to achieve a perfect score when taking the test.

The examinee's task is to take loose chips one at a time from the dispenser and decide which of the easel chips it

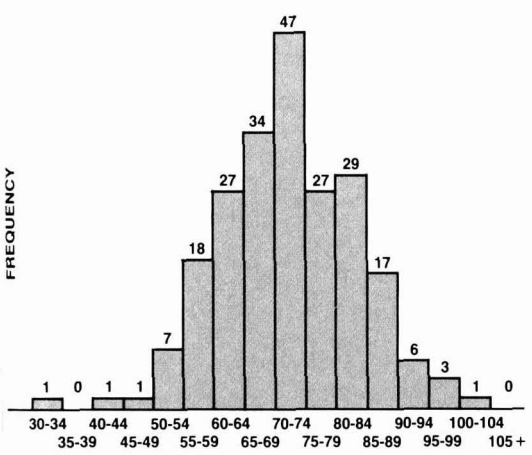


Figure 1—1978 data: total scores frequency histogram

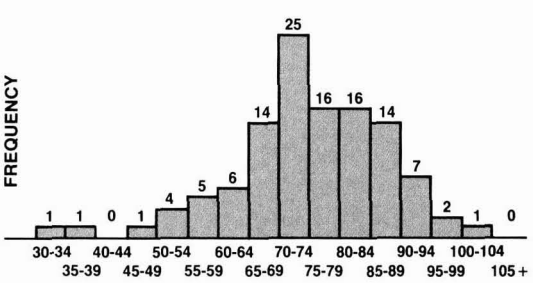


Figure 2—1964 data: total scores frequency histogram

Table 7—1978 Test Data, Age Analysis

Age Range	Sample	Scores B	R	G	Y	Total
MALE						
Under 20	23	18.78	15.13	13.05	19.91	66.87
20-4	43	19.45	16.24	14.47	20.70	70.84
25-9	24	20.54	17.42	17.46	21.29	76.75
30-4	31	20.20	17.29	16.10	20.62	74.19
35-9	22	20.32	17.68	15.45	19.68	73.13
40-9	13	18.38	17.77	16.23	18.92	71.31
50-9	10	18.50	15.90	14.70	17.30	66.40
FEMALE						
Under 20	9	17.44	15.33	13.78	19.67	67.22
20-4	11	21.45	17.73	15.09	19.91	74.19
25-9	12	19.09	17.25	15.49	19.76	71.58
30-4	2	18.00	17.50	16.00	21.50	73.00
35-9	1	20.00	14.00	15.00	17.00	66.00
40-9	6	18.50	20.67	14.83	16.33	70.33
50-9	11	18.64	17.82	15.45	19.00	70.91
COMBINED						
Under 20	32	18.68	15.19	13.26	19.84	66.97
20-4	54	19.86	16.54	14.60	20.54	71.52
25-9	36	20.06	17.36	16.80	20.78	75.03
30-4	33	20.07	17.30	16.09	20.67	74.12
35-9	23	20.31	17.52	15.43	19.56	72.82
40-9	19	18.42	18.68	15.79	18.10	71.00
50-9	21	18.57	16.91	15.09	18.19	68.76

Table 8—1964 Test Data, Age Analysis

Age Range	Sample	Scores B	R	G	Y	Total
MALE						
Under 20	20	21.15	19.25	17.10	16.70	74.25
20-4	23	21.08	19.26	19.44	18.69	78.52
25-9	11	22.09	19.73	18.09	19.82	79.72
30-4	19	18.53	18.53	15.53	15.58	68.16
35-9	12	19.91	20.33	18.67	18.92	77.84
40-9	12	18.50	20.00	18.83	17.59	74.91
50-9	4	17.25	18.50	17.50	13.25	66.50
COMBINED MALE & FEMALE						
Under 20	21	20.71	19.43	17.14	16.81	74.14
20-4	26	21.19	18.92	19.35	18.42	77.88
25-9	12	21.67	19.50	18.17	19.50	78.83
30-4	19	18.53	18.53	15.53	15.58	68.16
35-9	13	20.15	20.61	18.85	19.23	78.85
40-9	13	18.46	19.46	18.61	17.39	73.92
50-9	7	16.14	19.57	17.00	14.57	67.29

most closely matches. The loose chip number (indicated on its reverse) is written on the scoring sheet below the easel chip chosen and the chip returned to the dispenser. Each chip is treated similarly.

In practice, most examinees find three or perhaps four chips in each easel row that are reasonably near to each loose chip. These chips are physically separated from one another by other easel chips which are more or less clearly different from the loose chip being matched. The examinee needs to be able to make a decision between the three or four options, only one of which is correct.

Of the 48 chips in the set, the first eight are to accustom the examinee to the test and are not included in the score.

The remaining 40 chips (ten in each color row) score broadly in the following way:

For correct matching	3
For matching one saturation step below or above correct	2
For matching two saturation steps below or above correct	1
For matching more than two saturation steps away from correct	0

However, the scoring is not the same for all the matches, presumably because the color difference steps are not equal throughout the series, and lower scores are awarded where the differences are larger.[5]

Thus, instead of a maximum possible score of 120 (four rows each scoring 30), the actual maximum scores are Blue-28, Red-29, Green-25, Yellow-29, and Total-111.

The scoring in fact was based on placements made by examinees in earlier test editions, using statistical methods to assess ease or difficulty of making matches with each loose chip and weighting the scoring accordingly. A

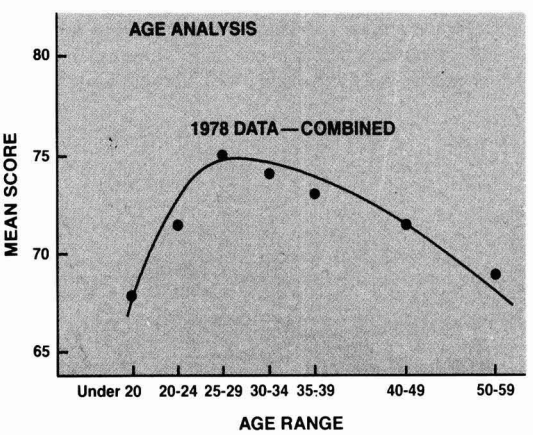


Figure 3—1978 data: age analysis of combined male and female scores

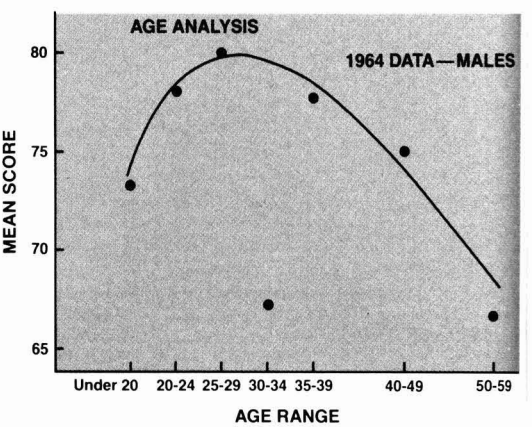


Figure 4—1964 data: age analysis of male scores only

different pattern of possible maximum scores is achievable in the 1964 and 1978 editions when compared with the two earlier editions: It is to be regretted that each row score maximum is not equivalent.

Since the test is ordered in a very precise way, one advantage is that all examinees make their assessments in the same sequence, which should lead to the possibility of comparing results made by different examinees at different times. Attention needs to be given to use of correct lighting, both to achieve proper levels and quality of light and to avoid specular reflection of the light source. Test instructions give advice on these points.

Most candidates take between 30 minutes and one hour to complete the test, but some individuals take widely different times. Provided that an examinee has high motivation to achieve a good score, length of time taken on the test does not seem to correlate with the level of score obtained.

TEST DATA CORRELATION

For the purposes of the work of CATSUB, a questionnaire score sheet was devised for respondents to show the following details:

(1) Individual identification (by number only);
(2) Age;
(3) Sex;
(4) Row scores:
    Blue
    Red
    Green
    Yellow
    Total;
(5) Time taken for chips 9-48; and
(6) Experience levels—No Experience/Some Experience/Experienced.

In some cases, certain items of information were not available, but for all cases where row scores were given, the data was included in the survey.

In addition, the respondent was asked to give details on the lighting and other conditions used in the test, whether any other tests were used to assess color vision defects or color matching ability, and whether any of their individual examinees were known to be color vision defectives.

Initially, information was sought from the nine companies who purchased 1978 CAT Sets through the BPVLC up to the summer of 1981. Although all initially agreed to cooperate, only six companies supplied data. Subsequently, through the good offices of Mrs. Ruth Johnston-Feller, data from about 50 individuals' tests made in the U.S. were obtained. The group of individuals had each performed the test on both a 1978 and 1964 edition of CAT. Later still, CATSUB was able to obtain a further group of about 60 test scores made by two Birmingham companies using one 1964 CAT Set.

In total, there were 219 test scores available from 1978 Test Sets and 113 scores from 1964 Test Sets. These were made by individuals having a wide spread of age, experience, and background.

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To deal with the information collected, a computer program was devised to sort and process the data.

SUMMARY OF RESULTS

Results are outlined in *Tables* 1-12. *Table* 1 outlines the mean scores achieved in each of the groups of respondent sets, together with the overall means. (See also *Figure* 1.) *Table* 2 shows a histogram analysis of total scores for each group, together with totals, while *Table* 3 shows a histogram analysis of all the 1978 scores in individual colors. For *Tables* 2 and 3, the appropriate means, variance, and standard deviations are noted.

Tables 4-6 show the parallel analysis for the 1964 data. (See also *Figure* 2.) *Table* 7 shows an age analysis for the 1978 test data for males, females, and both combined, while *Table* 8 gives an age analysis for the 1964 test data. In this case, only male and combined data is presented due to the small number of female examinees. Combined data from the 1978 test is presented in *Figure* 3 and data for males alone from the 1964 test is shown in *Figure* 4.

Analysis by experience level was also made, but no significant trends could be detected.

Since some of the examinees in each test series were reported as color defectives as determined by another test, the individual and group scores for these tests are shown in detail in *Table* 9. The group data for each test set was analyzed, as shown in *Tables* 10 and 11. Here the data for females, color-normal males, and color-defective males is compared.

Table 9—Scores of Individual Reported Color Defectives

		1978 DATA			
Examinee	B	R	G	Y	Total
1	19	6	5	25	55
2	15	9	5	23	52
3	16	11	10	27	64
4	24	13	8	21	66
5	13	11	14	21	59
6	17	16	23	20	76
7	23	5	8	29	65
8	20	8	0	23	51
Total Means	18.38	9.88	9.12	23.63	61.00

		1964 DATA			
Examinee	B	R	G	Y	Total
9	12	11	11	16	50
10	18	12	17	15	62
11	23	17	12	22	74
12	23	20	6	15	64
13	21	20	14	16	71
14	28	18	9	12	67
15	19	15	10	19	63
Total Means	20.57	16.14	11.29	16.43	64.43

Table 12 was constructed from the 1978 data to show the score contribution by color row for various divisions of the examinees (by sex, and by highest and lowest octile groups) for comparison with the color defective group.

DISCUSSION OF RESULTS

Comparison of *Table* 1 and 4 shows that the overall mean score achieved with the 1978 data was slightly lower than that achieved with the 1964 test data.

Within each table, the contribution to the overall score by each color row score from each source calculated as a percentage of the appropriate mean total is fairly consistent. However, when comparing the make-up of scores by color row achieved with the two sets, significantly different proportions are seen. For the overall totals in each case, the figures are as follows:

	B	R	G	Y	Totals
1978 Mean Scores	19.56	16.92	15.23	19.99	71.71
% of Mean Total	27.3	23.6	21.2	27.9	(100)
% of Maximum Possible	69.9	58.3	60.9	68.9	64.6
	B	**R**	**G**	**Y**	**Totals**
1964 Mean Scores	20.01	19.32	17.77	17.49	74.58
% of Mean Total	26.8	25.9	23.9	23.5	(100)
% of Maximum Possible	71.5	66.6	71.1	60.3	67.2

In the case of the U.S. group data for each test set, the color row contributions to the mean group score for each of the test sets is very similar to those shown above, viz:

	B	R	G	Y	Totals
U.S. group, 1978 Set % of Mean Score	27.7	22.5	22.2	27.6	(100)
U.S. group, 1964 Set % of Mean Score	24.8	26.2	25.1	23.9	(100)

It should be re-emphasized that these results are for the same examinees taking each test within a few days, with some taking the older test first, others the newer test first, on a purely random basis. The correlation between mean color row scores for the two editions of the test is not good for the red, green, and yellow rows. However, for overall mean scores the variations are much smaller, and well within the range of expected re-test variations.

Nonetheless, on average, an examinee could expect to achieve significantly poorer red and green row scores, and significantly better yellow row scores on the 1978 Test Set.

In *Tables* 2 and 5, it can be seen that the results for overall scores fall into essentially Gaussian distribution.

By using tables of areas of the normal probability curve in the case of the two sets of data, the following table may be constructed.

Total Scores	1978 Probability (%)	Actual (%)
Over 93	2.5	2.3
84-93	14.1	12.3
77-83	16.7	15.5
67-76	33.3	38.8
61-66	16.7	17.4
51-60	14.1	11.9
Under 51	2.5	1.8
Total Scores	**1964 Probability (%)**	**Actual (%)**
Over 100	2.5	1.8
88-99	14.1	14.2
80-87	16.7	19.5
70-79	33.3	36.3
62-69	16.7	16.8
50-61	14.1	8.8
Under 50	2.5	2.7

These can each be seen as good fits to the theoretical distribution on a purely probability/score basis, and may be used as a guide to score ratings for examinees as outlined in our recommendations (discussed later).

The most interesting results are those shown in *Tables* 7 and 8 where the examinees score is analyzed by age.

It is clear that the scores of the examinees in the youngest and oldest categories are lower than for those in the middle age ranges, the highest mean scores being achieved by the examinees in the 25-29 age band. This effect is most clearly shown in the 1978 data, where more results were available, but are essentially replicated for the 1964 data, with higher mean scores, and peaking at the same age group. There is an anomalous mean for the 30-34 range for this set. This particular group of 19 males includes two reported color defectives, and, in addition, includes three examinees from the U.S. group whose score on the 1964 test was very much poorer than they achieved on the 1978 test, suggesting that their results are not reliable. If these five tests are discounted, the mean for the remaining 14 individuals is 74.7, which is still lower than the curve drawn, but more acceptable.

These results confirm the findings of Gilbert[7] and contradict statements by Dimmick.[3]

The remaining tables were drawn up to illustrate the differences between the group scores for normal and de-

Table 10—1978 Test Data, Total Scores

Group	No. of Examinees M	F	Mean Scores B	R	G	Y	Total
All males	167	—	19.65	16.75	15.30	20.23	71.92
Reported Color-defectives	8	—	18.38	9.88	9.12	23.63	61.00
"Normal" males	159	—	19.72	17.09	15.61	20.06	72.47
Females	—	52	19.29	17.48	15.04	19.23	71.04
Color normal males + females	159	52	19.61	17.18	15.47	19.86	72.12
All tests	167	52	19.56	16.92	15.23	19.99	71.71

Table 11—1964 Test Data, Total Scores

Group	No. of Examinees M	F	Mean Scores B	R	G	Y	Total
All males	103	—	20.20	19.35	17.76	17.52	74.83
Reported Color-defectives	7	—	20.57	16.14	11.29	16.43	64.43
"Normal" males	96	—	20.17	19.58	18.23	17.60	75.58
Females	—	10	18.00	18.90	17.90	17.10	71.90
Color normal males + females	96	10	19.96	19.52	18.20	17.56	75.24
All tests	103	10	20.01	19.31	17.77	17.49	74.57

Table 12—1978 Test Data, Score Profiles

Group	% Contribution to Total Score B	R	G	Y	Actual Group Mean Total Score
All correct score	25.2	26.1	22.5	26.1	111
All females	27.2	24.6	21.2	27.1	71.0
Males, color normal	27.2	23.6	21.5	27.7	72.5
Females—top octile	25.9	25.6	21.9	26.6	87.6
Females—last octile	25.2	24.4	21.8	28.6	54.4
Males, color normal					
Top octile	26.6	24.1	21.9	27.3	90.2
Last octile	28.5	23.5	21.3	26.8	54.9
Males, color defective	30.1	16.2	15.0	38.7	61.0

fective color vision examinees. Note, however, that only examinees reported to us as color defectives are so grouped—it is possible that a small number of undetected or unreported color defectives are retained within our "normal" groups.

Table 9 gives the score details for all of the color defectives reported to us, for each of the two test sets. Note that as in Adams' table,[6] while the group has a low red and green score mean, some individuals score quite well in these rows. Since nearly 25% of normal observers, both male and female, show as individuals, low scores for red or for green, occasionally for both, this further illustrates the inability of CAT to diagnose individuals as color defectives.

Table 10 compares mean score data for various groups from the 1978 data. The contrast between our color defectives (all of whom are male) on the one hand, and the color normal males and females on the other hand is clear. Note that the exclusion of the color defective data increases the normal group mean by 0.41 score units only.

Table 11 gives the parallel 1964 data, and although the detail is different, the consistency of the normal observer groups in contrast to the color defectives is again illustrated. Here the effect on the mean by excluding the color defectives is higher at 0.67 score units but this is due to the small proportion of female tests in this group.

Table 12 lists what we have termed "score profiles" for various sub-groups of the 1978 data. Here the contribution of each color row, expressed as a percentage, to the total mean score for each group is shown. The groups shown are, in addition to the color defectives, all color normal males, all females, and the latter two groups subdivided into eight scoring ranges or octiles—the highest and lowest octile in each group being detailed as typical of the general uniformity of profile. The color defectives group profile is entirely different.

CONCLUSIONS

From this study of scores from CAT tests, the broad findings of earlier workers with the earlier versions of the test are confirmed. The overall mean score is in the low seventies, and represents approximately two/thirds of the maximum possible. The range of scores is essentially Gaussian, with no scores being perfect, and none as low as would be achieved by purely random placement, which can be calculated as around 26.

These results show that, on average, those examinees in the youngest and oldest categories score less well than those in the 25-29 age group.

Because of the different mean scores achieved in three of the four color rows by the groups of examinees in the two test versions considered, it is unwise to compare in detail results from different versions of CAT.

RECOMMENDATIONS

From the statistical analysis of the total scores for the 1978 tests, it is possible to construct a revised score rating for this edition of the test to help in categorizing of examinees. However, the age-effect should also be considered.

The following interpretation of scores for the 1978 Set is recommended to replace the statement given with the test instructions:

Score Range	Comment	Statistical Population
Under 51	Very Poor	2.5%
51-60	Poor	14.1%
61-66	Fair	16.7%
67-76	Average	33.3%
77-83	Good	16.7%
84-93	Excellent	14.1%
94 and over	Outstanding	2.5%

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This project could not have been undertaken without the cooperation of the following organizations who supplied test records, and to whom the thanks of this subcommittee are expressed: The Boots Company Ltd.; Carrs Paints Ltd.; Croda Paints Ltd.; Holden Surface Coatings Ltd.; Newtown Industrial Finishes Ltd.; Postans Ltd.; and Team Management Appointments Ltd.

