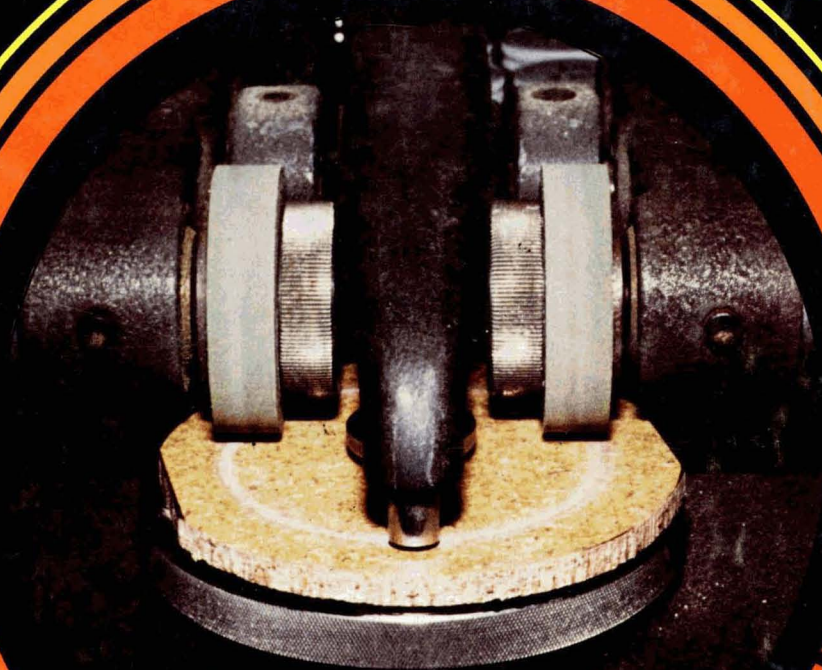
JCTAX 56 (715) 1-96 (1984)
August 1984

JOURNAL OF COATINGS TECHNOLOGY

CHICAGO '84
Annual Meeting and Paint Show
CONRAD HILTON HOTEL
OCTOBER 24, 25, 26



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AUGUST 1984

jct JOURNAL OF COATINGS TECHNOLOGY

VOLUME 56 NUMBER 715

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

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

Subscriptions: U.S. and Canada—1 year, $27; 2 years, $51; 3 years, $73. Europe (Air Mail)—1 year, $50; 2 years, $97; 3 years, $142. Other countries—1 year, $37; 2 years, $71; 3 years, $103.

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Methyl Methacrylate	Solution, Ethyl Acetate	Reactivity with Blocked Isocyanate
Styrene, Butyl Acrylate	Emulsion	Reaction with Aminoplasts
Vinylidene Chloride, Propylene, Alkyl Acrylate	Emulsion	Adhesion, Stabilization
Acrylic Acid	Aqueous Solution or Dispersion	Crosslinking Site
Ethyl Acrylate, Methyl Methacrylate, Methacrylic Acid	Solution, t-butanol	Reactivity with Melamine Resin
N-Alkoxymethyl Urethanes	Solvent	Crosslink Site
Glycidyl Acrylate, Alkyl Acrylate	Solvent	Crosslinking with Isocyanate
Branched Polyester Monomers	Solvent	Crosslink Site for Melamine Resins
Branched-Chain Glycol Polyester, Alkyl Acrylate, Other Vinyl Monomers	Low Solvent	Crosslink Site
Other Vinyl Monomers	Low Solvent	Crosslink Site
Other Acrylates	Solvent	Crosslink Site
Methyl Methacrylate, Butyl Acrylate	Emulsion	Reaction with Blocked Isocyanate
Ethylene, Vinyl Chloride	Emulsion	Formulation Compatibility
Styrene, Butadiene	Emulsion	Stability, Compatibility
Styrene, 2-Ethylhexyl Acrylate, Acrylic Acid	Emulsion or Solution	Crosslinking with Cyclic Acetals
Isocyanate, Ethyl Methacrylate	Solution/Neat	Reaction Site for Olefinic Isocyanate
Diacrylates, Diisocyanate	Solution	Reaction Site for Isocyanate
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Annual dues for Active and Associate Members of the Federation of Societies for Coatings Technology is $20.00. Of this amount, $13.50 is allocated to a membership subscription to this publication. Membership in the Federation is obtained through prior affiliation with, and payment of dues to, one of its 26 Constituent Societies. Non-member subscription rates are:

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1 Year	$27.00	$ 50.00	$ 37.00
2 Years	$51.00	$ 97.00	$ 71.00
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When available, single copies of back issues of the JOURNAL OF COATINGS TECHNOLOGY are priced as follows: $3.00 each for current calendar year issues; $4.00 each for all other issues.