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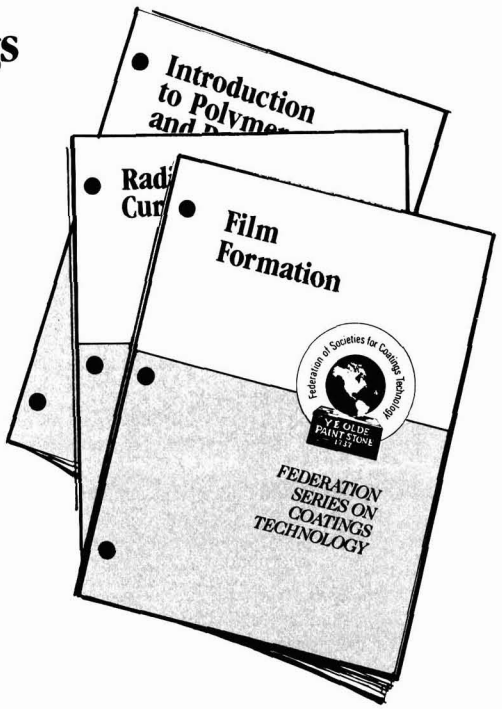

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Polyester Resin Synthesis Techniques For Achieving Lower VOC And Improved Coating Performance

J.D. Hood, W.W. Blount, and W.T. Sade
Eastman Chemical Products, Inc.*

For the past several years, the coatings industry has faced the challenge of increased regulation of solvent emissions. Lowering the molecular weight of the polyester resin appears to be a feasible approach to higher-solids coatings. However, studies have shown there is an optimum point in lowering the molecular weight below which the VOC of the enamel actually increases. Typically, one-stage resin cooks are employed, leading to high levels of unreacted monomers and oligomers which are volatilized during VOC determinations.[1] Selectively staging the addition of the polyol to minimize the formation of unwanted products is an important key to quality systems for higher-solids enamels with good physical properties.

INTRODUCTION

The coatings industry is striving to comply with federal, state, and local regulations to minimize air pollution. These regulatory pressures have challenged the coatings chemist to make rapid technology changes characterized by higher solids and lower volatile organic content (VOC) coatings.

The high molecular weight resins that gave such good performance in yesterday's conventional polyester systems require too much solvent for today's low VOC standards, and the systems we call high solids today will not meet tomorrow's demanding VOC requirements.

High-solids coatings are generally defined as having nonvolatiles of approximately 80 wt % or a VOC of 2.8 lbs/gal or less. The high molecular weight polyester resins used in conventional low-solids systems generally cannot be used in high-solids enamels. Using less solvent to increase solids and lower the VOC results in extremely high viscosity solutions with these conventional resin systems. A low viscosity enamel solution is essential for good atomization, leveling, and flowout of the coating.

The use of hot spray techniques, reactive diluents, and solvent optimization, plus the development of high-speed bells and discs have helped to lower VOC, but still leave something to be desired.

At the 1981 Water-Borne and Higher-Solids Coatings Symposium,[2] Stephen Belote discussed the reduction in the molecular weight of polyester resins as a means of achieving higher solids. He noted, however, that a point of diminishing return exists beyond which further reduction in the molecular weight actually causes a decrease in solids. Studies have shown that the levels of unreacted monomers and oligomers increase as the polyester molecular weight decreases using conventional synthesis techniques. These monomers and oligomers are volatilized during baking of the enamel, thus adversely affecting both determined solids and VOC. This earlier work showed that an optimum molecular weight exists for a polyester to give the lowest VOC for the coating.

The work presented here describes a synthesis technique that produces polyester resins with a more optimum molecular weight distribution for high solids/low VOC coatings.

Laboratory work has demonstrated that staging the addition of the polyol during resin synthesis can minimize the presence of unwanted products—both high- and low-molecular-weight fractions—present in the finished resin.

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Table 1—TMPD Glycol-Based Resins

	Equivalents		
	Resin 1 (Control)	Resin 2 (2-Stage TMP)	Resin 3 (Lower MW 2-Stage TMP)
1st Stage			
TMPD glycol	11.96	11.96	12.24
Trimethylolpropane	1.72	0.86	0.88
Isophthalic acid	4.56	4.56	4.38
Adipic acid	4.56	4.56	4.38
2nd Stage			
Trimethylolpropane	—	0.86	0.88

Resins were cooked to an acid number of 10 ± 1.

THEORY

The typical synthesis of polyester coatings resins is a one-stage process where all of the reactants are added during the initial reactor charge. This conventional technique results in a broad molecular-weight distribution which includes both high- and low-molecular-weight fractions. The high-molecular-weight resin fractions raise the viscosity, thereby limiting enamel solids. The low-molecular-weight fractions are detrimental to both coating performance and enamel solids or VOC due to volatilization during cure.[3] The resin fraction that is volatilized is not as effective as solvents at reducing viscosity, yet has to be considered volatile under EPA guidelines.

To maximize solids and performance, it is desirable to eliminate both the high and low fractions from the molecular weight distribution of the resin. No doubt, resin chemists could offer many theories as to the preferential reactions that might occur which are influenced by the polymer stoichiometry. It is apparent that multiple staging the addition of some of the reactants will alter the stoichiometry at different points during synthesis as compared to the standard one-stage technique.

When a triol branching monomer, such as trimethylolpropane (TMP), is used in a resin, the probability is high that a significant level of "tetrol" will be formed if it is all added in the initial charge. A tetrol is two moles of TMP with one mole of diacid. This formation of tetrol has a significant effect on the stoichiometric balance of reactants.

Using the tetrol as a reactant in resin calculations, the weight average values, according to the W.H. Stockmayer equations,[4] are greatly increased and show premature gelation. It was theorized from a statistical approach that addition staging of the TMP branching monomer would minimize the tetrol formation and possibly other high- and low-molecular-weight fractions.

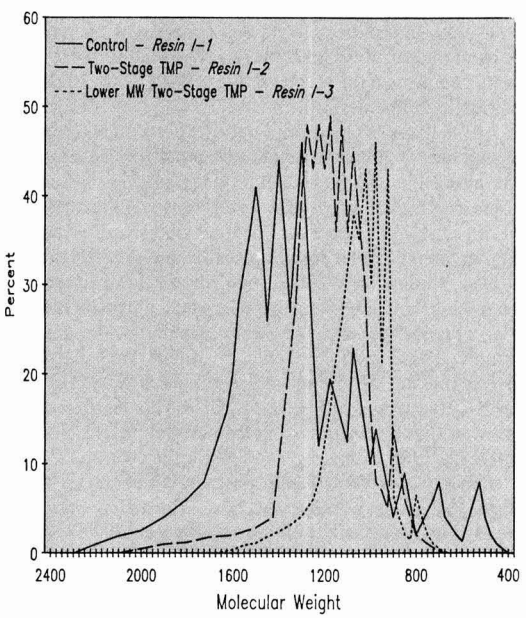

Figure 1—Molecular weight distribution of TMPD glycol-based resins

EXPERIMENTAL

Several types of polyester resins were studied during this detailed laboratory evaluation. Two were selected for the purpose of this report, one based on 2,2,4-trimethyl-1,3-pentanediol (TMPD® glycol) and one on 2,2-dimethyl-1,3-propanediol (NPG® glycol). Both resins utilized trimethylolpropane (TMP) as the branching monomer.

A TMPD glycol-based resin is normally a one-stage cook. All reactants are added initially, followed by nitrogen purge and up-heat to a maximum temperature of 210°C at the end of the synthesis reaction. This is the control resin, Resin 1, in *Table* 1. Resin 2 in *Table* 1 shows the TMP added in two stages (one-half in the first stage and one-half in the second stage), while Resin 3 is a lower-calculated molecular weight resin also two-staging the TMP. In both Resin 2 and Resin 3, the second stage of TMP was added after approximately 50% of the theoretical condensate was collected.

The second resin used in this study is based on NPG glycol. This resin is a two-stage cook because of the dimethyl 1,4-cyclohexane-dicarboxylate (DMCD) and isophthalic acid combination used. To insure a high de-

TMPD and NPG are registered tradenames of Eastman Kodak Co.

Table 2—NPG Glycol-Based Resins

	Equivalents		
	Resin 1 (Control)	Resin 2 (2-Stage TMP)	Resin 3 (Lower MW 2-Stage TMP)
1st Stage			
NPG glycol	25.13	25.13	29.35
Trimethylolpropane	6.65	3.325	1.2
DMCD[a]	10.46	10.46	10.25
2nd Stage			
Isophthalic acid	10.46	10.46	10.25
Trimethylolpropane	—	3.325	1.2

Resins were cooked to an acid number of 10 ± 1.

(a) Dimethyl 1,4-cyclohexanedicarboxylate is a product of Eastman Chemical Products, Inc.

Table 3—Enamels from TMPD Glycol-Based Resins (Calculated Values)

Ingredients	Parts by Weight		
Resin I-1 (85%) in xylene	436.3	—	—
Resin I-2 (85%) in xylene	—	447.1	—
Resin I-3 (85%) in xylene	—	—	454.7
"Cymel" 303 Resin[a]	159.4	163.4	166.2
TiO_2	353.2	362.0	368.1
PTSA catalyst	4.4	4.5	4.6
FC-430 additive[b]	5.5	5.7	5.8
Methyl amyl ketone	110.7	96.5	86.5
Ektapro™ EEP solvent[c]	22.1	22.7	23.1
n-Butanol	22.1	22.7	23.1
	1113.7	1124.5	1132.0
Weight % solids	76.0	77.1	77.9
Volume % solids	61.6	63.2	64.2
Enamel density, lb/gal	11.14	11.25	11.32
VOC, lb volatile/gal paint minus H_2O	2.67	2.57	2.50
VOC, lb volatile/gal solids	4.34	4.07	3.89
Pigment/binder	40/60	40/60	40/60
Polyester/crosslinker	70/30	70/30	70/30
% PTSA catalyst × binder	0.33	0.33	0.33
% FC-430 additive × binder	0.21	0.21	0.21

(a) Product of American Cyanamid Co.
(b) Product of 3M Company.
(c) Product of Eastman Chemical Products, Inc.

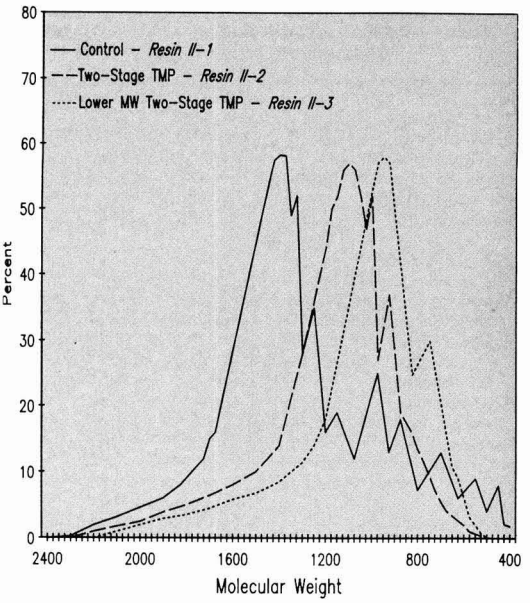

Figure 2—Molecular weight distribution of NPG glycol-based resins

gree of transesterification of the DMCD methyl esters, this intermediate is processed in a first stage reaction with the glycol. In *Table* 2, Resin 1 represents a control product with all of the TMP in the first stage; Resin 2 at the same calculated molecular weight shows one-half of the TMP in the first stage and the other half in the second stage; Resin 3 was calculated to give a lower molecular weight resin which also employs the two-staging technique of TMP addition.

Molecular weight distribution determinations were made by gel permeation chromatography on each synthesized resin. These computer plotted curves are shown in *Figure* 1 for the resins based on TMPD glycol and *Figure* 2 for those based on NPG glycol. Two-staging the TMP in both the TMPD and NPG-based resin systems versus the single-stage controls showed some reduction in average molecular weight, greatly reduced the number and total amount of low-molecular-weight products in the resin, and resulted in a reduced polydispersity (m_w/m_n) in the final resin. These data are shown in *Tables* 5 and 6.

It is known from earlier laboratory evaluations[2] that low-molecular-weight fractions in a coatings polymer adversely affect both enamel solids and physical properties. The elimination of these fractions permits the coatings chemist to improve the enamel physical properties at a higher determined solids. Resin 3 in both *Table* 1 and *Table* 2 shows this optimized resin of reduced molecular weight and two-staging the TMP monomer.

ENAMELS

Enamels were prepared from each resin shown in *Tables* 1 and 2, adjusted to similar viscosities, and evaluated. Enamel formulations, calculated solids, and VOC values are shown in *Table* 3 for TMPD glycol-based resins and *Table* 4 for NPG glycol-based resins.

Staging the TMP monomer gave significant reduction in determined resin viscosity (Resin 2 vs Resin 1) in both TMPD- and NPG-based systems. The lower calculated molecular weight version, which also two-staged the TMP (Resin 3), resulted in the lowest resin viscosity, the narrowest molecular weight distribution range, and a reduced amount of low-molecular-weight fractions. Determined values on the resins, enamels, and cured films are

Table 4—Enamels from NPG Glycol-Based Resins (Calculated Values)

Ingredients	Parts by Weight		
Resin II-1 (80%) in xylene	496.5	—	—
Resin II-2 (80%) in xylene	—	507.3	—
Resin II-3 (80%) in xylene	—	—	525.4
"Cymel" 303 resin	132.2	135.0	139.9
TiO_2	352.8	360.5	373.4
PTSA catalyst (40%)	2.7	2.7	2.8
FC-430 additive (10%)	5.8	5.9	6.1
Methyl amyl ketone	94.9	82.2	60.8
Ektapro EEP solvent	23.0	23.5	24.3
n-Butanol	23.0	23.5	24.3
	1130.9	1140.5	1157.1
Weight % solids	75.3	76.3	77.9
Volume % solids	60.2	61.5	63.7
Enamel density, lb/gal	11.31	11.41	11.57
VOC, lb volatile/gal paint minus H_2O	2.79	2.71	2.56
Pigment/binder	40/60	40/60	40/60
Polyester/crosslinker	75/25	75/25	75/25
% PTSA catalyst × binder	0.20	0.20	0.20
% FC-430 additive × binder	0.22	0.22	0.22

Table 5—Determined Resin, Enamel, and Film Properties (Resins Based on TMPD Glycol)

Resin Properties	Resin I-1	Resin I-2	Resin I-3
M_w (determined)	3886	2374	1555
M_n (determined)	1508	1074	999
Polydispersity M_w/M_n	2.57	2.21	1.56
Gardner viscosity (85%) in xylene	Z_2	Z	X-Y
ICI viscosity (125°C)	1.8	1.6	0.9
OH value (cal)	170	170	185
Enamel Properties			
NV, % by wt (determined)	75.6	76.5	77.6
Viscosity (no. 4 Ford cup), sec	37	34	36
VOC, lbs/gal (determined)	2.72	2.64	2.53
Resin/crosslinker	70/30	70/30	70/30
Film Properties[a]			
Thickness, mils	1.3	1.35	1.5
Impact res. front/reverse, in./lbs	100/20	140/80	140/80
Hardness, pencil	2H	2H	2H
MEK resistance (double rubs)	>200	>200	>200
Cleveland humidity, 48 hrs at 140°F			
Blisters	None	None	None
Gloss, 60°/20°	92/84	90/82	91/82

(a) Coatings were applied to zinc phosphate pretreated CR steel panels.

Table 6—Determined Resin, Enamel, and Film Properties (Resins Based on NPG Glycol)

Resin Properties	Resin II-1	Resin II-2	Resin II-3
M_w (determined)	2886	2007	1555
M_n (determined)	1424	1134	968
Polydispersity M_w/M_n	1.84	1.77	1.64
Gardner viscosity (85%) in xylene	Z_4	Z_3	Z_1
ICI viscosity (125°C)	6.8	5.4	3.2
OH value (cal)	175	175	180
Enamel Properties			
NV, % by wt (determined)	73.1	74.2	77.5
Viscosity (no. 4 Ford cup), sec	37	35	34
VOC, lbs/gal (determined)	2.94	2.82	2.54
Resin/crosslinker	75/25	75/25	75/25
Film Properties[a]			
Thickness, mils	1.2	1.3	1.4
Impact res. front/reverse, in./lbs	100/32	160/140	160/130
Hardness, pencil	4H	4H	4H
MEK resistance (double rubs)	>200	>200	>200
Cleveland humidity, 48 hrs at 120°F			
Blisters	None	None	None
Gloss, 60°/20°	90/81	91/81	91/80

(a) Coatings were applied to zinc phosphate pretreated CR steel panels.

tabulated in *Table* 5 for TMPD glycol resins and *Table* 6 for NPG glycol resins.

In comparing the enamel solution properties after viscosity adjustment, it was quite apparent that staging the TMP in resin synthesis caused significant improvements in enamel solids and VOC.[3] VOC determinations were made using curing time and temperature for the enamels. For the TMPD resin-based enamels, 325°F/20 min was used, while 250°F/20 min was used for NPG glycol resin-based enamels.

In the cured films, the impact resistance was also noticeably improved without sacrificing hardness. This is due to the reduction in low-molecular-weight fractions which are known to adversely affect physical properties as well as the VOC of a coating.[2]

RESULTS

During this evaluation, molecular weight distribution determinations showed conclusively that low-molecular-weight fractions were greatly reduced with multiple additions of TMP branching monomer over a single stage addition. It was also noted in related but unreported work that adding the branching monomer (TMP) in two stages was almost as effective as three or more additions of this material.

The two-stage technique for the addition of the branching monomer allowed for the formulation of lower molecular weight resins which produced higher solids enamels with improved physical properties.

SUMMARY

This work was designed to determine the effect of staging the branching monomer, such as trimethylolpropane (TMP), on resin viscosity, molecular weight distribution, and enamel properties. Two resin types, both using TMP monomer, were reported in this paper from several resins evaluated.

In all cases, two-staging the TMP monomer resulted in a narrower molecular weight range and minimized the amount of low-molecular-weight fractions in the resin. Resin viscosity was greatly reduced, enhancing the VOC properties of the enamels. This staging technique also permitted the formulation of lower molecular weight resins with improved physical properties over systems employing single stage TMP monomer additions.

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(1) American Cyanamid Publication CRT 178, "Cyanamid Cross-Linking Agents for High Solids Coatings."
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(3) EPA Publication EPA-450/2-77-008 (OAQPS No. 1.2-073), May 1977, "Guideline Series—Control of Volatile Organic Emissions from Existing Stationary Surfaces."
(4) Stockmayer, W.H., *J. Chem. Phys.*, *11*, 45 (1943); *12*, 125 (1944).

Influence of the Design of Instruments On the Accuracy of Color-Difference And Color-Matching Calculations

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In color-difference calculations for samples with extremely high metamerism (uncommon in practice), an influence of the band width of the instrument or the number of measurement points is noticeable. In color-matching calculations for samples with steep reflectance factor curves, the error caused by the instrument design can be up to four CIELAB units between the sample and its calculated match. For common samples, the deviations caused by laboratory work (sample preparation) or other factors, such as by pigment flocculation, are greater. If one calculates the color strength of a pigment from K value at reflectance minimum, the results can be affected by the band width of the monochromator.

INTRODUCTION

Instruments for color measurement available today differ in the following three important areas: (1) number of measurement points (16, 31, 64, or 310); (2) band width of the monochromator (5, 10, 20 nm); and (3) geometry of measurement (45°/0° or 8°/d). To meet the market needs for faster instruments, some manufacturers use silicon diodes and arrays as detectors instead of photo-multiplier tubes. The lower sensitivity of these silicon diodes and arrays leads to technical problems which can be solved by increasing the output of the light source. Because there are compelling reasons for the use of polychromatic illumination, this way is restricted due to possible thermochromic effects, which can be eliminated using flash lamps.

Another approach to solving noise problems is to broaden the half width of the monochromators, since, by doubling the half width, the radiation intensity reaching the detector is increased up to fourfold. At the same time, in many instruments the number of measurement points has been cut in half, because, according to some manufacturers, instruments with 16 points and 20 nm band width are able to record spectral information as well as those with 31 points at 10 nm band width.