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

A Guide for Authors is published in each January issue.

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

Comment

Helping to Bridge the Image Gap

Ours is an industry employing a variety of advanced technologies and scientific disciplines in the development and manufacture of products that beautify and protect in countless ways. It is a vital, indispensable element of our modern lifestyle. Sadly, however, its contributions are grossly underrated and largely unappreciated. Like Rodney Dangerfield, the coatings industry gets little, or no, respect.

An unfortunate by-product of this "image" problem is that students do not perceive a career in coatings as being challenging, rewarding, or "glamourous;" consequently, a limited number of graduates enter the coatings field.

To assist in this regard the Federation Educational Committee has been exploring ways to improve an awareness of, and appreciation for, our industry through increased contact with high school students, guidance counsellors, and teachers. Accordingly, a number of Societies schedule a special Education Night, to which local high school science teachers are invited; they hear a talk by an educator knowledgeable about the industry, and view demonstrations of various paint lab experiments (teachers are provided with kits so that they can perform the demonstrations in their classrooms). Additionally, Societies participate in local Science Fairs, counseling students on coatings-related projects and awarding prizes to winning entries. They also promote visits by their members to schools, to lecture on the industry and its career opportunities. (The Educational Committee is currently developing a general interest slide/tape program on coatings to show on these visits.)

The common thread linking these activities is the belief that the industry has an interesting story to tell—a belief that is underscored by the enthusiasm that our members bring to these encounter sessions. They know they are not selling from an empty wagon, and that coatings is a great industry to be a part of. They are doing their bit to help bridge the image gap.

Thomas A. Kocos

Thomas A. Kocos,
Contributing Editor

Abstracts of Papers in This Issue

COMPARISON OF ACRYLATED OLIGOMERS IN WOOD FINISHES—W.J. Morris

Journal of Coatings Technology, 56, No. 715, 49 (Aug. 1984)

Oligomeric resins designed for UV/EB curable coatings which offer a broad latitude for formulating wood finishes have been developed. Several epoxy and urethane based oligomers were compared to determine suitable polymers for coatings on wood substrates. Film properties such as abrasion resistance, adhesion, hardness, tensile strength, and chemical resistance were determined on filled particle board, oak flooring, and redwood floor substrates. Factors that may influence the abrasion resistance of a wood finish such as oligomer type, molecular weight, and crosslink density were explored. The effect of trifunctional monomers compared to di- and monofunctional monomers was determined. A suggested starting formula is presented along with film properties for the best performing oligomers on the three substrates.

AN ATTEMPT TO DEVELOP A ONE COAT EMULSION PAINT—L.A. Simpson

Journal of Coatings Technology, 56, No. 715, 57 (Aug. 1984)

An attempt was made to produce a 45% PVC white emulsion paint that could be easily applied by brush, and exhibits at least 98% contrast ratio after one application. In addition, good film integrity and high stain resistance were required.

To develop this product, formulation variables such as type and amount of titanium dioxide pigment, extender, thickener, and colored pigment were evaluated. It was evident that a paint could not be produced which satisfied all requirements. For example, a one coat white paint was produced by using a significant amount of thickener in order to increase build, but paint viscosity was so high that ease of application was unacceptable. By using small amounts of a colored pigment such as carbon black in order to increase opacity, a paint with a contrast ratio of 98% after one coat was obtained, but inevitably the product was 'off-white.'

Finally, changing the type of titanium dioxide pigment to a heavily coated grade produced a one coat paint but significant staining was evident.

PULSED NUCLEAR MAGNETIC RESONANCE MEASUREMENT OF THE RELATIVE AND ABSOLUTE LINSEED OIL CONTENT IN WOOD—H. Peemoeller, M.H. Schneider, A.R. Sharp, and D.W. Kydon

Journal of Coatings Technology, 56, No. 715, 67 (Aug. 1984)

Pulsed NMR has been applied to the determination of the relative and absolute linseed oil content in trembling aspen wood. Utilizing the oil and wood signals, the weight percent gains could be estimated within ±2% of the values determined gravimetrically. The techniques developed are nondestructive and performed easily and quickly.

COMPUTER FORMULATION OF COLORS FOR LETTERPRESS—M.A. Genshaw, B.F. Phillips, and K.A. Ruggiero

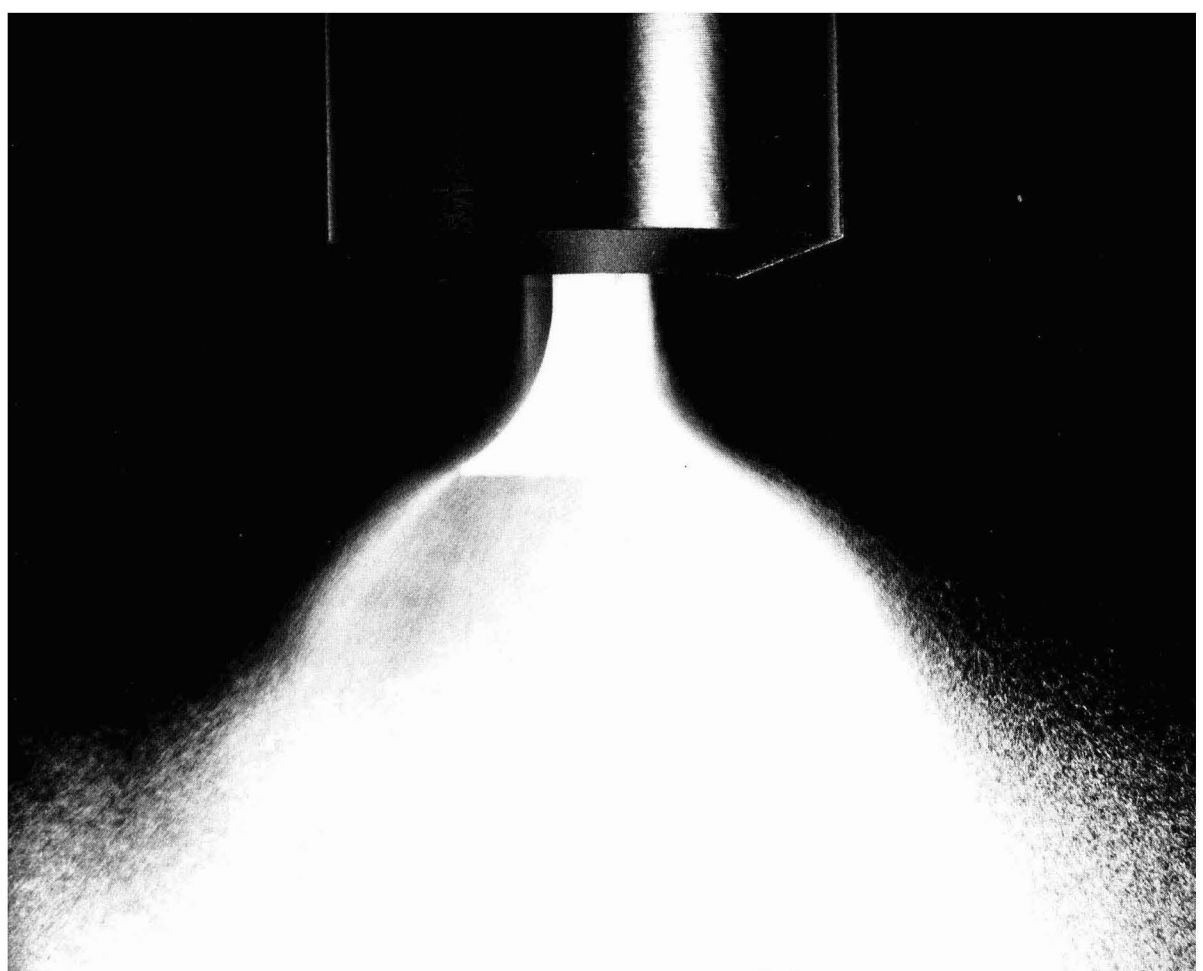
Journal of Coatings Technology, 56, No. 715, 75 (Aug. 1984)

The purpose of this work was to improve color matching between reagent strips and color charts. Reagent strips are chemically reactive papers which produce a color change on exposure to an appropriate chemical. In order to make a semiquantitative visual (quantitative instrumental measurements may also be done) determination, it is necessary to use a color chart to relate the color of the reagent strip to the concentration of the chemical sensed. In the past, ink formulations have been optimized by the visual, trial and error method. Although the computer colorant formulation method has been standard in the paint and textile industry for many years, its application to printing has been only recent. This manuscript describes our efforts in formulating inks for printing color charts by letterpress.