To our knowledge, no manufacturer has answered the question of whether an instrument with 16 points measurement and 20 nm half width is equivalent to an instrument with 31 points measurement using a monochromator with very small half width as far as the problems of color measurement and color matching are concerned. We considered this question when we were about to purchase faster instruments. To eliminate the influence of factors such as geometry of the instrument or transformation of measured data, we simulated 16 and 31 points, as well as 10 and 20 nm half width spectrophotometric measurement on a computer. Our main interest was to determine whether the design of the instrument alone has a significant influence on the measurement of coloristically close samples. The objective of this paper is, therefore, to estimate the largest possible deviations in measurements caused by the instrument design.

INFLUENCE OF NUMBER OF MEASUREMENT POINTS AND BAND WIDTH

The first investigation was to determine what influence, if any, the number of measurement points and band width of the monochromator have on the calculated color difference. As was mentioned before, we simulated instruments of different designs on the computer. Simula-

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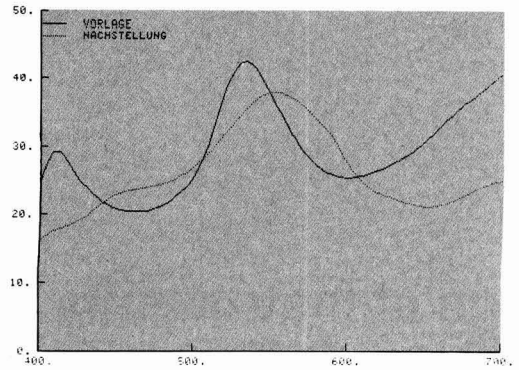

Figure 1—Reflectance factor curves for sample no. 7 in *Table* 1 (full line) and its metameric match (dotted line). Samples with such a high metamerism usually are not accepted in practice

tion of instruments with 10 nm half width was based on the assumption that the transmittance of the monochromator follows a triangular curve typical of prisms and gratings. Instruments with 20 nm half width were supposed to show a bell-shaped curve typical of interference filters. Also, the radiation intensity of the light source and sensitivity of the detector were supposed to be constant over the whole scanning range of the different monochromators. This assumption certainly is somewhat critical at the extreme ends of the scanning range of the detectors. However, variation in reflectance values at the extreme ends has little influence on the colorimetric data. This is true only if the light sources used have a continuous spectrum. Any possible influence of broadened spectral lines of flash type sources was not investigated.

Table 1—Influence of the Band Width And the Number of Measurement Points On the Calculated Color Difference of Metameric Sample Pairs

	31 Reflectance Values		16 Reflectance Values ΔH			
			Band Width			
Sample No.	10 nm	20 nm	10 nm A[a]	10 nm B[b]	20 nm A	20 nm B
1.....	2.0	2.0	2.0	2.0	2.0	2.0
2.....	1.0	1.0	1.0	1.0	1.0	1.0
3.....	0.2	0.2	0.2	0.2	0.2	0.2
4.....	1.1	1.1	1.1	1.1	1.1	1.1
5.....	2.3	2.3	2.3	2.3	2.3	2.3
6.....	2.4	2.4	2.4	2.3	2.3	2.3
7.....	0.6	0.4	0.7	0.3	0.4	0.4
8.....	0.2	0.6	2.1	0.9	0.6	1.3
9.....	0.4	1.1	1.4	1.5	0.9	2.2
10.....	0.1	0.3	0.1	0.3	0.3	0.5
11.....	0.2	0.6	0.9	0.7	0.4	1.0
12.....	0.5	1.3	1.3	1.7	1.1	2.6
13.....	0.3	0.9	0.7	1.4	0.9	1.9
14.....	0.1	0.3	0.7	0.4	0.4	0.5
15.....	0.5	0.5	1.1	0.6	0.7	0.7
16.....	0.3	0.8	1.1	1.2	0.8	1.7
17.....	0.2	0.5	0.8	0.9	0.5	1.1
18.....	0.1	0.3	0.6	0.4	0.2	0.6

(a) Method A—every second value of the color-matching function omitted.
(b) Method B—values of the color-matching function averaged.

In this study, we selected coloristically-close samples with very steep absorption curves (usually found with filters, printing inks, or solutions) as well as samples with metamerism, to estimate the magnitude of the deviations between different design instruments. Fluorescent samples were not studied.

Non-Metameric Samples

A yellow printing ink representing a sample with very steep absorption curve and the transmission curve of a violet dye in solution were used as examples. Both samples were measured on an instrument with 5 nm band width. By mathematical transformation using spline functions, the reflectance data were then interpolated to 1 nm intervals. To generate a sample pair with very small color difference, each reflectance curve was shifted by 1 nm towards the longer wavelength. Furthermore, the curves were shifted within the visible spectrum so that the absorption edges occurred at 430, 460, 490 nm, etc. This was done to estimate the influence of very small difference in wavelength scale over the whole color space. Using these reflectance and transmittance curves, and the transmittance curves of the monochromators, spectrophotometric data for different measurement conditions were calculated. This was done by the summation of the reflectance/transmittance of the sample multiplied by the transmittance of the monochromator. An example of the simulated data calculation for 10 and 20 nm band width is given in the following for 500 nm wavelength:

$$R^{10}_{500} = \sum_{V=490}^{510} R_v \cdot T_v^{10} \qquad (1)$$

and similarly for 20 nm half width:

$$R^{20}_{500} = \sum_{V=460}^{540} R_v \cdot T_v^{20} \qquad (2)$$

In this formula, T^{10} and T^{20} respectively represent the transmittance of the monochromator at 10 and 20 nm half width. The higher summation range for the 20 nm band width is due to the bell-shaped curve for interference filters.

Using this method, we calculated reflectance data for 10 and 20 nm band width for 31 points and, by omitting every second value, for 16 points measurements. Based on these data, color differences in the CIELAB system then could be calculated. No influence of the band width and the number of measurement points was noticed.

Metameric Samples

In the following, we wanted to show whether the same is also true for very metameric samples. We used 18 pairs of metameric samples, seven of which were metameric color matches obtained in our routine color matching and the other eleven were taken out of "Color Science," by Wyszecki and Stiles (see *Figures* 1 and 2). In both cases, though, we had to start with curves obtained by 31 points

measurement at approximately 10 nm band width and, therefore, could only investigate what influence a band width of 20 nm, as well as the number of measurement points, has.

Simulating the measurement method was done as discussed previously. The measured data were interpolated to 1 nm intervals and then reflectance data for 10 and 20 nm half width using 31 and 16 measurement points, respectively, were calculated. The color difference between each pair of metameric samples was calculated. As is apparent, the number of measurement points and the half width of the monochromator have a distinct influence on the total color difference between high metameric sample pairs. The results are given in *Table* 1.

Two different methods, A and B, were used to calculate the tristimulus values and the color differences for 16 points measurement. In method A, every second value of the color-matching function was omitted. In method B, the sum of 50% of the values of the color-matching functions on both sides of the measurement point was taken into calculation. It can be clearly seen that instruments with 16 points measurement capability depend very much on the selection of the color-matching functions. It is again stressed that these results are only applicable to very metameric samples. Such pairs of very metameric samples as represented in *Figure* 2 are highly uncommon in practice.

RESULTS

The influence of band width and number of measurement points is negligible for color-difference calculations for non-metameric samples. This also applies to instru-

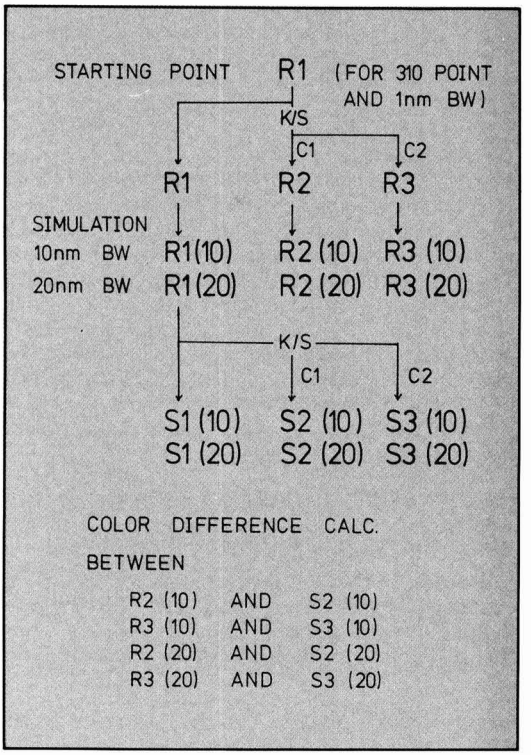

Figure 3—Schematic of the nomenclature of the simulated reflectance curves

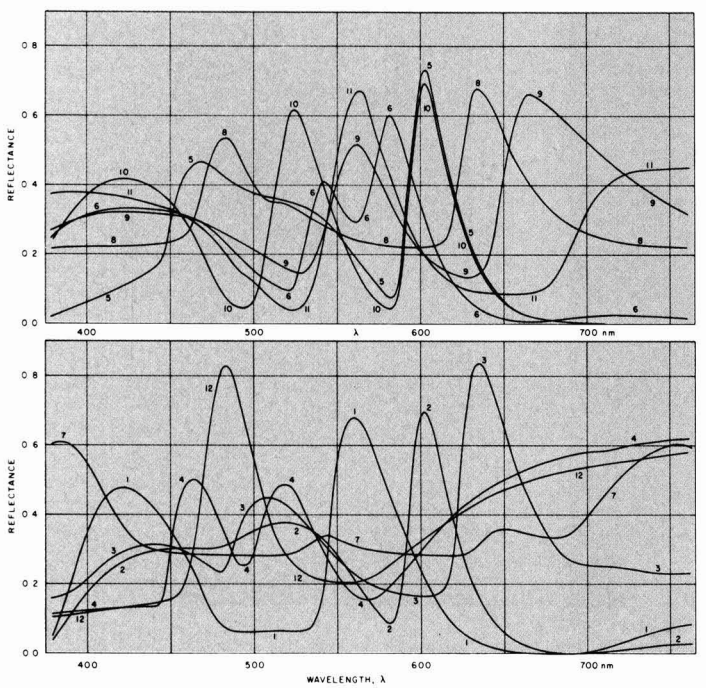

Figure 2—Reflectance factor curves for extremely metameric samples (from: "Color Science," G. Wyszecki and W.S. Stiles, John Wiley & Sons, NY). The color differences in *Table* 1 were calculated relative to sample no. 7

ments with 16 points measurement and 10 nm band width, although some spectrophotometric information is lost. In these cases, the results are not surprising since the human eye simulates "three point measurement" and "monochromators" with very broad band width.

For strongly metameric samples (*Table* 1, numbers 8 to 18), the results are quite different. The influence of the band width, the number of measurement points, and the color-matching functions selected is apparently great. However, in the case of sample pairs with metameric differences as encountered in practice (*Table* 1, numbers 1 to 7), simulations in most cases lead to identical results.

In these studies, we also observed that by shifting the absorption edge of very brilliant color samples by about 1 nm, a hue difference of about $\Delta H = 1$ is obtained. We know by experience that hue differences of $\Delta H = 0.2$ are easily perceived in most cases. Therefore, the reproducibility of wavelength in color measurement instruments has to be better than 0.2 nm.

INFLUENCE OF INSTRUMENT DESIGN

Influence on the First Color Match

It has been shown that in most practical cases the precision of color-difference calculation is only slightly influenced by the number of measurement points and the band width of the instrument. However, the same may not be true in calculating color-match formulations and the optical constants K and S. In color-matching calculations, the measured data is transformed into optical constants and these are then converted—using specific mathematical models—into reflectance data for other concentrations. It depends on many factors, such as the mathematical model, the total reflectance curve, etc., and to what extent these deviations in measured data influence the final result. To investigate this, the following assumptions and simulations were applied.

(1) Reflectance curves with sharp absorption curves again were used in our calculations since it is only there that an effect of the instrument design may be expected. Samples with such reflectance curves are, e.g., yellow printing inks and full shade paints with moly orange or chrome yellow pigments. In addition, the transmission curve of dissolved violet dye was used. All curves were measured at 1 nm intervals.

(2) The mathematical model for color matching is based on Kubelka-Munk theory. For our studies, it is of no importance whether this theory shows any deviations from reality. The Lambert-Beer law or Multi-channel theory may as well be used instead of Kubelka-Munk theory. Our investigation was only concerned with deviations caused by band width of the monochromator. Even the number of measurement points does not come into

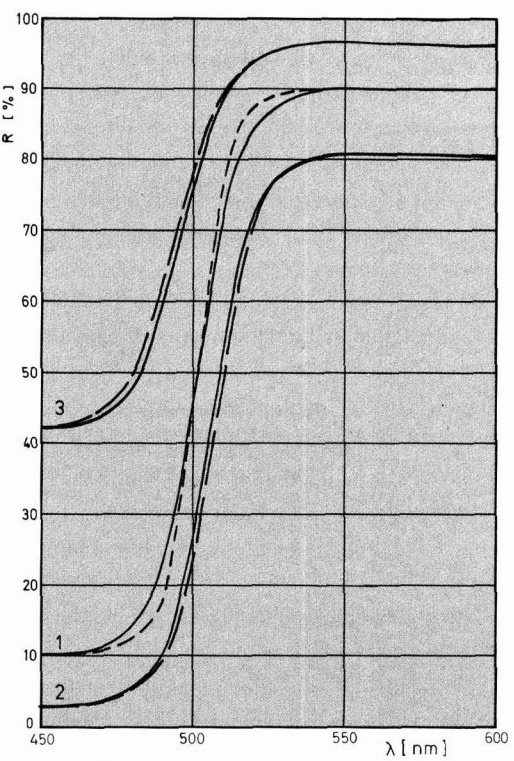

Figure 4—Influence of the band width of the instrument on the position of the slope of the reflectance curves

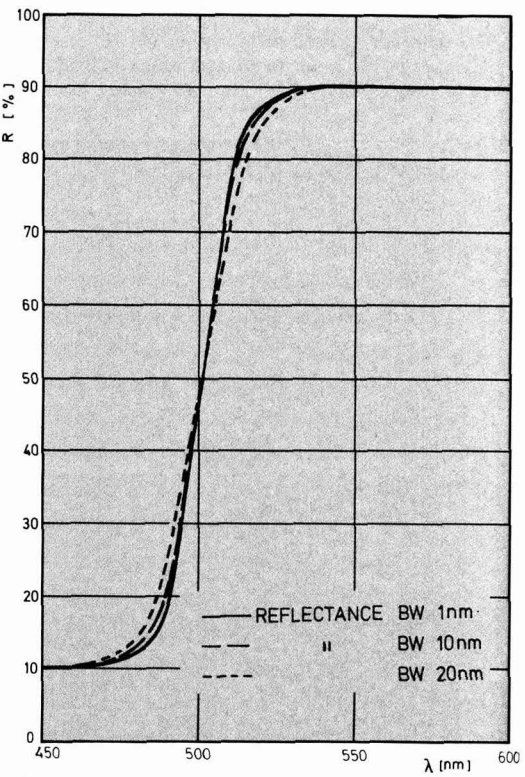

Figure 5—Influence of the band width of the instrument on the shape of the reflectance curve for a yellow pigment

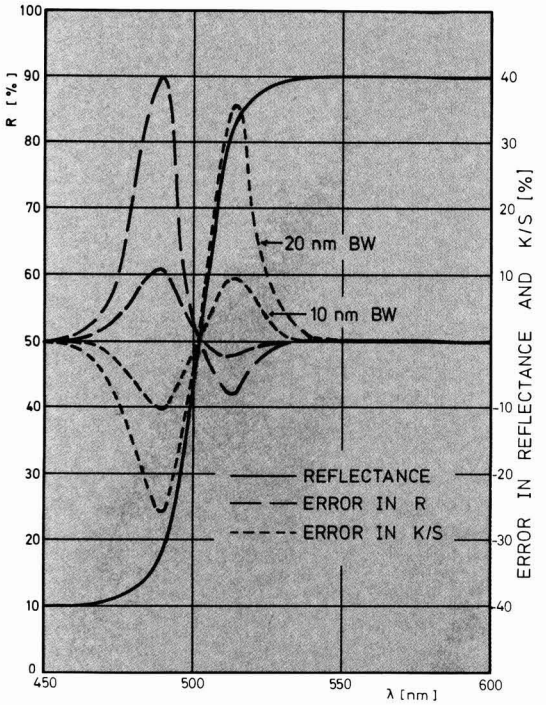

Figure 6—Error in the measured reflectance factor and in the corresponding K/S values for 10 and 20 nm band width in comparison with 1 nm band width instrument for sample in *Figure* 5

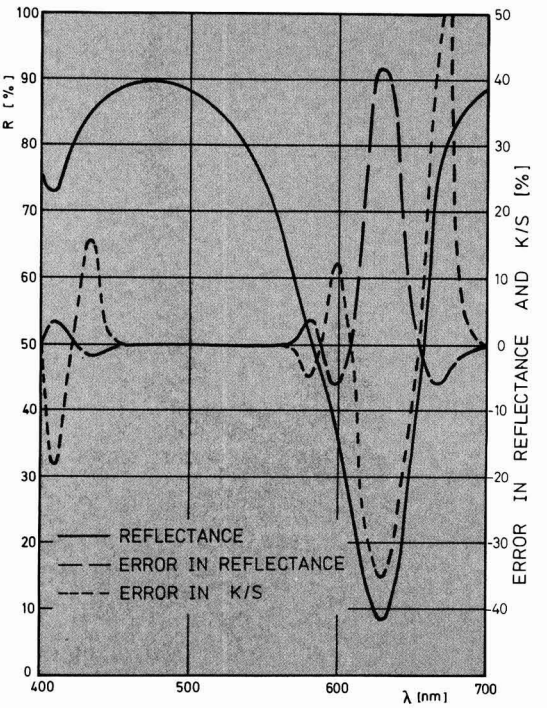

Figure 7—Same as in *Figure* 6 for a violet pigment and a band width of 20 nm

play since, as we have seen already, it has no influence on the calculated color differences.

(3) With the Kubelka-Munk theory, using one measured reflectance curve and changing colorant concentration, a host of curves that are designated R1, R2, R3 whose reflectance data are calculated for 1 nm intervals (see *Figure* 3) can be calculated. These curves then correspond to curves of a series of tints of a non-scattering color pigment in an ideal white pigment measured using an instrument with 1 nm half width at 1 nm intervals. In practice, spectrophotometers have band widths between 10 and 20 nm. Therefore, we simulated measurements with 10 and 20 nm band widths by using the above mentioned reflectance curves R1, R2, R3. The resulting reflectance curves now correspond to tints measured under realistic conditions. Therefore, they deviate from the correct curves R1, R2, R3. The new curves are called R1(10), R2(10), R3(10), and R1(20), R2(20), R3(20) where the numbers in parenthesis indicate the band width of the monochromator. In practical color-matching, these curves are used for calculating K and S values.

For practical reasons, the calculations were based on the following conditions:

(1) K and S were calculated using a single reflectance curve R1(10) or R1(20).

(2) The curves R2(10), R3(10) resp. R2(20), R3(20) are to be matched.

As was already mentioned, K/S values are influenced by the larger band width of the monochromator. For this

Table 2—Color Difference between the Sample And Its First Match Caused by the Band Width of the Monochromator

	Band Width 10 nm						Band Width 20 nm					
Sample	**460[a]**	**500**	**540**	**600**	**620**	**VIO[b]**	**460**	**500**	**540**	**600**	**620**	**VIO**
Conc.												
0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.4	0.2	0.4	0.3	0.4	0.2
0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.2	0.1
2.0	0.7	0.3	0.6	0.4	0.7	0.3	1.0	0.4	0.8	0.6	0.7	0.3
4.0	1.0	0.5	0.9	0.6	0.7	0.6	2.1	1.0	1.6	1.4	1.6	0.6
8.0	1.9	0.9	1.3	0.7	0.8	1.0	4.0	2.0	3.2	2.5	1.9	1.1

(a) The designation (460, 500, etc.) represents the wavelength of the 50% reflectance factor value of the samples at unit concentration.
(b) VIO represents a sample containing a violet pigment.