An initial calibration experiment was conducted to determine the ink thickness required to duplicate printed labels of the color charts. Standard rollouts have been prepared for mixtures of each of 10 colored inks in a white ink base. This data permits the computation of ink mixtures which should match the color of reagent strips.

The calculation methods used are those developed by Allen and involve the use of matrix algebra to compute the color of a mixture of inks. The method of optimization developed by Allen is used to optimize the formulation with an interpolation method recommended by Brockes. The results demonstrate that the method can provide close color matches with a minimum of metamerism.

The standard deviation in color difference units was: 0.4 between samples taken from a single rollout; 1.1 between rollouts; and 0.4 between replicated mixes of the same formulation.



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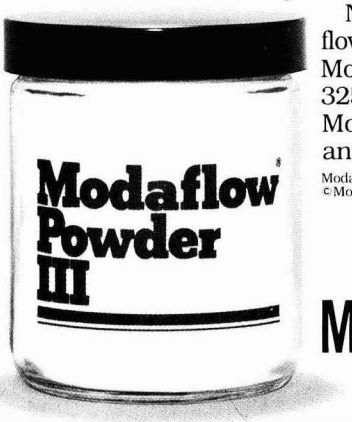

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William Mirick, of C-D-I-C Society; and Carlos Dorris of Dallas; Are Nominated to Federation Officer Positions for 1984–85

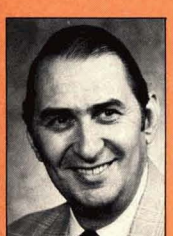
William Mirick, of Battelle Columbus Laboratories, Columbus, OH, has been nominated for the position of President-Elect of the Federation of Societies for Coatings Technology. Mr. Mirick, currently Treasurer, is a Past-President of the C-D-I-C Society and has served as Society Representative to the Federation Board from 1975–83 and Society Representative member of the Federation Executive Committee from 1979–81. He was Chairman of the Annual Meeting Program Awards Committee from 1972–74. A Researcher at Battelle, he joined the Laboratories in 1956. He attended Ohio State University.

Carlos Dorris, of Jones-Blair Co., Dallas, TX, has been nominated for the position of Treasurer. Mr. Dorris is a Past-President of the Dallas Society and has served as Society Representative to the Federation Board since 1977. He has served on several Federation committees including the Finance, Nominating, and Paint Show. Mr. Dorris is Plant Manager of Jones-Blair's Dallas facility.

The current President-Elect, Joseph A. Bauer, of Porter Paint Co., Louisville, KY, will assume the Presidency at the close of the 1984 Annual Meeting, October 26, in Chicago, IL.

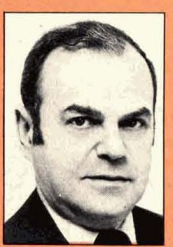
The Nominating Committee also submitted the names of the candidates for Board of Directors and Executive Committee positions.

Voting will take place on October 23 at the Federation's Annual Meeting in Chicago.



W. Mirick

C. Dorris



S. Spindel

M. Malaga

Executive Committee

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

Saul Spindel, President of D/L Laboratories, New York, NY. He has been Society Representative to the Federation Board since 1982. Mr. Spindel is a Past-President of the New York Society and served on its Technical, Program, and Joint Coordinating Committees. He is presently Chairman of the Federation's Technical Advisory Committee and a Past-Chairman of the Corrosion Committee.

Board of Directors

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

Michael W. Malaga, a Past-President of the Cleveland Society (1957) as well as the Federation (1973–74). He served several years as Society Representative to the Federation Board. Since his retirement from Glidden Coatings & Resins in 1980, Mr. Malaga has done consulting work for Seegott, Inc.

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

James E. Geiger, President, Sun Coatings, Inc., Largo, FL. Mr. Geiger is currently President of the Southern Society and has served on its Board of Directors for seven years. He is a member of the Federation's Finance Committee. He is also Chairman of the Florida PCA Scholarship Committee. Mr. Geiger is a graduate of Northern Illinois University.

J.E. Geiger

J. Richard Kiefer, Jr., Vice-President for Community, Industry, and Regulatory Affairs, McCloskey Varnish Co., Philadelphia, PA. Mr. Kiefer is a Past-President of the Philadelphia Society, an Honorary Director, and Editor of the Society Handbook. In the Federation, Mr. Kiefer has been Society Representative to the Federation Board, Chairman of the Membership, By-Laws, and Trigg Awards Committees.

J.R. Kiefer

A third candidate for Board member-at-large was nominated from the floor by the Baltimore Society.

John Emmerling, President of Lenmar, Inc., Baltimore, MD. Mr. Emmerling is a Past-President of the Baltimore Society and has served as Society Representative to the Federation Board. He has been Chairman of the Federation's Technical Advisory Committee. Mr. Emmerling is a member of the Baltimore PCA and was NPCA Regional Vice-President—Eastern Zone.

J. Emmerling

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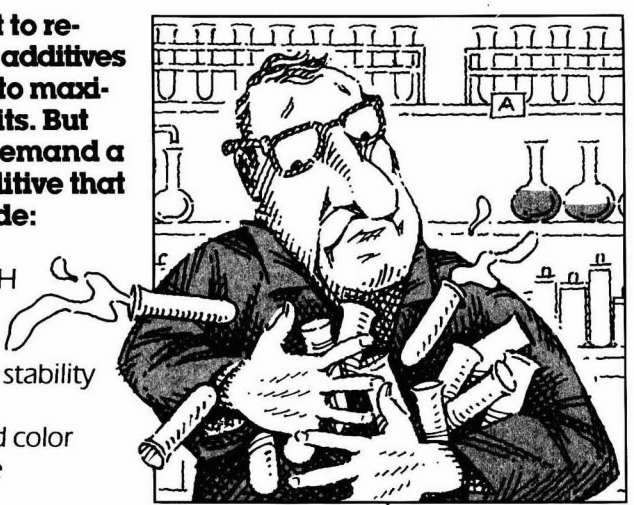

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Report From Executive Vice-President, Frank J. Borrelle

Annual Meeting Program

Program sessions for the 1984 Annual Meeting (October 24-26 at the Conrad Hilton in Chicago) are shaping up very nicely under the direction of Dr. Darlene Brezinski, Chairperson of the Program Committee.

The Opening Session on Wednesday morning will be different and dynamic. The first speaker will be Pat Buchanan, a leading strategist and syndicated columnist, who was a senior staff assistant and speech writer during the "Nixon Years." Drawing from his long political experience, Mr. Buchanan will discuss the "1984 Elections."

Immediately following Mr. Buchanan will be the Annual Meeting Keynote Address—"Meeting the Challenge of Managing Change"—by Robert E. Pajor, President and Chief Operating Officer of the Valspar Corp. The Federation is indeed fortunate to obtain Mr. Pajor as its Keynoter.

The featured technical presentation will be the Mattiello Lecture on Friday by Dr. Thomas J. Miranda, of the Whirlpool Corp. A noted author, lecturer, and scientist, Dr. Miranda has found the time and energy to serve the Federation in several important capacities since 1982. His lecture, "Reading the Signals of Science: Technology Push or Market Pull," will be most interesting.

Dr. Brezinski and her committee have arranged for an outstanding assortment of presentations linked to the theme of the program—"Appearance and Protection—Essential to Our Lifestyle."

There'll also be a Symposium on Color and Appearance, a Seminar on Filtration Technology, several papers entered into the 1984 Roon Awards competition, and papers from Federation Societies.

Paint Show

Once again, the current show will be the largest. The demand for exhibit space has been so great that the Show was expanded into the North Hall on the lower exhibit level of the Conrad Hilton Hotel. Registration, normally in the North Hall, has been moved to the mezzanine.

There are presently 192 exhibitors in the Show, compared to 176 in Montreal last year. Of the 192, 46 have been in the Show for 25 years or more, and 147 were in the 1983 Show.

Total net square footage will be in excess of 45,000. In Montreal it was 40,000 plus.

The publication, *Business Marketing*, recently ran a feature on exhibits (written by Exhibit Surveys) and the Paint Show was listed among the top buying-influential trade shows in the country.

Incoming Society Presidents

As the pages of a calendar move on, so do the Officers of our Constituent Societies. Here are the Presidents for the 1984-85 years. Good luck to them all.