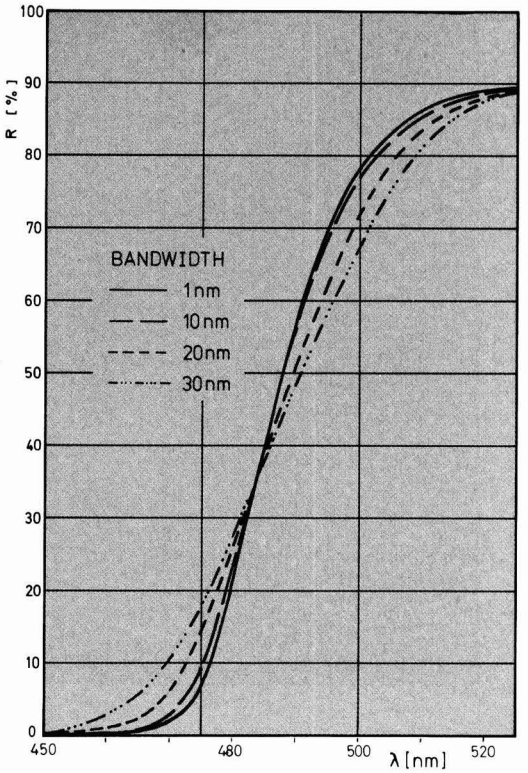

Figure 8—Transmittance curves of a yellow glass-filter measured on a Zeiss PMQ II spectrophotometer with variable band width

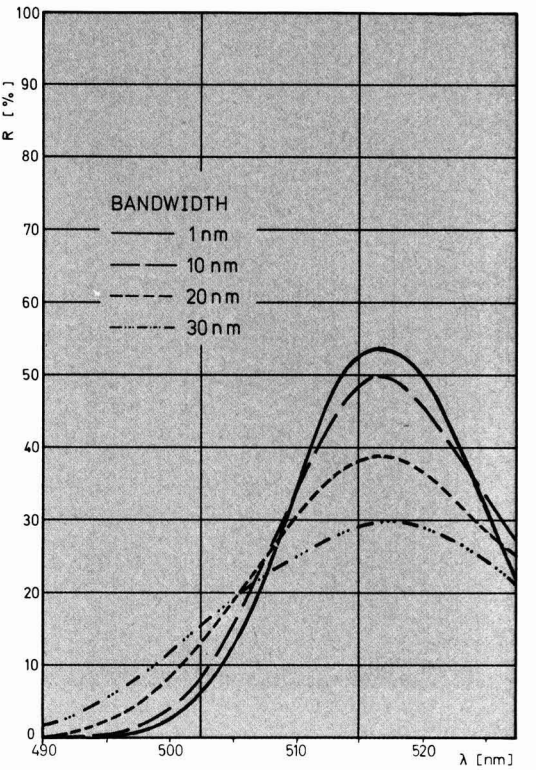

Figure 9—Transmittance curves for a green glass-filter measured on a Zeiss PMQ II spectrophotometer with variable band width

reason, the calculated reflectance curves S2(10), S3(10), as well as S2(20), S3(20), will deviate from the curves R2(10), R3(10), and R2(20), R3(20) even though they were calculated for the same concentrations. The effect of these deviations on K/S values is indicated in *Figure* 4. The deviations caused by the different measuring methods are summarized in *Table* 2.

Table 3—Verification of the Simulation Model

	Transmittance Measured on Zeiss PMQ II				Calculated from Measurements with 1 nm Band Width		
λ(nm)	BW 1[a]	BW 10	BW 20	BW 30	BW 10	BW 20	BW 30
460	0.0	0.1	0.5	2.5	0.05	0.56	2.5
465	0.1	0.3	2.3	6.0			
470	1.0	2.5	6.0	10.5			
475	7.0	10.0	15.0	18.2	9.0	14.6	18.5
480	21.0	22.5	25.0	27.0			
485	39.0	41.0	40.0	37.0			
490	59.0	57.6	51.1	47.5			
495	70.1	69.2	61.1	57.5			
500	79.0	76.7	71.0	66.1	77.8	74.5	69.0
510	87.1	86.0	85.2	82.5			
515	89.0	89.1	88.5	87.5			
520	90.0	90.1	89.5	89.1			

(a) BW1 . . . BW30 gives the band width used for transmission measurement.

The method used here can only be employed as a guideline to "guesstimate" maximum deviations possible in color matching. In general, deviations caused by color measurements are far smaller than those caused by other sources of error, such as the theoretical assumptions and errors in sample preparation. Since color-difference calculation is independent of the instrument design (at least as far as the points discussed here), any deviation due to the design of the instrument will be eliminated in the first correction of the calculated match.

There is another peculiar phenomenon caused by instruments using a 20 nm band width. *Figure* 4 shows three different series of reflectance curves. Series 1 represents a *1 nm* band width (dashed line) and a *20 nm* band width measurement (full line) of a sample of known concentration. Series 2 and 3 represent curves calculated in two different ways.

(1) From the *1 nm* measurement in series 1, the K/S values are calculated. By changing the colorant concentration, the new reflectance values are calculated and *then* a 20 nm band width simulation is applied to get the *dashed lines* in series 2 and 3.

(2) The K/S values are calculated from the 20 nm band width measurement (full line in series 1). For the concentrations mentioned above, the *full line* curves in series 2 and 3 were calculated.

The deviation in the position of the slope of curves in series 2 and 3 is caused by the imprecise K/S values, calculated from the 20 nm band width measurement. The visual comparison of the curves may lead one to believe in the wrong choice of pigments in a calculated match. This pitfall can be avoided by using instruments with a band width smaller than 10 nm.

Accuracy of the K/S Values

As discussed above, the deviations in the first color formulation are due to inaccurate K/S values. This defect is directly related to the band width of the instrument used. It occurs on both sides of steep absorption edge and in the areas where the reflectance curve is strongly bent. To investigate this further, we again used an existing reflectance curve measured at 1 nm intervals. Once more, the reflectance values were transformed to simulate reflectance values for 10 and 20 nm band width measurements by the procedure previously described. The results obtained for a yellow printing ink are given in *Figure* 5 where full-line corresponds to measurements with 1 nm band width instrument, the dashed line and the dotted, respectively, 10 and 20 nm band width simulated curves.

It can be easily observed that on both sides of the absorption band, the calculated curves are less bent and, therefore, there is a change in reflectance values. The optical constants were calculated from these simulated reflectance data and the percent deviation for 10 and 20 nm band width is shown by comparing them with the optical constants calculated from reflectance curves using an instrument with very small band width. *Figure* 6 shows clearly that deviations in the reflectance as well as in the K/S values can reach an important magnitude. *Figure* 7 shows the same calculations for a solution of a violet dye in which deviations up to 50% can occur in the reflectance data as well as in K/S values.

In order to check our simulations, we used a Zeiss PMQ II spectrophotometer. This instrument allows transmission as well as reflectance measurements using different band widths. *Figures* 8 and 9 show the results for a yellow and a green filter. The numerical data are compiled in *Table* 3. It can be seen that our model closely follows results obtained on a measuring instrument of good quality.

SUMMARY

The influence of the number of measurement points and the band width of the color-measurement instruments on deviations in the first color-match formulation was investigated by using a computer simulation. Both parameters in most cases have only a minor influence on the results of the first match. Much more important are deviations caused by the sample preparation and the varnish system. The band width of the monochromator, on the other hand, has a very big influence on the accuracy of the optical constants. This is especially important if one uses the K-value at the reflectance or transmission minimum to determine the tinting strength of the colorant. If there is no wavelength shift of the absorption maximum between two samples, the influence of the band width is negligible. On the other hand, with an instrument of 20 or 10 nm band width one cannot decide whether there is a shift or not. If, for example, a violet as shown in *Figure* 7 is shifted by 4 nm, a 20 nm measurement gives a difference in color strength of 6%. If the K/S-method is applied for determining color strength, only the flat area of the curve with minimum reflectance or transmission should be used.

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Hiding Power and the Cost-Effectiveness Of Titanium Dioxide

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Pigmentech Consulting*

The cost-effectiveness of titanium dioxide as a producer of white hiding power and tinctorial strength has been a neglected variable in paint formulation. The hiding power of any existing paint formulation can be developed at minimum total raw-material cost by one, *and only one,* combination of titanium dioxide content and total solids volume—and this optimum combination may call for the use of *more titanium dioxide* rather than less. Formulation variables, hiding power, and raw-material costs are interrelated in such a way that relatively simple mathematics may be used to identify the combination yielding maximum cost-effectiveness for simple paint systems. Since this has not been done in the past, every existing product line offers opportunities for significant cost savings.

Introduction

The light-scattering ability of titanium dioxide, deriving from its high refractive index, is the recognized source of its whiteness, brightness, and opacity. This paper, however, will concern itself with the hiding power of trade sales coatings, rather than the scattering coefficient of titanium dioxide, for while the latter is constant for any given effective PVC, the hiding power of the coating in which it is dispersed will vary with total solids content. Furthermore, hiding power can be expressed in units that are meaningful to both the manufacturer of the coating and the consumer who applies it, while the scattering coefficient can not.

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Hiding power is the only appearance attribute of a pigmented coating that is recognized by the average consumer as direct evidence of quality. Color, gloss, and angular sheen or texture are attributes viewed in the light of individual preference—a preference that may be exercised at the point of sale, by means of selection based upon visual displays such as color cards—but the consumer has yet to be found who has expressed a preference for low hiding power.

For almost 50 years, titanium dioxide has been essentially the only white pigment employed by the coatings industry for the sole purpose of developing white hiding power and tinctorial strength. In view of the importance placed upon hiding power by the consumer, it should not be surprising that the cost of titanium dioxide will comprise more than 40% of the total cost of many coatings, or that it has been estimated to represent at least 25% of the industry's total expenditures for raw materials. Polymers come and go, but there is no substitute for titanium dioxide, and this has made it a favorite "whipping boy" when the industry has been faced with a profit-squeeze.

At the 1985 annual meeting of the National Paint and Coatings Association in New Orleans, an official representative of the British paint industry reported that price increases for titanium dioxide over the previous 18 months would, during the 12 months of 1985, erase the profits of the entire industry for 1984. This may well be more of an indictment of the British paint industry's unrealistic pricing policies during 1984 than of excessive titanium dioxide price increases, but the reasoning is typical, and of potential harm to the coatings industry.

Over the past 10-12 years, titanium dioxide loadings in paint systems, particularly in trade sales coatings, have exhibited a steady decrease that is only now beginning to taper off. It has occurred because far too many paint manufacturers have responded to increasing raw-material, energy, and labor costs by electing to compromise quality by removing titanium dioxide from their formulations, rather than by raising prices. Not all of the resulting quality reductions were evi-

Table 1—Comparison of Two Alkyd Enamels

	Alkyd Enamel #1		Alkyd Enamel #2	
Rutile TiO_2	250.0 lbs	7.33 gal	311.0 lbs	9.11 gal
Alkyd resin (60%)	615.0 lbs	79.35 gal	476.2 lbs	61.45 gal
Mineral spirits	86.6 lbs	13.33 gal	191.4 lbs	29.44 gal
	951.6 lbs	100.00 gal	978.6 lbs	100.00 gal
Formulation Constants				
% PVC	15.0		22.1	
% Solids (v)	48.8		41.3	
Cost/gal	$6.11		$5.87	
HP/gal	382		382	

dent to the consumer in the form of inadequate hiding power, however. In many flat wall paints, the high dry-hiding provided by increased dry-film porosity was used to compensate for reduced titanium dioxide content, and the consumer merely found that flat wall paints were no longer as washable as they used to be.

The plateau now being reached in respect to titanium dioxide loadings appears to be the result of industry fears that further reductions in quality will jeopardize the competitive position of coatings, as compared to alternative decorative and protective finishing systems. Widespread dissatisfaction with low hiding power and poor washability has been voiced by both consumer advocates and the industry's own trade journals. Raw-material prices continue to rise, however, and this obviously poses quite a dilemma for those who have looked upon across-the-board titanium dioxide reductions as their only logical means of relief. It is the premise of this paper that at least a partial answer to that dilemma can be provided by increasing the cost-effectiveness of titanium dioxide.

Cost-Effectiveness

Titanium dioxide content is not the only factor that determines the level of hiding power developed by a given coating, nor (contrary to the opinion apparently held by much of the coatings industry) is it the only raw material responsible for its cost.

There are possibly just as many paint formulations in production today that can be reduced in cost by raising their titanium dioxide content, as there are those that might benefit from its reduction—without changing either hiding power or film porosity in either case. The goal of too many formulators has been that of reducing titanium dioxide content to a minimum, when they should have been striving to develop hiding power at minimum cost, and the two goals are far from synonymous. This can be demonstrated by a comparison of the two simple alkyd enamels shown in *Table* 1; the second was produced by modifying the first for maximum cost-effectiveness.

Despite the fact that titanium dioxide cost represents 41% of the total cost for Enamel #2, as compared to only 32% for Enamel #1, and despite the fact that the scattering power of rutile titanium dioxide at 22 PVC is only 80% of its scattering power at 15 PVC, Enamel #2 is 24¢ per gallon less expensive than Enamel #1 and develops identical hiding power. Its titanium dioxide content has developed less hiding power per pound of pigment, but more hiding power per dollar of total raw-material cost.

It is not implied that either of these formulations necessarily represents an acceptable commercial product. They are presented here for the sole purpose of illustrating two basic principles relating to the cost-effectiveness of titanium dioxide:

(1) Exactly the same amount of hiding power per gallon of applied coating may be produced either by a relatively small amount of titanium dioxide in a thick film, or by a larger amount of titanium dioxide in a thinner film (dry film thickness is directly related to percent solids by volume in the example formulations).

(2) For any given set of raw materials, there is one specific combination of pigment and binder that will develop a given level of hiding power at minimum total raw-material cost. Its composition is dependent both upon the level of hiding power desired, and the relative costs of pigment and binder.

Mathematical Relationships

The formula of Enamel #2 was generated from that of Enamel #1 by computer, using a program designed to identify the combination of any given set of raw materials that will yield maximum cost-effectiveness with an accuracy of about one pound of titanium dioxide in a 100-gallon batch. Any possible change in this formulation, using the same raw materials, will either increase cost or decrease hiding power.

As an over-simplification, the computer program may be described as functioning by first analyzing any input formula for the cost-effectiveness of its titanium dioxide content, and by then changing the composition as required to minimize cost without changing the original hiding power. This is only one of numerous applications, since it is capable of retaining constant hiding power throughout any series of modifications of a given formula, or of modifying hiding power by any specified amount.

None of this would be possible using the typical trial and error procedures common to paint laboratories, for the simple reason that no adequately precise test method exists for the rapid determination of relative hiding power. A hiding power difference large enough to vary the cost of either of the example enamels by as much as 10¢ per gallon would be too small to be detected by routine methods.

The computer program avoids this difficulty by *calculating* hiding power, using a time-tested equation for predicting the performance of rutile titanium dioxide that was originally developed for solvent systems, but which has proved equally effective for predicting *relative* hiding power in latex systems. It is quite possible to identify the composition of maximum cost-effectiveness for a simple system, using manual calculations, if this same equation is employed.

For such a simple system, the basic relationships are:

$$\text{PVC} = \text{vol } TiO_2/(\text{vol } TiO_2 + \text{vol resin solids}) \quad (1)$$

$$\text{HP/gal} = TiO_2/\text{gal} \times 409\,(.9045 - \text{PVC}^{1/3}) \quad (2)$$

$$\text{Cost/gal} = (\text{vol } TiO_2 \times \text{cost} + \text{vol resin solids} \times \text{cost} + \text{vol solvent} \times \text{cost})/100 \quad (3)$$

For equation (3), costs must be expressed as cost per gallon for all materials.

Example Calculation

The following raw-material costs were assumed for Alkyd Enamel #1:

Rutile TiO_2 @ 78¢/pound = $26.62/gallon
Alkyd resin (60%) @ 65¢/pound = $8.54/solid gallon
Mineral spirits @ $1.20/gallon

The hiding power of Alkyd Enamel #1 is first calculated using equation (2):

$$\text{HP/gal} = 2.50 \times 409\,(.9045 - 0.15^{1/3}) = 381.6 \text{ sq ft (spreading rate at 0.98 C.R.)}$$

Simple algebra is then used to calculate the formula composition for any other TiO_2 loading:

Let x = gallons TiO_2; y = gallons resin solids

PVC = $(.9045 - 381.6/(TiO_2/gal \times 409))^3$

y = x/PVC − x

Knowing x and y, cost is calculated using equation (3):

$/gal = (26.62x + 8.54y + 1.20(100-x-y))/100

= (25.42x + 7.34y × 120)/100

Since most formulators are apt to expect cost to be reduced by removing titanium dioxide, the first step in re-formulating Alkyd Enamel #1 might be a trial removal of 10 pounds of titanium dioxide from the 100-gallon batch:

PVC = $(.9045 - 381.6/(2.40 \times 409))^3$

= 0.137

x = 240/34.13

= 7.03 gallons

y = 7.03/0.137 − 7.03

= 44.28 gallons

$/gal = (25.42×7.03 + 7.34×44.28 + 120)/100

= 6.24

Since removing 10 pounds of titanium dioxide from the formula of Alkyd Enamel #1 has increased the total cost of its raw materials by 13¢ per gallon, the obvious next step is the trial *addition* of the same weight of pigment:

PVC = $(.9045 - 381.6/(2.60 \times 409))^3$

= 0.162

x = 260/34.13

= 7.62 gallons

y = 7.62/0.162 − 7.62

= 39.42 gallons

$/gal = (25.42×7.62 + 7.34×39.42 + 120)/100

= 6.03

With the addition of 10 pounds of titanium dioxide having produced a seven cents per gallon cost reduction, the process is repeated. Each increment of pigment will produce a smaller and smaller reduction in cost as the composition of maximum cost-effectiveness is approached. The final addition required to provide a titanium dioxide content of 310 pounds, which is very close to the computer-generated formula, will produce a cost reduction of less than one cent per gallon, and the next increment will cause the cost to increase by a similar amount.

For such a system, titanium dioxide content, PVC, total solids by volume, and cost per gallon are all interrelated if hiding power is kept constant, and a hyperbolic curve will be produced if titanium dioxide content is plotted vs cost (*Figure* 1). Alkyd Enamel #1 contained too little titanium dioxide for maximum cost-effectiveness, but it is just as possible for another formula based upon the same raw materials to contain too much—in which case titanium dioxide must be removed. The potential saving, in either case, is entirely dependent upon the degree to which the original formulation deviates from the composition of maximum cost-effectiveness.