Baltimore—Bob Hopkins, of SCM Pigments
Birmingham—Roland Staples, of Midland Specialty Powders
Chicago—Fred Foote, of U.S. Gypsum Co.
CDIC—Dave Kinder, of Asarco, Inc.
Cleveland—Bob Thomas, of PPG Industries, Inc.
Dallas—Terence LaBaw, of Sherwin-Williams Co.
Detroit—Bill Passeno, of Mercury Paint Co.
Golden Gate—Ken Trautwein, of Sherwin-Williams Co.
Houston—Dick Batchelor, of Valspar Corp.
Kansas City—Steve Bussjaeger, of Davis Paint Co.
Los Angeles—Earl Smith, of Spencer Kellogg Div.
Louisville—Ed Thomasson.
Montreal—Bob Payette, of L.V. Lomas Co.
New England—Paul Mueller, of D.H. Litter Co., Inc.
New York—Mike Iskowitz, of New York Bronze Powders.
Northwestern—Rich Johnson, of Cargill, Inc.
Pacific Northwest—Ottwin Schmidt, of Helzer Canada Ltd.
Philadelphia—Bill Georgov, of J.M. Huber Corp.
Piedmont—Philip Wong, of Reliance Universal, Inc.
Pittsburgh—Cliff Schoff, of PPG Industries, Inc.
Rocky Mountain—Larry Lewandowski, of J.D. Mullen Co.
St. Louis—Bill Truszkowski, of Mozel Chemical Products.
Southern—Jim Geiger, of Sun Coatings.
Toronto—Rob Kuhnen, of Tioxide Canada Ltd.
Western New York—Don Kressin, of Spencer Kellogg Div.

Society News

BIRMINGHAM—Presented Distinguished Service Awards to Hal J. Clarke, Graham W. Fowkes, Sid T. Harris, Bob E. Howse, George Hind, and George Tennant.

LOS ANGELES: Presented Honorary Membership to Past-Presidents Clyde L. Smith and Al Aronow. Clyde was President of the Federation in 1955-56. . . . Also honored Past-President Don Jordan with the Outstanding Service Award and Ben Friedland with a 50-year membership pin.

NEW YORK: Voted Past-Presidents Herbert E. Hillman and Herman Singer into Honorary Membership. Herb, of course, is our own "Humbug." He left his comfortable nest in Vermont (but not for long) to attend the Society meeting at which he was honored.

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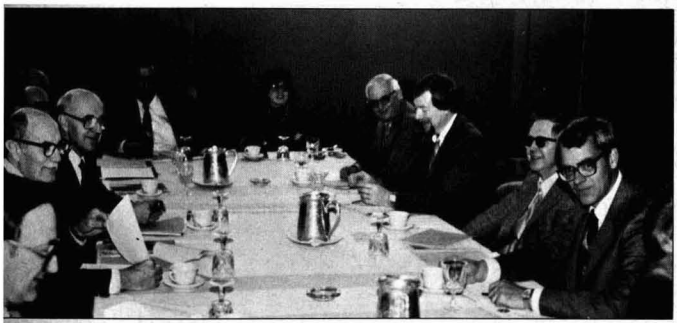
Publications and Manufacturing Committee Meetings

Publications

Manufacturing



Publications

Manufacturing

Publications

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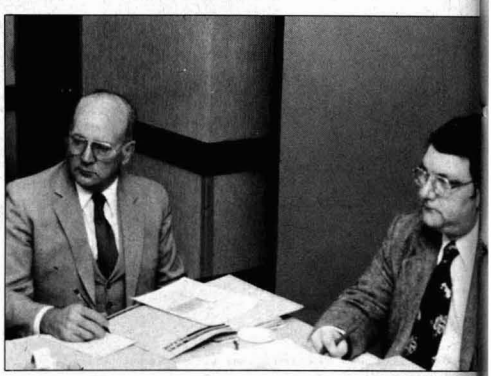


Manufac

FSCT Manufacturing, Publications Committees Meet

In recent, separate meetings, the Federation's Manufacturing and Publications Committees reviewed goals and formulated plans for their respective groups.

The following are highlights from the two meetings.

Manufacturing

The Manufacturing Committee, which met in St. Louis, reviewed the 1983 Annual Meeting Committee-sponsored seminar, "Improved Profitability Through Efficient Cleaning, Recycling, and Reclamation Techniques," as well as the plant tour, held in conjunction with the Annual Meeting.

The success of the plant tour (NL Chemicals Canada, Montreal), attended by Committee members and Society Manufacturing Committee Chairmen, prompted discussions of a similar effort in conjunction with the 1984 Annual Meeting in Chicago, for which tentative plans were approved.

The Committee agreed on the topic, "Filtration—The Last Step Before the Customer," for its sponsored seminar at the 1984 Annual Meeting. The presentation is to feature discussions of the various types of equipment currently available.

The Kansas City Society Manufacturing Committee (Larry Kytaasari, Chairman) was commended for its study, "Filtration Procedures Used in the Resin Manufacturing Industry" (published in JCT, Nov. 1983, pp. 16–17).

Larry and his Committee were also commended for developing their slide/tape program on "Operation of a Vertical Sandmill." The program, which focuses on the basics of operating a vertical sandmill, was developed to assist in the training of plant personnel in the use of such equipment. The program has been produced in quantity by the Federation, and is now available for sale.

The "Sandmill" program is the fourth in the Federation A/V series on manufacturing topics, joining "High Speed Dispersion" (Montreal), "Introduction to Resin Operations" (Toronto), and "A Batch Operated Mini-Media Mill" (New York).

The next meeting of the Manufacturing Steering Committee was tentatively scheduled for Wednesday morning, October 24, in Chicago, in conjunction with the Federation Annual Meeting.

Members of the FSCT Manufacturing Steering Committee attending were: *Chairman,* Richard E. Max, Synkote Paint Co., Elmwood Park, NJ; Michael O. Beatty, Athey Paint Co., Baltimore, MD; Cleties Crowe, Crowe Industrial Coatings, Stone Mountain, GA; George Finn, Burn-Zol Div., W. Dennis, MA; Donald Fritz, Superior Varnish & Drier Co., Merchantville, NJ; Robert Hogg, Preservative Paints Co., Seattle, WA; Larry Kytasaari, Tnemec Co., Inc., Kansas City, MO; Richard Mundinger, 3M Co., St. Paul, MN; Anne M. Probizanski, Ampro Technologies, Riverside, CA; and Joseph P. Walton, Jr., Jamestown Paint & Varnish Co., Jamestown, PA.

Also attending were Joseph Saake, Chemcentral, St. Louis, MO (St. Louis Society Manufacturing Committee Chairman); Chuck Reitter, Editor of *American Paint & Coatings Journal*; FSCT Technical Advisor, Roy Brown; and FSCT staff members, Robert Ziegler and Thomas Kocis.

Publications

Meeting in Washington, D.C., the Publications Committee discussed new topics for JCT features, the new FSCT Coatings Technology Series, and the publication of Society Technical Committee reports.

"Open Forum" and "Humbug from Hillman" are increasingly popular departments. "Safety Net" proved to be not so popular in its current form, and suggestions were made to revise the format. New topics to be investigated are a "Computers in Coatings" department and "CrossLinks," a crossword puzzle feature developed by Earl Hill.

A progress report on the new "Federation Series on Coatings Technology," which will feature 40 new titles, noted that the first of the booklets will be published this year or early 1985.

The committee again invited the Society Technical Committees to submit reports of their activities for publication in abstract form.

In attendance at the meetings were: *Chairman,* Dr. Thomas J. Miranda, Whirlpool Corp., Benton Harbor, MI; *Vice-Chairman,* Paul R. Guevin, Jr., AMF, Inc., Stamford, CT; Dr. Taki Anagnostou, Wyandotte Paint Products Co., Troy, MI; Dr. Darlene Brezinski, DeSoto, Inc., Des Plaines, IL; Dr. G. Dale Cheever, General Motors Corp., Warren, MI; Dr. Ross Dowbenko, PPG Industries, Inc., Allison Park, PA; F. Louis Floyd, Glidden Coatings & Resins, Strongsville, OH; H. Earl Hill, Lord Corp., Erie, PA; Dr. Loren W. Hill, Monsanto Co., Indian Orchard, MA; Dr. Joseph V. Koleske, Union Carbide Corp., S. Charleston, WV; Dr. M.J. McDowell, DuPont Co., Philadelphia, PA; Dr. Percy E. Pierce, PPG Industries, Inc., Allison Park, PA; and Joseph A. Vasta, DuPont Co., Wilmington, DE.

Also attending were JCT staff members Lorraine Ledford, Patricia Viola, and Robert Ziegler.

Battelle Offers Program Comparing Chemical Companies' R&D

Battelle Memorial Institute's Columbus Division is offering a program which will enable chemical companies to compare their R&D support and staff levels with other firms in the same product lines.

Intended to help companies gain insights into their competitive posture and to assess their productivity of R&D dollars and staff, the proposed program will provide participants with information not typically available. As designed, Battelle will collect and hold confidential R&D data supplied by participating companies and then develop profiles and analyses of research expenditures for several chemical industry segments.