Additional Variables

When the original formulation is such that the composition of maximum cost-effectiveness may be approached by removing titanium dioxide, PVC may be kept constant by using a spacing extender. If the extender is fine enough to provide a dilution efficiency equivalent to that of resin solids (E_d = 1.0), manual calculation of the composition of maximum cost-effectiveness is little more complicated than that just described. It simply becomes necessary to replace the PVC term in the hiding power equation (2) with the effective PVC (PVC_e) of the titanium dioxide, and to add a new variable (z) for the volume of spacing extender:

PVC_e = vol TiO_2/(vol TiO_2 + vol spacer + vol resin solids) (4)

PVC = (vol TiO_2 + vol spacer)/(vol TiO_2 + vol spacer + vol resin solids) (5)

HP/gal = TiO_2/gal × 409 $(.9045 - PVC_e^{1/3})(6)$

The following formulation, modeled after a recommendation published by a major polymer producer, will be used to illustrate the calculation changes introduced by the use of a spacing extender:

Acrylic Latex Semi-Gloss #1

Rutile TiO_2.....	220.0 lbs	6.45 gal
Acrylic latex (48%)...	400.0 lbs	44.94 gal
Water + additives....	405.0 lbs	48.61 gal
	1025.0 lbs	100.00 gal

% PVC — 24.40
% Solids (v) — 26.4
Cost/gal — $3.56
HP/gal — 251.6 sq ft

The cost of the additives typical of latex paints — thickener, surfactants, defoamer, etc. — need not be included in the calculations, since it may be considered to be unaffected by the formula changes to be made in approaching maximum cost-effectiveness. The following costs were assumed for the remaining raw materials:

Rutile TiO_2 @ 78¢/pound = $26.62/gallon
Spacing extender @ 11¢/pound = $2.48/gallon
Acrylic latex (48%) @ 46¢/pound = $9.21/solid gallon

This time, the assumption that cost will be reduced by removing titanium dioxide from the formula proves to be correct:

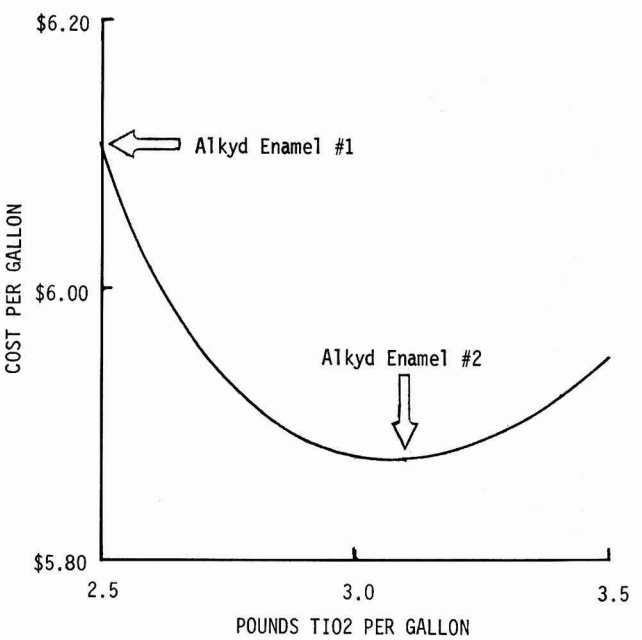


Figure 1—Cost vs TiO_2 content for alkyd system

$PVC_e = (.9045 - 251.6/(2.10 \times 409))^3$
$= 0.2287$

$x = 210/34.13$
$= 6.15$ gallons

$(x + y + z) = 6.15/0.2287$
$= 26.89$ gallons

$(x + z) = 26.89 \times 0.244$
$= 6.56$ gallons

$y = 26.89 - 6.56$
$= 20.33$ gallons

$z = 6.56 - 6.15$
$= 0.41$ gallons

$\$/gal = (26.62 \times 6.15 + 9.21 \times 20.33 + 2.48 \times 0.41)/100$
$= 3.52$

The fact that the reduction in cost amounts to only four cents per gallon is indicative that the formula recommendation in its original form was relatively close to the composition of maximum cost-effectiveness, and since each successive increment of titanium dioxide removed will produce a smaller and smaller added saving, it is also indicative that the maximum cost reduction will also be small. As a matter of fact, the computer-generated composition of maximum cost-effectiveness provides a cost reduction of only six cents per gallon:

Acrylic Latex Semi-Gloss #2

Rutile TiO_2.....	193.5 lbs	5.67 gal
Spacing extender	26.7 lbs	1.18 gal
Acrylic latex (48%) ...	425.3 lbs	47.79 gal
Water + additives	377.8 lbs	45.36 gal
	1023.3 lbs	100.00 gal

% PVC — 24.40
% Solids (v) — 28.1
Cost/gal — $3.50
HP/gal — 251.6 sq ft

It will be noted that the interrelationship between titanium dioxide content and total solids is such that, whereas solids were reduced when titanium dioxide was added in the first example, total solids are increased when titanium dioxide is removed. This tends to reduce the potential saving when titanium dioxide is to be removed, due to the high cost of the solids that must be increased.

The use of a spacing extender, as in the above example, increases the potential saving when titanium dioxide is removed by lowering the cost of these solids. Had the extender not been used, and the PVC permitted to drop as the titanium dioxide content was lowered, the total saving produced by re-formulation would have been less than one cent per gallon for the Acrylic Latex Semi-Gloss, instead of six cents per gallon, again indicative of the relatively high cost-effectiveness of the original formulation.

Effect of Vehicle Cost

The location of the composition of maximum cost-effectiveness on the hyperbolic curve of titanium dioxide content versus cost is affected by the cost of vehicle solids relative to that of the pigment. If, for example, the acrylic latex of the previously described semi-gloss were to be replaced with a vinyl copolymer emulsion costing only 36.5¢ per pound at 55% solids, the cost of the original formulation (minus the cost of additives) would be reduced from $3.56 per gallon to only $2.99 per gallon, and the computer-generated composition of maximum cost-effectiveness would appear as below:

Vinyl Semi-Gloss

Rutile TiO_2.....	183.3 lbs	5.37 gal
Spacing extender	39.4 lbs	1.75 gal
Vinyl latex (55%)....	386.3 lbs	42.92 gal
Water + additives ...	416.2 lbs	49.96 gal
	1024.2 lbs	100.00 gal

% PVC — 24.40
% Solids (v) — 29.2
Cost/gal — $2.88
HP/gal — 251.6 sq ft

Despite the lower cost of the starting formulation, its conversion to the composition of maximum cost-effectiveness has produced a cost reduction of 11¢ per gallon, as compared to only six cents using the more expensive latex. This apparent paradox is due to the fact that the saving that may be produced by re-formulation is greatly influenced by the degree to which the starting formulation deviates from maximum cost-effectiveness, and this will vary with the cost of vehicle solids.

This is most easily explained in terms of hiding power per gallon of total solids, and for a system without extender. The composition of these solids that will produce the maximum hiding power per dollar of cost will vary with the cost of the resin component. In the case of the alkyd enamel, this composition is identified by the 22.1 PVC of Alkyd Enamel #2. If, instead of keeping the PVC constant by the addition of spacing extender, the latex semi-gloss examples had been similarly treated, thus permitting the PVC to vary as the composition of maximum cost-effectiveness was approached, the calculations would result in 23.29 PVC for the more-expensive acrylic polymer, and 20.19 PVC for the less-expensive vinyl. The higher the cost of resin solids, the higher is the percentage of titanium dioxide in the total solids.

When, as in the case of the semi-gloss formulations, these optimum PVC's are *lower* than the PVC of the starting formulation, it is indicative that titanium dioxide must be removed from the total solids to achieve maximum cost effectiveness. If, however, the volume of removed titanium dioxide is replaced with a spacing extender instead of with resin solids, keeping the formula PVC constant, the effect is the same as lowering the cost of the resin solids. Insofar as the hiding power/cost relationship is concerned, the spacing extender is replacing resin solids as a diluent.

Hiding Power Changes And Cost-Effectiveness

Hiding power per gallon of coating, as applied, is simply a percentage of hiding power per gallon of solids — a percentage that is identical to the percent total solids by volume. Consequently, the hiding power of Alkyd Enamel #2 might be increased by withholding mineral spirits, or decreased by an addition, without changing relative cost-effectiveness; the optimum PVC remains the same. The same would be true of the latex semi-gloss formulations.

Thus, if a given formulation is to be both reduced in hiding power and re-formulated for maximum cost-effectiveness, it would make no difference whether the hiding power reduction were first produced in the original by the addition of thinner and by then calculating the composition for maximum cost-effectiveness, or whether the composition of maximum cost-effectiveness were first calculated for the original formula and the result diluted with thinner to provide the hiding power reduction. The end result would be the same in either case.

Actually, however, there is no need to perform two separate calculations for such a hiding power change and for maximum cost-effectiveness. It is only necessary to change the hiding power figure obtained for the original in conformance with the desired decrease (or increase) before calculating for maximum cost-effectiveness. Hiding power, being directly related to total solids by volume, is also involved in the interrelationships of titanium dioxide content, PVC, total solids by volume, and cost per gallon. Thus, the effect of adding five gallons of mineral spirits to the 100-gallon batch of Alkyd Enamel #1 might be simulated by dividing its calculated hiding power by 1.05 (381.6/1.05 = 363.4), and changing the first step in the addition of titanium dioxide to:

$$PVC = (.9045 - 363.4/(2.60 \times 409))^3 = 0.178$$

$$x = 260/34.13 = 7.62 \text{ gallons}$$

$$y = 7.62/0.178 - 7.62 = 35.19 \text{ gallons}$$

$$\$/gal = (25.42 \times 7.62 + 7.34 \times 35.19 + 120)/100 = 5.72$$

Continuing the process of adding successive increments of titanium dioxide until a minimum cost is achieved will result in a cost per gallon ($5.65) that is exactly the same as that resulting from the addition of five gallons of mineral spirits to the 100-gallon batch of Alkyd Enamel #2, while the PVC will have been increased to the same level.

Flat Wall Paints And High Dry-Hiding

While the manual calculations required to locate the composition of maximum cost-effectiveness for gloss and semi-gloss finishes are not too difficult, although somewhat time-consuming, the complications introduced by more-highly pigmented formulations make manual treatment of the problem virtually impossible. These derive from two sources: the presence of large-particle-size flatting extenders, and the development of high dry-hiding due to film porosity.

Large-particle-size extenders have an effect upon formula PVC that is directly proportional to their volume, but their effect upon the effective PVC (PVC_e), and therefore upon hiding power, is diminished by their relatively low dilution efficiencies as compared to those of spacing extenders. While the experimental technique for establishing dilution efficiency has been published, E_d values are rarely supplied for their products by extender manufacturers, making the accurate calculation of hiding power impossible when previously untested extenders are involved. Rough estimates can be made, however, from published values of E_d for other extenders of similar particle-size distribution. The methods used by the computer program to calculate these values from mean particle-diameter have not been published. Fortunately, extreme accuracy is not required for the E_d values for such extenders, since their over-all dilution effect will tend to remain constant if the extender content is held at a constant percentage of the total dry-film volume — not too difficult for a computer, but somewhat involved for manual calculations.

FRED B. STIEG's contributions regarding white hiding power and applications of CPVC during his 49-year career in the paint industry are widely recognized. Honored by the Federation as the 1967 Mattiello Memorial Lecturer at its Annual Meeting, he has been a member of the Los Angeles, New York, and Southern (Atlanta Section) Societies. Among his many citations is that of Honorary Member of ASTM Committee D-1. His most recent activity has involved incorporating the concepts of hiding power and CPVC into a computer program for the working paint formulator, technical service representative, and industry consultant. Mr. Stieg is a chemical engineering graduate of Lehigh University.

Of greater significance is the effect of dry-film porosity upon hiding power. The hiding power calculated from equation (2) is "basic" hiding power which, in the case of highly pigmented finishes, must be multiplied by a porosity factor to truly represent the dry hiding power that will be produced by a given amount of titanium dioxide. This "porosity factor" is determined by the ratio of binder-demand to binder-supply, and this ratio (which is *not* a simple PVC/CPVC ratio) may be expected to vary as the result of pigmentation changes made during the process of re-formulation for maximum cost-effectiveness.

Since the concept of titanium dioxide cost-effectiveness is based upon the attainment of a specific level of hiding power at minimum total cost, and any increase in film porosity will permit that hiding power to be produced by a smaller amount of titanium dioxide, it is impossible for calculated values to be meaningful unless dry-film porosity is also matched. Once matched for porosity, two formulations with the same calculated basic hiding power will develop the same high dry-hiding. The computer program utilizes volumetric oil absorption determinations for this purpose, providing the dry pigment blends to be used. The method for calculating these blends has been described in the literature, as has a graphical procedure for matching film porosity.

The more familiar PVC-ladder method for matching dry-film porosity by means of tinctorial strength comparisons may also be used, but is considerably more time-consuming. If both the high- and low-PVC bases for the PVC-ladder are first adjusted to maximum cost-effectiveness, it may be assumed that the same will apply for any intermix.

Limitations

It must be recognized that the calculated composition of maximum cost-effectiveness will not *necessarily* be a completely practical paint formulation, although this is not generally a problem.

To achieve this maximum, as represented by minimum cost for a given level of hiding power, it is necessary to vary total solids content. When titanium dioxide is to be removed, total solids will increase to retain the original level of hiding power per gallon; when titanium dioxide is to be added, total solids will decrease. As a consequence, total solids *may* be either excessively high or excessively low at the composition of maximum cost-effectiveness—particularly if the original formulation was somewhat abnormal in this respect. This may also prove to be true of other variables.

So-called "junk" flat wall paints, for example, are generally characterized by abnormally low titanium dioxide contents, abnormally low total solids, and abnormally high dry-film porosity—the latter is sometimes the result of abnormally high PVC, sometimes the result of abnormally high oil absorption extenders, and sometimes a combination of both.

Because of their originally low titanium dioxide contents, such formulations may almost invariably be increased in cost-effectiveness by adding titanium dioxide while reducing total solids. With some vehicle systems, however, there may be practical limitations to total solids content reduction, and the originally low total solids will present a problem.

Furthermore, since the addition of titanium dioxide will have been accompanied by the removal of extender to retain the original PVC, it is quite probable that binder-demand will have been reduced, calling for a PVC increase to match porosity and high dry-hiding. If the original PVC was already abnormally high, an increase may not be practical. In other words, while the process of identifying a formula composition of maximum cost-effectiveness can be reduced to a few manual calculations, or even to the pressing of a single computer key, there is no substitute for the critical judgement of an experienced paint formulator in respect to the practical limits of some formulating parameters.

Fortunately, however, the very abnormality of such formulations leads to savings that are disproportionately large in comparison with original formula cost, and it becomes possible to expend some

part of them on quality improvements such as reduced dry-film porosity.

Conclusion

Paint formulators have not employed the described procedures in the past to reduce raw-material costs for the simple reason that the basic principles involved were published at a time when industry profits were higher than they are today, and they lacked any economic incentive to burden themselves with calculations to which they were not accustomed. It was easier to label them "theoretical" and "impractical"—and to ignore them. Once ignored, they were easily forgotten, because the trade journals in which they had been published seldom found their way into the reference libraries accessible to students of the paint courses conducted by university departments of polymer science.

As a consequence, the present product lines of the coatings industry have been created without regard for these principles, and we must expect to find individual formulations randomly distributed in respect to cost-effectiveness, irrespective of their technical excellence or the innovative thinking that they may represent. There may possibly be some tendency for the distribution to be skewed toward excessively low titanium dioxide contents because of past efforts to reduce raw-material cost that have concentrated solely upon the removal of that pigment.

There seems little reason to doubt that the correction of past errors in respect to cost-effectiveness can, in the aggregate, represent a significant contribution toward the relief of the profit-squeeze presently faced by the coatings industry.

With the common availability of pocket-size computers that will automatically perform all of the necessary calculations for even the most complicated system, there is no longer any excuse for paint formulators to ignore the waste that has found its way into the product lines of the industry—or to ever again permit it access.

CLEVELAND ..... MAY

"Past-Presidents' Night"

Society Past-President Robert Thomas, of PPG Industries, Inc., introduced the fourteen other Past-Presidents in attendance: Gene Ott, Chester Leopold, George Selden, Ken Waldo, Don Fordyce, Tom Keene, Helen Skowronska, Carl Knauss, Mike Malaga, Fred Hollenberg, Sam Huey, Charles Beck, Paul Houck, and Vic Sandorf.

The Society Award of Merit was presented to Jim Benduhn, of Dar-Tek, Inc., for his work on the Finance and Membership Committees. The Frank Selden Award, which recognizes outstanding service to the community and Society, was presented to Society Representative Fred Schwab, of Coatings Research Group, Inc., by George Selden, of Selden Chemicals Consultants, Inc. Accepting for Mr. Schwab was Steve Damko.

The presentation of three 25-Year Membership Pins followed. Pins were awarded to Fausto Hidalgo, of Glidden Coatings and Resins, Div. of SCM; Tom Keene, of Harshaw/Filtrol; and Stanley Rapaport, of Plasti-Kote Co.

Milton Hardt, of Sherwin-Williams Co., provided a talk on "Automotive Aftermarket Coatings."

Mr. Hardt began his presentation by explaining that each automobile manufacturer introduces 15-30 new colors every year. The new colors must then be matched by aftermarket (refinish/repair) formulators. The main chemistry employed by OEM paint chemists is alkyd/melamine.

Next, he noted that basecoat/clearcoat is becoming a dominant trend. This technology allows extra pigment to be used in the basecoat to achieve special color and gloss effects. He told that in Europe a basecoat/mica-filled/clearcoat technology is growing in use. This poses an even greater challenge for the aftermarket.

The methods for achieving color matching, including color application variables and formulation, were then addressed by the speaker. He explained that a lighter color can be attained by greater solvent reduction, more atomizing air pressure, using faster thinning solvents, and increased distance to substrate. These achieve a thinner liquid coat, which keeps the metallic additive near-surface for less depth of color. Conversely, darker colors are obtained with less solvent reduction with slower solvents, less atomization, and shorter gun-to-substrate distance, stated Mr. Hardt. This yields a thicker wet film, in which the metallic pigments sink deeper.

Next, he described aftermarket finishes, which rely chiefly on acrylic lacquer, acrylic enamel, or acrylic urethanes. An obsolescent technology is alkyd enamel, due to weathering deficiencies.

In closing, Mr. Hardt stated that the choice of system for a given refinish job is determined by handling, finish, and quality requirements, as well as cleanliness of shop, and other factors.

Richard R. Eley, *Secretary*

KANSAS CITY ..... APR.

"Solvent Recovery"

Society President Steve Bussjaeger read the Nominating Committee's proposed officers for 1986-87. They are: President—Steve Johnson, of Cook Paint & Varnish Co.; Vice-President—Jerry Hefling, Loctite Corp.; Secretary—Roger Haines, Tnemec Co., Inc.; and Treasurer—Nick Dispensa, of Davis Paint Co.

James O'Brien, of Du Pont Co., reported on the activities of the Educational Committee. He noted that the Kansas City Science Fair would be held the week of April 14, and that projects pertaining to the paint and coatings industry would be judged and awarded. The winners, along with their parents and teachers, would be invited to the Society's next meeting, he explained.

President Bussjaeger reported on the upcoming annual Joint Meeting with St. Louis Society to be held June 6-7 at the Holiday Inn, Lake of Ozarks, MO.

The evening technical presentation was provided by Gary Brown, of Midwest Spray Equipment. With the assistance of a slide presentation, Mr. Brown discussed, "Solvent Recovery by Distillation."

Steven D. Johnson, *Secretary*

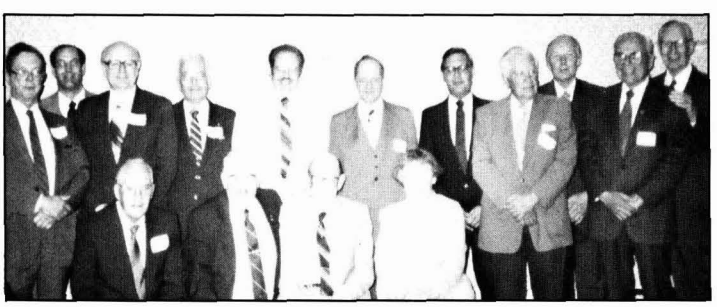
LOS ANGELES ..... MAY

"Awards Night"

Society President, Mike Gildon, of Guardsman Chemicals, presented Ed Marberg, Consultant, with a 50-Year Pin.

Lloyd Haanstra, of Guardsman Chemical, awarded 25-Year Pins to the following members: Steve Bosan, Ameron PCD; W.S. Benton, retired; Al Curado, Western Specialty Co.; Andy Ellis, NL Industries, Inc.; Richard Erwin, retired; Vern Erlandson, Frank D. Davis Co.; Larry Goodmanson, retired; Bert Gottschalck, Engard Coatings Corp.; Joe King, McCloskey Corp.; Dave Kittredge, E.T. Horn Co.; Mario Montferrand, Given Paint Co.; Henry Nakano, Cargill, Inc.; Joe Pagan, Devoe Marine Coatings; Ron Petry, BASF Inmont Corp.; Max Saltzman, Consultant; and Martin Weisman, Sher-Mar Cosmetics.

Mr. Haanstra then presented the Society's "Outstanding Service Award" to three recipients: Don Curl, of E.T. Horn Co.; Earl Fenstermaker, of Conklin-Fenstermaker; and Romer Johnson, of Dorsett & Jackson, Inc. The award recognizes con-



CLEVELAND SOCIETY PAST-PRESIDENTS were honored at the May meeting. Those in attendance were as follows. Seated (left to right): Sam Huey, Gene Ott, George Selden, and Helen Skowronska. Standing (left to right): Ken Waldo, Bob Thomas, Vic Sandorf, Charles Beck, Paul Houck, Carl Knauss, Tom Keene, Chester Leopold, Don Fordyce, Mike Malaga, and Fred Hollenberg

FSCT Membership Anniversaries

50-Year Members

Los Angeles

Edwin H. Marberg, Consultant

25-Year Members

Cleveland

Fausto Hidalgo, Glidden Coatings and Resins, Div. of SCM Corp.
Thomas H. Keene, Harshaw/Filtrol Partnership
Stanley Rapaport, Plasti-Kote Co., Inc.

Los Angeles

Steven Bosan, Ameron Protective Coatings Div.
William S. Benton, Retired
Al Curado, Western Specialty Co.
Andrew R. Ellis, NL Chemicals/NL Industries, Inc.
Richard Erwin, Retired
Vern Erlandson, Frank D. Davis Co.
Larry Goodmanson, Retired
Bert Gottschalck, Engard Coatings Corp.
Joseph King, McCloskey Varnish Co.
Dave Kittredge, E.T. Horn Co.
Mario Montferrand, Given Paint Co.
Henry Nakano, Cargill, Inc.
Joseph A. Pagan, Devoe Marine Coatings
Ronald J. Petry, United Technologies-Inmont
Max Saltzman, Consultant
Martin J. Weisman, Sher-Mar Cosmetics

Toronto

Gord H. Brown, APCO Industries Co. Ltd.
Thomas M. Callaghan, MacNaughton-Brooks Ltd.
William J. Giffen, DuPont Canada, Inc.
Len Harrison, Rust-Oleum Corp.
Roy Kennedy, BASF Inmont Canada, Inc.
Greg Loane, Loane Associates Ltd.
Al T. McDonald, Nuodex Colortrend Ltd.
Elmar Mikazans, Pioneer Executive Consultants
V.M. Pasta, MacNaughton-Brooks Ltd.
Helmut Schweisfurth, BASF Inmont Canada, Inc.

PRESENTATION OF 25-YEAR PINS was made at the May meeting of the Toronto Society. Recipients were (left to right): Gord Brown, of APCO Industries Co. Ltd.; Greg Loane, of Loane Associates Ltd.; Elmar Mikazans, of Pioneer Executive Consultants; and Bill Giffen, of DuPont Canada, Inc. Absent from the meeting were: Tom Callaghan and Babla Pasta, of McNaughton-Brooks Ltd.; Roy Kennedy and Helmut Schweisfurth, of BASF Inmont Canada, Inc.; Len Harrison, of Rust-Oleum Corp.; and Al McDonald, of Nuodex Colortrend Corp.

tribution of talent, effort, and devotion to the aims and objectives of the Society.

Next, Mr. Haanstra awarded John A. Gordon, Jr., of Eastern Michigan University, with Society Honorary Membership, the highest award a Society can bestow on an individual.

Society Scholarship Committee member Chuck Miyada, of Reichhold Chemicals, announced the students who will be receiving Society scholarships for the 1986-87 academic year. A graduate studies scholarship was presented to Jeffrey Gray. College Junior recipients include Douglas F. Spaeth and Edward Reilly; Sophomore recipients were Nerissa Ko, Douglas Gray, and Jacqueline Calkin. Incoming Freshman scholarships were presented to children of three Society members: Linda Ellis, daughter of Andrew Ellis, NL Industries, Inc.; Warren Holmes, son of Brian Holmes, Union Chemicals Div.; and Gerald Sarte, son of Eduardo Sarte, Lilly Industrial Coatings, Inc.

Earl Smith, Chairman of the Nominating Committee, introduced Parker Pace, of Behr Process Corp., the Society candidate for election to the Board. Mr. Smith told that nominations will be accepted from the floor at the Society's June meeting, at which time voting for the new board member will take place.

An Environmental report was then given by Lloyd Haanstra. He began by discussing the Architectural Coatings Task Force headed by John Gordon. Two EPA officials in opposition of the extension to the 380 Rule, attended the meeting of the task force, held in Ontario, CA. The EPA, he explained, is doing their own investigation to determine if the paint industry is justified in needing the 380 Rule extension. Districts rendering the extension, especially the South Coast District, are being scrutinized as well, he noted. As it now stands, the Rule, which reduces VOC of 380 to 250 will go into effect in September 1986 for many districts. It is not certain whether the change will be enforced, Mr. Haanstra told the group, but the South Coast District has extended the Rule until September of 1989.

In discussing Rule 1107, he explained that it is slated to change but workshops regarding the Rule have not been scheduled at the present time.

President Gildon announced that the Golden Gate Society would be conducting their Conference '86 on June 16, 1986. The theme is "Demonstration/Determination of Volatile Organic Compounds in Solvents and Water-Borne Coatings."

The first speaker for the evening was Al Eilender, of Cosan Chemical Corp. Mr. Eilender, the Legislative Coordinator for NPCA for New Jersey, discussed "Paint Waste."

Using a slide presentation, the speaker addressed a number of timely subjects. He stated that the California Assembly is considering two bills pertaining to household waste, including paint and coatings products. He then discussed how the bills will

affect the paint manufacturer, the raw material supplier, the customer, and their inter-relationship with the State and Federal Resource Conservation and Recovery Act.

Richard Ensminger, of NL Chemicals/NL Industries, Inc., provided the second presentation, "TITANIUM DIOXIDE—WHY SO MANY GRADES?"

A discussion of the influence of inorganic and organic treatments of titanium dioxide comprised Mr. Ensminger's program. To illustrate the effects of inorganic treatments, he showed results on a series of pigments in which inorganic treatment was closely controlled. He noted that different grades are commonly available due to the morphology of the pigment surface and various treatment levels.

Q. What causes some lots of TiO_2 to have stronger tinting strengths than other lots in the same grade?

A. Titanium dioxide is micronized as part of the finishing process at a rate of a ton every five minutes. Occasionally the chamber will become clogged and the TiO_2 does not get ground properly. Maybe three bags will turn out this way out of a ton.

Q. If a company wished to develop their own organic coating for specific requirements, what grade should they start with?

A. I would start with one of the general purpose grades. The most widely used TiO_2 has only the alumina treatment on it.

MELINDA K. RUTLEDGE, *Secretary*

NORTHWESTERN ..... MAY

"Metal Pretreatments"

Officer nominations for the 1986-87 Society year were presented to the membership: President—Larry Brandenburger, Valspar Corp.; Vice-President—Joan B. Lamberg, Horton-Earl Co.; Secretary—Richard Karlstad, Ceramic Industrial Coatings; and Treasurer—Mark Uglem, Hirschfield's Paint Mfg., Inc. The slate was voted in unanimously.

Technical Committee Chairman Ed Ferlauto, of Valspar Corp., announced that the annual Committee meeting would be held May 9, 1986, at H.B. Fuller Company. The "Permeability of Films" project will be discussed, he stated.

Society Representative Richard Fricker, of Valspar Corp., reported on two interrelated environmental matters. Extensive testing of ozone levels around the country has shown that levels have not been going down. EPA has decided that the regulations on the books will have to be strictly enforced. Additional enforcement officers and attorneys are being hired to carry out the work.

Mr. Fricker then told of the New York Society's request to the Federation regarding member insurance. The Society is interested in learning if FSCT can offer an insurance plan to members as other organizations have done. He explained that there would be more reports on the issue after he attended the Spring Board Meeting.

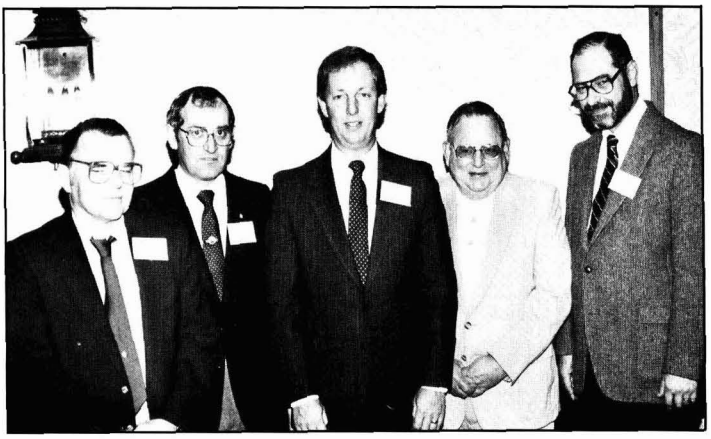
Bill Witke, of Oakite, provided the first presentation on "METAL PRETREATMENTS."

Commencing the program, the speaker stated that you don't paint metal, you paint a conversion coating. He further explained that a clean, inactive surface is necessary for optimum adhesion and corrosion prevention. A proper conversion coating will lessen the effects of abrasion, UV exposure, heat, and humidity. The primary job of the conversion coating process is to remove soil and surface imperfections, as well as establish a corrosion barrier.

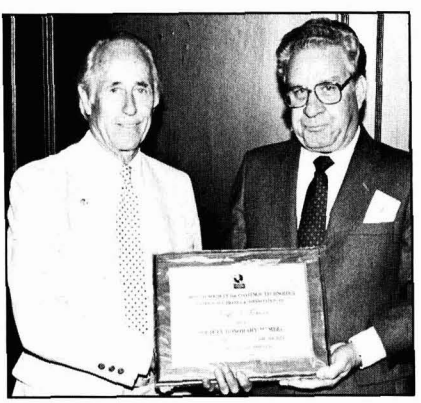
Next, Mr. Witke discussed two basic methods of applying a conversion coating. One way is through tank immersion, the most simple method to employ, but with the major shortcoming of a relatively low rate of through-put. The other method, spray coating, can increase speed and reduce the total amount of materials necessary. The latter method should be used when cleaning and coating over 2500 sq ft per hour. For every square foot to be treated, approximately 2½ gallons per minute of pump capacity is required.

The type of phosphate to be used was the next area explored by the speaker. Phosphate selection depends on soil, quality of metal, and type of metal, he explained. Iron phosphates have the lowest cost, but give the least amount of protection. They form a non-crystalline barrier with coverage of approximately 25-70 mg per sq ft. Zinc phosphate gives a thicker coating, a higher degree of protection, and are much more expensive. It forms a crystalline barrier of approximately 150-200 mg per sq ft.

Mr. Witke discussed two basic types of washer systems used. One is a three-stage



OFFICERS OF THE PACIFIC NORTHWEST SOCIETY for 1986-87. Left to right: Secretary John Daller, Vice-President Yvon Poitras, President Dennis Hatfield, Society Representative Carlton Huntington, and Treasurer Emil Iraola



LLOYD LOMAS (left), Founder and Chairman of the Board of L.V. Lomas Chemical Co. Ltd., was awarded Honorary Membership by the Toronto Society at the May 1986 meeting. Society President Ted Stevenson presented a plaque to Mr. Lomas in recognition of his contribution not only to the Society, but also for his life-long interest in helping people succeed in the coatings industry. Mr. Lomas joins W.B. Bats, William Dunn, and Dr. Joseph W. Tomecko in the Honorary class

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Martin's Market Square, Towson, MD). ED COUNTRYMAN, Bruning Paint Co., 601 S. Haven St., Baltimore, MD 21224. Virginia Section—Fourth Wednesday, Ramada Inn-East, Williamsburg, VA.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.M. HEATH, Holden Surface Ctgs. Ltd., Bordesley Green Rd., Birmingham B9 4TQ England.

CHICAGO (First Monday—meeting sites vary). EVANS ANGELOS, Kraft Chemical Co., 1975 N. Hawthorne Ave., Melrose Park, IL 60160.

CDIC (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; and Nov., Feb. in Dayton). SAMUEL KRATZER, Potter Paint Co., P.O. Box 265, Cambridge City, IN 47327.

CLEVELAND (Third Tuesday—meeting sites vary). R. EDWARD BISH, Jamestown Paint & Varnish Co., 108 Main St., Jamestown, PA 16134.

DALLAS (Thursday following second Wednesday—Executive Inn, near Lovefield Airport). FREDERICK T. BEARD, Glidden Coating & Resins, Div. of SCM Corp., 1900 North Josey Ln., Carrolton, TX 75006.

DETROIT (Fourth Tuesday—meeting sites vary). JOANNE CEDERNA, Inmont Corp., 26701 Telegraph Rd., Southfield, MI 48086.

GOLDEN GATE (Monday before third Wednesday—Alternate between Sabella's Restaurant on Fisherman's Wharf and Francesco's in Oakland, CA). KARL SAUER, Pfizer, Inc., MPM Div., 776 Rosemont Rd., Oakland, CA 94610.

HOUSTON (Second Wednesday—Sonny Look's, Houston, TX). JAMES TUSING, PPG Industries, Inc., P.O. Box 1329, Houston, TX 77251.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). ROGER HAINES, Tnemec Co., Inc., P.O. 1749, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). MELINDA RUTLEDGE, Allo Chemical Co., P.O. Box 443, Ontario, CA 91761.

LOUISVILLE (Third Wednesday—Breckinridge Inn, Louisville, KY). LOUIS HOLZKNECHT, Devoe Marine Coatings, 1437 Portland Ave., Louisville, KY 40203.

MEXICO (Fourth Thursday—meeting sites vary).

MONTREAL (First Wednesday—Bill Wong's Restaurant). R. FERRIS, Canbro Ltd., 29 E. Park St., Valleyfield, Que., Canada J6S 1P8.

NEW ENGLAND (Third Thursday—LeChateau Restaurant, Waltham, MA). ROGER WOODHULL, California Products Corp., P.O. Box 569, Cambridge, MA 02139.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). DAVID PENICHTER, D.H. Litter Co., Inc., 116 E. 16th St., New York, NY 10003.

NORTHWESTERN (Tuesday after first Monday—Jax Cafe, Minneapolis, MN). RICHARD KARSTAD, Ceramic Industrial Coatings, 325 Hwy. #52-South, Osseo, MN 55396.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). JOHN DALLER, McCloskey Corp., 4155 N.W. Yeon, Portland, OR 97210.

PHILADELPHIA (Second Thursday—Dugan's Restaurant, Philadelphia, PA). LAWRENCE J. KELLY, Peltz-Rowley Chemicals, 5700 Tacony St., Philadelphia, PA 19135.

PIEDMONT (Third Wednesday—Howard Johnson's, Brentwood Exit of I-85, High Point, NC). CHARLES HOWARD, DeSoto, Inc., P.O. Box 22105, Greensboro, NC 27420.

PITTSBURGH (First Monday—Montemurro's, Sharpsburg, PA). RICHARD G. MARCI, Royston Laboratories, 128 First St., Pittsburgh, PA 15238.

ROCKY MOUNTAIN (Monday following first Wednesday—Bernard's, Arvada, CO). MARCY S. BAUGH, Hutson Industries, 60 Tejon St., Denver, CO 80223.

ST. LOUIS (Third Tuesday—Engineers Club). JAMES N. MCDERBY, F.R. Hall & Co., 6300 Bartmer Ind. Dr., St. Louis, MO 63130.

SOUTHERN (Gulf Coast Section—Third Thursday; Central Florida Section—Third Thursday after first Monday; Atlanta Section—Third Thursday; Memphis Section bi-monthly on Second Tuesday; Miami Section—Tuesday prior to Central Florida Section—R. SCOTT MCKENZIE, Southern Coatings & Chemicals, P.O. Box 2688, Sumter, SC 29150.

TORONTO (Second Monday—Cambridge Motor Hotel). LARRY HAM, Stochem Inc., 5200 Dixie Rd., Suite 201, Mississauga, Ont., Canada L4W 1E4.

WESTERN NEW YORK (Third Tuesday—meeting sites vary). MARK K. MARKOFF, Spencer Kellogg Prods., NL Chemicals/NL Industries, Inc., 4201 Genessee St., Buffalo, NY 14225.

system which includes a cleaner/phosphate, a rinse, and a sealer stage. The other system contains five stages comprised of an alkaline cleaner, water rinse, cleaner/phosphatize, rinse, and sealer.

The speaker also described some of the quick tests which can be used to determine if your metal has been properly treated. The simplest test is to observe whether the coating can hold a solid film of water for 30 seconds. Another test is to spray a fine mist on the coating and observe whether the drops run together. A slightly more complicated test involves using a mild acid solution (pH 4) and observing whether the coating can hold a solid film for 30 seconds. All of these tests, explained Mr. Witke, tell if your surface is clean.

Today, deionized water rinses have become increasingly important because with the thin film coatings used today, water spots will show up or even be magnified.

In conclusion, Mr. Witke noted that, with both phosphate systems, organic and/or metallic accelerators can significantly affect the performance of the conversion coatings.

The second presentation of the evening was given by Ron Schara, of the Minneapolis *Star & Tribune*. He spoke on "SPRING 'WALLEYE' FISHING TIPS."

JOAN B. LAMBERG, *Secretary*

PITTSBURGH ..... MAY

"Reflections on the Phenomenon of Fading"

Officer nominations for the 1986-87 year were read: President—Anthony J. Isacco II, of Puritan Paint & Oil Co.; Vice-President—Mark D. Troutman, of Bradley Paint Co.; Secretary—Rich Marci, of Royston Laboratories; and Treasurer—Ed Threlkeld, of Ashland Chemical Co. Votes were taken and the nominees were unanimously elected to the posts.

Educational Chairman, Don Boyd, of PPG Industries, Inc., introduced the two recipients of the Society's Award given at the Buhl Science Fair for projects related to the coatings industry. The junior winner was Heather Fugger, of Monroeville High School, whose project was entitled "Effects of Moisture on Wood." The senior winner was James Knapton, of McKeesport High School, for his project on "Effect of Salt on Car Paint." Both students received monetary awards donated by the Society.

The guest speaker was Ruth Johnston-Feller, of Mellon Institute. Mrs. Feller gave a slide presentation and talk entitled "REFLECTIONS ON THE PHENOMENON OF FADING." This presentation was published in the May 1986 issue of the JCT.

MARK D. TROUTMAN, *Secretary*

BIRMINGHAM

Active

LEE, BRIAN D.—Holden Surface Coatings Ltd., Birmingham.

C-D-I-C

Active

HARMEYER, TERESA L.—Talsol Corp., Cincinnati, OH.

KUBALAK, ANDREW—Majestic Paint Co., Columbus, OH.

PERRY, CHRISTOPHER W. II—Beecham Home Improvements, Tipp City, OH.

Associate

KNECHTLY, REX E.—Reichhold Chemicals, Inc., Columbus, OH.

NEEB, JOHN B.—Ashland Chemical Co., Cincinnati, OH.

CHICAGO

Active

ANDERSON, JEFFREY L.—S.C. Johnson & Son, Inc., Racine, WI.

BENDER, HOWARD S.—Masonite Corp., St. Charles, IL.

DADE, RONALD J.—Sherwin-Williams Co., Chicago, IL.

DOMINGO, JOSE L.—Service Coatings, Harvey, IL.

DONOVAN, MARCELLA G.—General Paint & Chemical Co., Cary, IL.

FUHS, THEODORE J.—General Paint & Chemical Co., Cary.

KAWA, MICHELLE L.—Universal Chemicals, Elk Grove Village, IL.

KESTNER, ANN E.—Union Carbide Corp., Alsip, IL.

KIRKEGAARD, PHILLIP—Illinois Bronze Paint Co., Lake Zurich, IL.

LENCIONI, LEONARD—The Enterprise Cos., Chicago.

LYTTON, RICHARD N.—Markal Co., Chicago.

MICHAEL, WILLIAM E.—PPG Industries, Inc., Oak Creek, WI.

PLACEY, ALBERT W.—Polychrome Chemical Corp., Chicago.

POMYKALA, RICHARD—DeSoto, Inc., Des Plaines, IL.

RICH, ART F.—DeSoto, Inc., Des Plaines.

VAN HEULE, JIM—Rockford Chem Coatings, Rockford, IL.

WHITMAN, WAYNE—General Paint & Chemical Co., Cary.

YGLESIAS, PATRICIA J.—Union Carbide Corp., Alsip.

Associate

BATT, JAMES M.—Union Carbide Corp., Chicago, IL.

CUCA, GERALD—Fitz Chem. Corp., Chicago.

GOLD, BARRY A.—Reichhold Chemicals, Inc., Oak Brook, IL.

HORATH, RAYMOND F.—BASF Corp., Palatine, IL.

LEE, JIMMIE S.—DuPont Co., Hoffman Estates, IL.

LEONLY, WILLIAM W.—DuPont Co., Hoffman Estates.

WALTENSPIEL, HERB F.—Kay-Fries, Inc., Berwyn, IL.

WRIGHT, MICHAEL D.—American Hoechst Corp., Wood Dale, IL.

NORTHWESTERN

Active

WERNER, TODD A.—Cargill, Inc., Minneapolis, MN.

Associate

BURKHARD, D. RICHARD—Henley & Company, Genoa, IL.

Educator/Student

MCDONALD, WILLIAM F.—North Dakota State University, Fargo, ND.
ROJAS, EVELISSE M.—North Dakota State University, Fargo.
ROJAS, RAMON A.—North Dakota State University, Fargo.

PHILADELPHIA

Active

EBERHARDT, GARY L.—Thoro Systems Product, Bristol, PA.

Associate

CAMPBELL, RICHARD G.—Loos & Dilworth, Inc., Bristol, PA.
CARROLL, ROBERT E.—R.E. Carroll Inc., Trenton, NJ.
DOMEN, VICTOR J.—Quaker City Chemicals Inc., Philadelphia, PA.
FAULKNER, THOMAS D.—Heraeus Inc., Equipment Div., W. Conshohocken, PA.
GLAVIN, MICHAEL J.—M.A. Bruder & Sons Inc., Broomall, PA.
HILFIKER, FRANK R.—CIBA-GEIGY Corp., Newport, DE.
PATRICK, GEORGE R.—CIBA-GEIGY Corp., Newport.
RUGGIANO, MICHAEL A.—M.A. Bruder & Sons Inc., Broomall.
WHITELEY, RICHARD J.—Loos & Dilworth, Inc., Bristol.

PIEDMONT

Active

BRIGGS, VON W.—Reliance Universal, Inc., High Point, NC.
OCAMPO, DON O.—Rexham Corp., Matthews, NC.
ROBERTS, ROBERT—Consultant, Charlotte, NC.

Associate

CHICELLA, DONALD V.—Rieke Corp., Linden, NJ.
LINDELL, MICHAEL G.—Environmental Options, Roanoke, VA.
NUTTALL, WILLIAM E.—Burris Chemical, Inc., Charlotte, NC.

PITTSBURGH

Active

GEIER, RICHARD P.—V.L. Towner, Pittsburgh, PA.
RAILSBACK, PAUL T.—Sauereisen Cements Co., Pittsburgh.
STURM, JEFFREY C.—Koppers Co., Inc., Monroeville, PA.

Associate

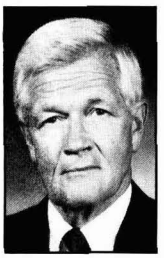
POWELL, JOSEPH J.—Union Carbide Corp., Latrobe, PA.

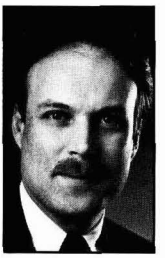
ST. LOUIS

Active

BROWN, KENNETH J. SR.—Carboline Co., St. Louis, MO.
GIERY, ROBERT J.—Omni Industrial Coatings Inc., St. Louis.
KEMPER, JOHN W.—Sinnett-Elpaco Coatings Corp., St. Louis.
LINDSLEY, JAMES B.—Lanchem Corp., E. St. Louis, MO.
PETERSEN, CARL E.—P.D. George Co., St. Louis.
PHELPS, ROBERT B.—P.D. George Co., St. Louis.
POTTS, KEITH B.—Futura Coatings, Inc., Hazelwood, MO.
SCHINNER, JOSEPH R.—Sterling Lacquer Mfg. Co., St. Louis.
SCHWEIKART, JAMES W.—Lanchem Corp., E. St. Louis.
SHAH, DALE O.—Dennis Chemical Co., St. Louis.
TAYLOR, TIMOTHY A.—Spatz Paint, Inc., St. Louis.


J.A. Gordon, Jr.


J.M. Williams


D.A. Lillback


J.J. Compass

John A. Gordon, Jr., who has been associated with the coatings industry for nearly a half-century and is still going strong, was elected an Honorary Member of the Los Angeles Society on May 14, 1986. He was President of the Society in 1975 and for many years has been active in environmental matters on the West Coast.

He was graduated from San Diego State College with a B.A. Degree in Chemistry. His first employer was Cal Ink Co. in San Francisco and later, National Lead Co. in the same city. He was with Monsanto Co. in Santa Clara, CA, and Springfield, MA, for 10 years. Then followed four years with Technical Coatings Co. in Santa Clara and 10 years with (what is now) Unocal Chemicals Div. of Union Oil Co. in Charlotte, NC, and La Mirada, CA.

In 1978, Mr. Gordon joined the University of Missouri–Rolla as Director and Lecturer of the Paint Short Courses. He moved to a similar position with Eastern Michigan University in 1985.

Promotions of **John Becker** to Western Sales Manager and **Victor Herbert** to Eastern Sales Manager have been announced by Union Process, Inc., Akron, OH. Both men will be responsible for supervising sales and marketing in the U.S. and Canada through a network of manufacturers representatives.

Arnold M. Gavin, President of EMI EX/IM Corp., Scottsdale, AR, has been elected President of the American Oil Chemists' Society for 1986-87. Mr. Gavin succeeds **Joyce Beare-Rogers,** of the Canadian Department of Health and Welfare. He and the other officers were installed at the organization's 77th annual meeting. Other officers elected included: Vice-President—**Robert Hastert,** Harshaw/Filtrol Partnership; Treasurer—**Timothy L. Mounts,** USDA; and Secretary—**David R. Erickson,** American Soybean Association.

David Lunzer has joined UCAR Emulsion Systems, Union Carbide Corp., Cary, NC, as Staff Chemist at its Torrance, CA, facility. Mr. Lunzer will provide technical service support to West Coast customers and assist in the firm's product development and process improvement activities.

James M. Williams has been appointed Executive Vice-President of Chemcentral Corp., Chicago, IL. Mr. Williams succeeds **D.J. Resch** who retired in 1985.

David A. Lillback has been named Product Manager, dispersions at the Harshaw/Filtrol Partnership, Cleveland, OH. He joined the firm in 1981 and has held the position of Production Supervisor, industrial chemicals.

DeSoto's Research Center, Des Plaines, IL, awarded **Gregory Shay, Arthur Rich,** and **James Kail** the prestigious "Researcher of the Year Award." These three scientists, with their expertise in polymer and coatings science, were honored as a team that developed new thickener technology for latex paint formulations. All three are members of the Chicago Society.

In addition, DeSoto has appointed **Ron Lewarchik** to Manager of Industrial Research. Mr. Lewarchik, also a member of the Chicago Society, will be responsible for the activities of the firm's Aerospace, Automotive, and Coil Research and Development Groups.

The Coatings Division of Ferro Corp., Cleveland, OH, has promoted **Kevin P. McLaughlin** to the position of a Senior Market Development Representative. He will be responsible for sales and technical service of powder coatings to the automotive market.

In addition, Ferro's Coatings Division has named **Richard A. Holt** to the post of District Sales Manager for FRP coatings, western region, and **Jack B. Branch** to Sales/Service Representative for powder coatings, western region.

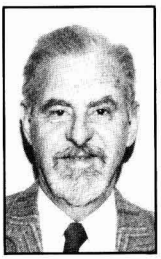
Reichhold Chemicals, Inc., headquartered in White Plains, NY, has appointed **James J. Compass** to Division President of the newly formed Chemical Coatings Div. Mr. Compass will serve from the division's headquarters in Pensacola, FL.

W.H. Clark, Jr., Chairman of the Board, President and Chief Executive Officer of Nalco Chemical Co., has been elected Chairman of the Board of the Chemical Manufacturers Association. He succeeds **George J. Sella, Jr.,** Chairman of the Board, President and Chief Executive Officer of American Cyanamid Co.

Robert C. Forney, of E.I. du Pont de Nemours & Co., was elected Vice-Chairman of the Board and **Harold A. Sorgenti,** of ARCO Chemical Co., was named Chairman of the Executive Committee.

The "Peltz/Rowley Chemical Award to Past-Presidents" was introduced at the annual awards dinner of the Philadelphia Society in April. Plaques were prepared by the Peltz-Rowley Chemical Co. for 30 Past-Presidents of the Society. Thirteen were present at the affair to accept their plaques: **H.A. McConaghie, P.J. Whiteway, Jr., D.J. Fritz, J.R. Kiefer, Jr., R.C. Sonntag, S. LeSota, W.A. Kraus, L.S. Sander, C.W. Fuller, B. Oppenheim, W. Johnston, F. Bartusevic,** and **W. Georgov.** In the future, the plaque will be presented annually to the immediate Past-President.

Wexler Named Recipient of New York Society's PaVaC Award



Marvin Wexler, of Troy Chemical Corp., Newark, NJ, received the New York Society's coveted PaVaC Award on May 13, 1986, for "outstanding contributions to the advancement of the Protective Coatings Industry and the New York Society for Coatings Technology." He was the 39th member to be so honored since the award was established in 1951.

Mr. Wexler is a native New Yorker and a graduate of the City College of New York with a B.S. Degree in Chemistry. He is a Purple Heart veteran of World War II, having served with the 94th Infantry Div. in Europe.

His career in the coatings industry began in 1947 as a Control Chemist with 20th Century Paint & Varnish Co. From 1951 to 1968, he was associated with H. Kohnstamm Co., Subox, Inc., and Luminall Paints. He joined Lehman Bros. in 1969 as Chief Chemist and moved to his present position in technical sales with Troy, in 1977.

Mr. Wexler joined the New York Society in 1955 and subsequently served on many committees prior to going through the Chairs. He was President in 1972.

He is still active, particularly on the Scholarship Committee which gave him the opportunity to visit high schools and lecture on careers in the coatings industry. A long-time member of the Technical Committee, he received the Society's Kienle Award in 1961.

Rocky A. Courtain has joined the headquarters staff of Myers Engineering, Bell, CA, as a Sales Engineer. Mr. Courtain has been associated with the mixer/dispenser industry for the past 14 years.

Chemray Coatings Corp., Kenilworth, NJ, has promoted **John S. Bilinski** to the position of President. Mr. Bilinski joined the company in 1970 and has over 20 years of experience in the paint industry.

Obituary

Emory G.A. Fleming, retired Technical Director of The McCloskey Corp., Philadelphia, PA, died on June 8, 1986. He was 78.

He received his formal education in chemistry at the Evening College of Drexel University, finishing in 1932. He joined McCloskey in 1942 as Chief Chemist in the research and development laboratory, and retired in 1973.

Mr. Fleming was President of the Philadelphia Society for Coatings Technology in 1955. He was Chairman of the Technical Committee from 1964-67 and chaired the seminar in 1969. He received the Society's Liberty Bell Award in 1964 and Technical Committee Award in 1973.

Don Kressin, 49, Past-President of the Western New York Society (1984-85) died on May 13, 1986. Mr. Kressin had worked for Lucidol Division of Pennwalt from 1962-72 and was last employed with Spencer Kellogg Products/NL Chemicals, Inc. During his career there, he held positions as Technical Service Representative and Project Chemist.

ACS Particle Size Analysis Workshop To be Conducted, September 6-7

The American Chemical Society will conduct a two-day workshop on "Modern Methods of Particle Size Analysis," on September 6-7, in conjunction with the annual meeting of the Division of Polymeric Materials: Science and Technology, in Anaheim, CA.

Directed towards persons who require a basic understanding of modern particle size analysis methods, the workshop offers both lectures and demonstrations of some selected state-of-the-art particle size techniques. Lectures will be presented on the following topics: particle size distribution concepts and statistics; classical methods, including turbidity, angular scattering, diffraction, electro-zone sensing, microscopy, and quality control methods; sedimentation methods; photon correlation spectroscopy; particle and droplet sizing; column chromatography analysis; field flow fractionation methods; and image analysis.

Drs. Keith Beddow, University of Iowa; J. Calvin Giddings, University of Utah; Anthony J. McHugh, University of Illinois; Theodore Provder, Glidden Coatings and Resins, Div. of SCM Corp.; and Bruce Weiner, Brookhaven Instruments Corp. will deliver the lectures.

The course is designed for those scientists, engineers, analytical chemists, product development specialists, technical managers and other technical professionals who engage in characterizing, quantitating, evaluating and controlling the quality of particulates, particulate formulations, suspensions and dispersions, including latex, pigments, paints, and inks. Participants should have a technical, chemical, or engineering degree or equivalent experience.

Fee for the workshop is $350, which includes lecture notes, beverage breaks and two lunches. There is a limited registration.

Details and additional information can be obtained from Dr. Theodore Provder, Glidden Coatings and Resins, Div. of SCM Corp., 16651 Sprague Rd., Strongsville, OH 44136.

Kent State University Schedules Two Coatings Courses for October

The Coatings Division of the Chemistry Department at Kent State University will sponsor two coatings courses in October 1986, at the campus in Kent, OH.

"Painting Processes: Industrial Paint Technology" will be held October 15-16, and "Introduction to Coatings Technology" will be conducted October 20-23. Both programs are designed for persons engaged in formulation, testing, research, manufacture, and sales of organic coating materials.

Professor Norman R. Roobol, of the GMI Engineering Institute and NR Consulting Services will provide the lectures of the first course. Topics to be covered include: modern industrial coatings methods, paint application methods and cure, as well as safety, economic, energy, and ecological considerations for the various methods.

The second course features Professor John A. Gordon, of Eastern Michigan University and Pacific Technical Consultants. Many raw materials will be discussed, along with their functions in both architectural and industrial finishes. He will also detail regulatory restrictions, and economic forces and other factors which influence the composition and performance of coatings. In addition, Dr. Gordon will provide formulating techniques, describe manufacture and testing, and give new trends in coating materials.

Complete details on both courses are available from Carl J. Knauss, Program Chairman, Kent State University, Chemistry Dept., Kent, OH 44242.

OCCA's Surfex '86 Exhibition Attracts Attendance of 1,700

The Surfex '86 exhibition of the Oil and Colour Chemists' Association attracted a registered attendance of 1,694 to the Harrogate International Conference Center, Yorkshire, England, May 14-15.

Surfex is an exhibition of raw materials and equipment used in the manufacture of paints, printing inks, and allied products.

Surfex '88 will also be held at the Harrogate Center, June 15-16. For information write to: Surfex '88, P.O. Box 161, Wigan WN2 5TG, England.

CALL FOR PAPERS

Water-Borne and Higher-Solids Coatings Symposium
New Orleans, LA
February 25-27, 1987

The Southern Society for Coatings Technology and the Department of Polymer Science at the University of Southern Mississippi invite all interested persons to submit papers for presentation at the 14th Annual Water-Borne and Higher-Solids Coatings Symposium.

Papers relating to the chemistry, formulation, and marketing of water-borne, higher-solids, and other advanced coating systems, as well as engineering aspects of coating systems or solvent abatement are solicited.

Papers to be presented at the symposium will be chosen based on abstracts. Title and abstract should be submitted by *September 30, 1986* to:

Dr. Gordon L. Nelson, Chairman
Department of Polymer Science
University of Southern Mississippi
Southern Station Box 10076
Hattiesburg, MS 39406-0076.

The completed paper should be submitted by December 15, 1986. It is preferred that all papers be original and of scientific value.

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Literature

Adhesion Material

A high performance vehicle system, based on new technology, which yields 4H plus hardness and 160 in.-lbs impact resistance is described in a technical bulletin. This one-component material is designed to adhere well to all substrates with corrosion resistance over treated or untreated steel or plastics. For further information, contact Denomi Corp., 3407 Kilmer Ln. N., Plymouth, MN 55441.

Cartridge Filters

Material selection, pressure losses, corrosion allowances, and cartridge sealing systems are among the many topics discussed in a new 30-page cartridge filter housings guide. The guide is designed to provide both the first time user, or the seasoned specifier of filtration products with a quick reference on the technical considerations in filter housing selection. Copies are available from the Industrial Marketing Dept., Filterite, 2033 Greenspring Dr., Timonium, MD 21093.

Specialty Chemicals

Chemical analysis, properties, and particle size distribution of new high purity aluminas are presented in a new comprehensive 16-page catalog. Also included in the catalog are descriptions and typical properties of a complete line of specialty chemicals. Copies of the "Product Catalog" can be obtained from ARCO Specialty Chemicals, 3801 West Chester Pike, Newtown Square, PA 19073.

Lead for Corrosion-Resistant Applications

A 132-page soft-cover guide which familiarizes engineers and engineering students with corrosion resistance, design and fabrication data on lead and lead-based equipment is now available. The fully-illustrated book presents the latest information on lead's use by chemical processors and other industries where corrosion is a problem. Included are discussions of applications, qualitative and categorical chemical data, basic design considerations, construction, and chapters on inspection and maintenance. "Lead for Corrosion Resistant Applications" (publication number H-6) is available free of charge from Association Services Dept., Lead Industries Association, Inc., 292 Madison Ave., New York, NY 10017.

Pigments Industry Study

A new report provides an overall assessment of pigment markets in the U.S., western Europe, and Japan—the three regions which together produce and consume more than 75% of the world's pigments. In-depth coverage of producers, products, consumption patterns and processes are provided for iron oxides, chromes, mixed metal oxides, and organics. For further information on "Overview of the Worldwide Pigments Industry," contact Thomas C. Gunn, Director, Chemical Economics Handbook Program, SRI International, 333 Ravenswood Ave., Menlo Park, CA 94025.

Alkyd Resin

A new high solids baking alkyd resin is the subject of a recently released product bulletin. For full details, contact U.S. Polymers, Inc., 300 East Prim St., St. Louis, MO 63111.

Water-borne Vinyl Resins

A new line of water-borne vinyl resin dispersions for printing inks has been introduced in literature. Developed for gravure and flexographic applications, these dispersions are compatible with acrylics and other resins currently used in water-borne inks. For more information, write to Union Carbide Corp., UCAR Coatings Resins, Dept. L4489, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Additives Wall Chart

A wall chart/selector guide to a company's additives for industrial coatings is now being offered. The chart includes the entire line of anti-settling, anti-float, thixotropic, dispersing, anti-cratering, and anti-mar agents and defoamers. Also covered are products for use in solvent, water reducible and high-solids systems. For additional information, contact Manager of Marketing Services, Troy Chemical Corp., One Avenue L, Newark, NJ 07105.

Drum Fillers

A line of net weight drum fillers is described in technical literature. Standard features of the drum fillers include electronic console with digital display, target selection keypad, and signals for fast and slow filling. Additional details may be obtained by contacting Serac, Inc., Executive Plaza, 510 North Church, Rockford, IL 61103.

Rheology Modifier

Literature which describes a new paint rheology modifier that reportedly improves brush drag and reduces roller spatter is now available. The modifier is designed specifically to improve both the application and curing properties of paint, and at the same time, improve leveling properties to help minimize roller and brush marks. For technical information regarding DSX-1514, write Diamond Shamrock Process Chemicals Division, 350 Mt. Kemble Ave., CN-1931, Morristown, NJ 07960-1931.

Acrylic Polymers

A recently issued technical bulletin details the features of newly developed acrylic polymers. These coatings are designed to offer adhesion to treated and untreated metals, flexibility, solvent-resistance, metal protection, gloss, and depth of image, as well as hot print and block resistant capabilities. For additional information, contact Rohm and Haas Co., Marketing Services Dept., Independence Mall West, Philadelphia, PA 19105.

Co-axial Disperser

A new lab/pilot dual drive co-axial disperser designed to handle small batch dispersing or mixing up to 10 gallons is the subject of literature. Applications include scale-up exercises, trial batching of new products, and daily production of small batches of putties, epoxies, adhesives, flush pigments, inks, resins, and caulks. For details, write to Schold Machine Co., Southern Manufacturing, 10590 Oak St. NE, St. Petersburg, FL 33702.

Coatings Evaluation Techniques

A recently released application note describes the use of electrochemical impedance techniques to evaluate corrosion protection of organic coatings on metallic substrates. Prepared in accordance with Lehigh University's Center for Surface and Coatings Research, the note reviews a variety of approaches to coatings evaluation and illustrates the benefits of using electrochemical impedance tests. Inquiries for copies should be addressed to EG&G Princeton Applied Research, Electrochemical Instruments Div., CN 5206, Princeton, NJ 08540.

Letters to the Editor

May JCT Draws Rave Reviews

To the Editor:

Congratulations on the excellent choice of technical papers published in the recent May 1986 issue of the JCT!

In the past I have been one of many Society members who have criticized the excessive publication of 'highly' technical Basic-Research type papers (in the JCT). However, I thoroughly enjoyed reading with ease all of the quite practical and very interesting papers in the May '86 issue.

Please try to continue this pattern, at least after every two or three issues!

Congratulations to Tom Miranda and the others on the Publications Committee, as well.

R.C. Pierrehumbert
(Retired Honorary Member
—Dallas Society)

To the Editor:

Your May 1986 issue was packed with very good technical information.

It was by far one of your better issues.

Congratulations!

Eric Simon
Southern Texas Chemical Corp.

Book Review

PHYSICAL PROPERTIES OF POLYMERS

By
James E. Mark
Adi Eisenberg
William W. Graessley
Leo Mandelkern
Jack L. Koenig

Published by
American Chemical Society
Washington, D.C.
1984
246 pages, $44.95

Reviewed by
Percy E. Pierce
PPG Industries, Inc.
Allison Park, PA

The purpose of this book is to provide information on recent advances in the physical chemistry of polymers that are of importance to the utilization of polymeric materials. The five chapters of the book, each contributed by a different author, cover rubber elasticity, the glassy, viscoelastic, and crystalline states in polymers, and polymer spectroscopy.

Each chapter covers an introduction to basic concepts, detailed descriptions of current topics of importance, comments on unsolved problems, and projections for future research. The material presented is derived from an American Chemical Society short course developed through a series of oral, audio, and teleconference presentations.

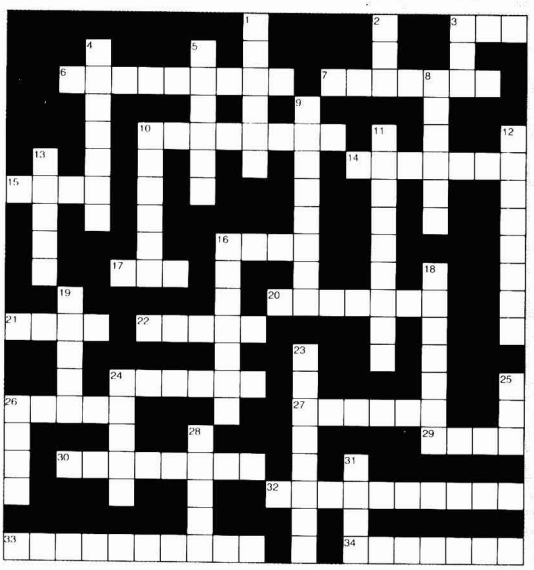
The coverage and treatment of topics is directed primarily toward those working with high polymers, such as elastomers and structural polymers. However, much of the information developed is relevant to or can be adapted to coatings problems. The sections on rubber elasticity, the glassy state, and viscoelasticity are especially recommended to coating technologists.

The chapters are reproduced from typed text with a wide margin suitable for reader notes. The figures and tables are taken from different sources, but are readable and relate well to the text. Each chapter is well documented with references and most chapters contain a selected bibliography for further reading.

The book is neither a basic textbook nor a specialized monograph. Instead, it fulfills the valuable function of leading the reader from the relevant basics through the intricacies of their application to real world problems and on to the frontier of unsolved problems. It thus bridges the gap between conventional textbooks and specialized monographs. It will be especially useful to individuals encountering polymer problems for the first time, those requiring a quick fix of information, or persons needing a refresher and update on the specific topics covered.

CrossLinks

by Earl Hill



Solution to be published in September issue.

No. 13

ACROSS

3. Large English chemical company
6. Plaster substrate substitute, e.g.
7. Turpentine alcohol
10. Natural resin, S____
14. Cyclohexanol (syn)
15. Synonym for 1 down
16. Ink build-up (Printing)
17. Printing fluid
20. Well known color comparator
21. Printing defect
22. Hardness
24. Pebble-like finish
26. English (Br.) Journal
27. Varnish clarifying process
29. Enamel surface attribute
30. Acidic condensation resin
32. Luminance booster
33. Flow curve
34. Iron corrosion

DOWN

1. Coarse single yarn fabric
2. G____ cotton
3. Chemical prefix
4. Thin protrusions on blasted metal
5. Famous for driers
8. Petroleum hydrocarbon, C_6
9. Type of printed image
10. Silk ____
11. Weed wacker
12. Unique form of printing
13. Glazing material
16. Chemical element grouping
18. Supporting timber (Const.)
19. International chemistry organization
23. Type of oven
24. APHA color scale
25. Initial ____ (Abr.)
26. Window framing
28. Amount of reflection
31. Sea weed gel substance

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact FSCT, 1315 Walnut St., Philadelphia, PA 19107 (215-545-1506).

1986

(Sept. 23-24)—Meeting of Technical Advisory Committee with Society Technical Committee Chairmen. Louisville, KY.

(Nov. 5-7)—64th Annual Meeting and 51st Paint Industries' Show. World Congress Center, Atlanta, GA.

1987

(Apr. 29-May 2)—Combined Federation Spring Week and Pacific Northwest Society Symposium. The Westin Hotel, Seattle, WA. FSCT Society Officers Meeting on April 29; FSCT Board of Directors Meeting on April 30; Seminar on May 1-2. Concludes with a dinner dance on May 2.

(Oct. 5-7)—65th Annual Meeting and 52nd Paint Industries' Show. Convention Center, Dallas, TX.

SPECIAL SOCIETY MEETINGS

1987

(Feb. 23-25)—Southern Society 14th Annual Water-Borne and Higher-Solids Coatings Symposium. New Orleans, LA. (Dr. Gordon L. Nelson, Chairman, Department of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Feb. 23-25)—Western Coatings Societies' Symposium and Show, Monterey Convention Center, Monterey, CA. (Barry Adler, Royell, Inc., 1150 Hamilton Ct., Menlo Park, CA 94025).

(Apr. 1-3)—Southern Society. Annual Meeting. Dutch Inn, Lake Buena Vista, FL. (C. Lewis Davis, 802 Black Duck Dr., Port Orange, FL 32019).

(Apr. 29-May 2)—Combined Federation Spring Week and Pacific Northwest Society Symposium. The Westin Hotel, Seattle, WA. April 29—FSCT Society Officers Meeting; April 30—FSCT Board of Directors Meeting; PNW Golf; PNW Evening Activities; May 1—Seminar; May 2—Seminar continued; PNW Sports Competition; Dinner Dance.

(June 12-13)—Joint meeting of St. Louis and Kansas City Societies. Holiday Inn, Lake of Ozarks. (A.E. Zanardi, Thermal Science, Inc., 2200 Cassens Dr., Fenton, MO 63026).

1988

(Apr. 13-15)—Southern Society. Annual Meeting. Charleston, SC. (Scott McKenzie, Southern Coatings Co., P.O. Box 160, Sumter, SC 29150).

(Apr. 28-May 1)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C., Canada. (Yvon Poitras, General Paint Corp., 950 Raymur Ave., Vancouver, B.C., Canada V6A 3L5).

OTHER ORGANIZATIONS

1986

(Sept. 3-4)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Lancaster, PA. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Sept. 3-5)—"Estimating for Painting Contractors and Maintenance Engineers" Short Course. Univ. of Missouri-Rolla, MO. (Prof. James O. Stoffer, Dept. of Chemistry, Univ. of Missouri-Rolla, Rolla, MO 65401).

(Sept. 6-7)—Workshop on "Modern Methods of Particle Size Analysis." Sponsored by ACS Div. of Polymeric Materials: Science and Engineering. Anaheim, CA. (Dr. Theodore Provder, Glidden Coatings and Resins, Div. of SCM Corp., 16651 Sprague Rd., Strongsville, OH 44136).

(Sept. 7-12)—Symposium on High Solids Coatings. Sponsored by the ACS Div. of Polymeric Materials: Science and Engineering. Anaheim, CA. (George R. Pilcher, Hanna Chemical Coatings Corp., P.O. Box 147, Columbus, OH 43216).

(Sept. 7-12)—192nd National Meeting. American Chemical Society. Anaheim, CA. (ACS, Barbara Hodson, 1155 16th St. N.W., Washington, D.C. 20036).

(Sept. 9-11)—RadCure '86—Association for Finishing Processes of the Society of Manufacturing Engineers Conference and Exposition. Baltimore Convention Center, Baltimore, MD. (AFP/SME Public Relations, Society of Manufacturing Engineers, One SME Dr., Dearborn, MI 48121).

(Sept. 15-17)—13th International Naval Stores Meeting. Waldorf-Astoria, New York, NY. (Douglas E. Campbell, Executive Director, Pulp Chemicals Assn., 60 E. 42nd St., New York, NY).

(Sept. 15-19)—53rd Introductory Short Course on "The Basic Composition of Coatings." Univ. of Missouri-Rolla, MO. (Prof. James O. Stoffer, Dept. of Chemistry, Univ. of Missouri-Rolla, Rolla, MO 65401).

(Sept. 18-19)—"Radiation Curing of Polymers" Symposium sponsored by the Royal Society of Chemistry, Industrial Div., Northwest Region. Lancaster University, England. (Dr. D.R. Randell, CIBA-GEIGY Industrial Chemicals, Tenax Rd., Trafford Park, Manchester M17 1WT, England).

(Sept. 21-23)—Canadian Paint and Coatings Association. 74th Annual Convention. Hilton Hotel, Quebec City, Que., Canada. (CPCA, 515 St. Catherine St. W, Montreal, Que., Canada H3B 1B4).

(Sept. 21-26)—XVIIIth Congress of FATIPEC. (Federation of Associations of Technicians in the Paint, Varnish, and Printing Ink Industries of Continental Europe). Venice, Italy. (C. Bourgery, Secretary General of FATIPEC, 76 Blvd. Pereire, 75017 Paris, France-or-Amleto Poluzzi, AITIVA, Piazzale R. Morandi 2,20121 Milano, Italy).

(Sept. 22-25)—"Your Chosen Finish." FINSTRAT Conference and Exposition sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Long Beach, CA. (Gerri Andrews, SME, Public Relations Dept., One SME Dr., P.O. Box 930, Dearborn, MI 48121).

(Sept. 23-25)—"Industrial Painting Processes" clinic sponsored by AFP/SME. Indianapolis, IN. (Diane Korona, SME Special Programs Div., SEM Dr., P.O. Box 930, Dearborn, MI 48121).

(Sept. 29-Oct. 3)—13th Introductory Short Course on "Paint Formulation." Univ. of Missouri-Rolla, Rolla, MO. (Prof. James O. Stoffer, Dept. of Chemistry, Univ. of Missouri-Rolla, Rolla, MO 65401).

(Oct. 1-2)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Minneapolis, MN. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Oct. 8-10)—SPI/SPE Plastics Show and Conference—South. Georgia World Congress Center, Atlanta, GA. (Jeffrey A. Forger, Conference and Programs Director, SPE, 14 Fairfield Dr., Brookfield Center, CT 06805-0403).

(Oct. 13-17)—"Physical Testing of Paints & Coatings" Short Course. Univ. of Missouri-Rolla, Rolla, MO. (Prof. James O. Stoffer, Dept. of Chemistry, Univ. of Missouri-Rolla, Rolla, MO 65401).

(Oct. 15-16)—"Industrial Paint Application Technology" Course. Sponsored by Kent State University, Kent, OH. (Dr. Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(Oct. 20-23)—"Introduction to Coatings Technology" Course. Sponsored by Kent State University. Kent, OH. (Dr. Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(Oct. 27-28)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Dalton, GA. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Oct. 27-31)—"Modern Instrumentation for the Polymer & Coatings Industry" Short Course. Univ. of Missouri-Rolla, Rolla, MO. (Prof. James O. Stoffer, Dept. of Chemistry, Univ. of Missouri-Rolla, Rolla, MO 65401).

(Nov. 3-4)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Atlanta, GA. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Nov. 3-5)—Paint Research Association. Sixth International Conference, Sheraton Hotel, Brussels, Belgium. (D. Dasgupta, PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD, England).

(Nov. 3-5)—Annual Meeting of National Paint and Coatings Association. Hilton Hotel, Atlanta, GA. (Karen Bradley, NPCA, 1500 Rhode Island Ave., Washington, D.C. 20005).

(Nov. 5-6)—Ninth Resins and Pigments Exhibition. Brussels, Belgium. (Exhibition Director, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 21-23)—39th Annual Show and Convention of National Decorating Products Association. Cervantes Convention Center, St. Louis, MO. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

(Dec. 3-5)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Orlando, FL. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

1987

(Jan. 19-22)—Annual Meeting and Symposium of Steel Structures Painting Council. Fairmont Hotel, New Orleans, LA. (James G. Busse, SSPC, 4400 Fifth Avenue, Pittsburgh, PA 15213).

(Feb. 4-6)—"Formula" Forum on Chemical Specialties sponsored by the Societe Francaise de Chimie, Nice. (Societe Francaise de Chimie, Departement Congres, 250 rue Saint Jacques 75005 Paris, France).

(Feb. 8-11)—Inter-Society Color Council. Williamsburg Conference on "Geometric Aspects of Appearance." The Lodge, Colonial Williamsburg, VA. (Dr. D.H. Alman, Du Pont Co., P.O. Box 2802, Troy, MI 48007).

(Mar. 9-13)—CORROSION/87. National Association of Corrosion Engineers. Moscone Center, San Francisco, CA. (NACE, P.O. Box 218340, Houston, TX 77218).

(Mar. 17-19)—Powder Coatings '87. G-MEX Exhibition Center, Manchester, England. (Mervyn W.K. Little, Specialist Exhibitions Ltd., Grantleigh House, 14-32 High St., Croydon, Surrey CRO 1YA, England).

(Mar. 26-29)—Colour 87—the International Exhibition for Painting Techniques and Colour Application. Cologne, Germany. (Koln Messe, Postbox 210760, D-5000 Cologne 21, Germany).

(Apr. 5-10)—ACS, Div. of Polymeric Materials: Science & Engineering, Anaheim, CA. (T. Davidson, Ethican, Inc., Route 22, Somersville, NJ 08876).

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'Humbug' from Hillman

Roy Tasse sent along a clip from the *Atlanta Journal and Constitution,* which had the following quote from *Los Angeles Times* columnist, Jim Murray:

"As a fisherman, I have a wet line now and again but, believe me, Hemingway was never going to write any book about me. The trouble with it as a sport is that there are always more fishermen than fish. And although man may be the more intelligent creature on land, the reverse is true on water. The fish has the home court advantage. It is a sad commentary on our civilization that pollution has killed more fish than hooks. I once encountered a fisherman who had left his writings on the bulkhead of a fishing boat. If not a pessimist, he was at least a realist. This lavatory poet had listed:

—You should have been here yesterday.
—It will pick up tomorrow.
—It's too cloudy.
—The sun is too bright.
—They ain't hitting sardines.
—Boy, if we only had sardines.
—The sea is too choppy.
—If we only had more chop.
—And "the world's greatest lie"—I really didn't mind not catching any fish, because the fresh air, sunshine, and boat ride were wonderful.

Barry Burke, a collector of sage sayings, must put those that follow on his daily calendar. I hope that some of them will help you face those days when raw materials don't arrive on time, when your biggest customer's check bounces, when your spouse arrives as you are taking a speck out of your secretary's eye or when the batch goes solid.

Do not join encounter groups. If you enjoy being made to feel inadequate, call your mother.

—Liz Smith

It was partially my fault that we got divorced. I had a tendency to put my wife under a pedestal.

—Woody Allen

When a man comes to me for advice, I find out the kind of advice he wants and I give it to him.

—Josh Billings

Love conquers all except poverty and a toothache.

—Mae West

I have a simple philosophy. Fill what's empty. Empty what's full. And scratch where it itches.

—Alice Roosevelt Longworth

You can't unscramble scrambled eggs.

—American Proverb

No man dies before his time.

—Yiddish Proverb

It ain't bragging if you really done it.

—Dizzy Dean

Papyromamia—Compulsive accumulation of papers.
Papryophobia—Abnormal desire for a clean desk.

—Laurence J. Peter
Raymond Hull

It's even harder for the average ape to believe that he has descended from man.

—H.L. Mencken

May you have the health of a salmon—a strong heart and a wet mouth.

—An Irish toast

Joe Vasta, who avidly reads all technical literature such as "Humbug," found this story in the *Del-Chem Bulletin:*

The members of the Chester County, Pa., Hunt Club decided to hold a fox hunt, and instructed its members to bring only male dogs. But an influential member owned only a female and she was allowed to run with the rest.

The morning of the hunt, they followed the dogs for an hour, then lost the dogs completely. One of the members saw a farmer in a field and stopped to ask him: "Have you seen a pack of dogs and a fox?"

"Sure, just a minute ago. They were going that way."

"What were they doing?"

"Wal," said the farmer, "the last I seen, the fox was running fifth."

More of Henry Pritula's Murphy's Laws:

- The Murphy philosophy: Smile . . . tomorrow will be worse.
- O'Toole's commentary on Murphy . . . "Murphy was an optimist."
- If you're feeling good, don't worry, you'll get over it.
- You will always find what you're looking for in the last place you look.
- Everybody should believe in something. — I believe I'll have another drink.
- Never eat prunes when you're famished.
- The light at the end of the tunnel is the headlamp of an oncoming train.
- Never sleep with anyone crazier than yourself.
- If everything seems to be going well, you obviously don't know what the hell is going on.
- In case of doubt, make it sound convincing.
- If more than one person is responsible for a miscalculation, no one will be at fault.
- Murphy's Law of Thermodynamics: Things get worse under pressure.

—Herb Hillman
Humbug's Nest
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Whitingham, VT 05361

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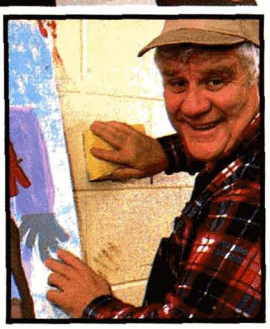

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