Expected segments to be studied include: basic petrochemicals, derived intermediates, plastics and resins, synthetic elastomers, synthetic fibers, coatings, surface-active agents, pesticides, specialty chemicals, and fabricated and compounded products.

In reporting the information to participants, Battelle will keep the data of individual companies confidential while showing industry trends. Resulting reports will be provided only to those companies that join the program and submit data. To ensure confidentiality, a minimum of five companies must provide data in each industrial segment studied.

More information is available from Dr. Peter R. Taussig, Battelle's Columbus Division, 505 King Ave., Columbus, OH 43201-2693.

Paint Manufacturers Challenge Enforcement in Toxic Waste Cleanup

In testimony before the Senate Environment and Public Works Committee, Larry Thomas, Executive Director of the National Paint and Coatings Association, representing U.S. paint manufacturers, challenged the current enforcement policies on cleanup efforts directed at the nation's waste disposal sites.

At the hearing, Mr. Thomas said that "under current procedures, EPA and the Justice Department are so concerned with litigation aimed at recovering cleanup costs that they are losing sight of the actual cleanup itself." He stated that under the "joint and several" liability concept, EPA and the Justice Department are taking legal action against only certain companies for entire cleanup costs—greatly disproportionate to their actual contribution to the problem. He then proposed new legislation which would allow for fair-share apportionment for responsible parties and a tax which would provide an adequate fund for entire annual cleanup costs. This way, he stated, "the financial resources would go to cleaning up the environment and not be dissipated in costly litigation."

Union Carbide Reorganizes Latex Business In Emulsion Systems Group

Union Carbide Corp. has reorganized its latex business operations through the formation of UCAR Emulsion Systems. The company will consolidate the management, marketing, and research and development functions of that business in Cary, North Carolina, a suburb of Raleigh.

Loy Wilkinson, President of Union Carbide's Solvents and Coatings Materials Div., said that having the entire latex group in North Carolina will mean greater efficiency and closer proximity to the fastest growing markets. The area was selected because of the availability of high technical skills, he stated.

The Cary facility will include offices, an extensive R&D laboratory, and a test fence, which will be moved from the firm's facility in South Charleston, WV. The laboratory will provide technical service and develop new formulations for customers, as well as perform basic research and development for new products relating to the latex business.

Karl J. Hutchinson will serve as General Manager for UCAR Emulsion Systems. He will report to Dr. Richard J. Kerr, Vice-President of the Solvents and Coatings Materials Div., who will remain at the corporate headquarters in Danbury, CT.

CIBA-GEIGY Consolidates Technical Service For Automotive Paint Pigments

CIBA-GEIGY Corp. has announced plans to consolidate technical service for its automotive paint pigments business in Newport, DE, site of the recently-acquired Monastral® Quinacridone pigment manufacturing facility. The multi-million dollar project, which includes construction of new pigments laboratories dedicated to automotive paints, will be completed during the first half of 1985.

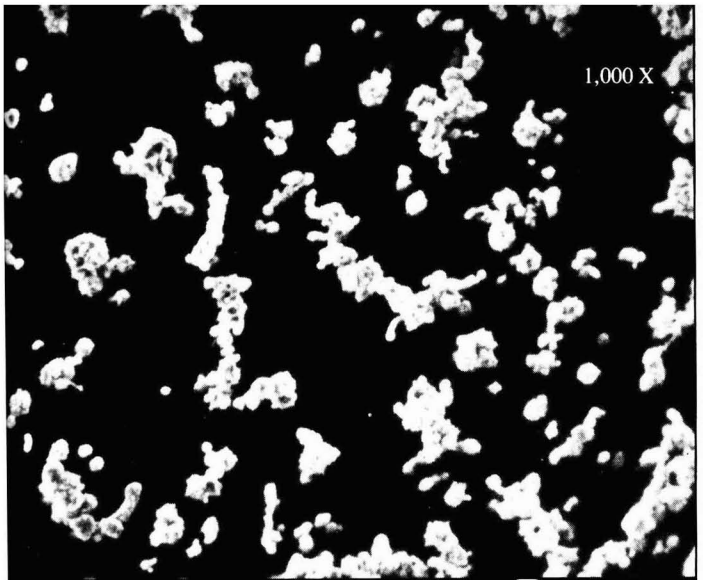
The CIBA-GEIGY Pigments Dept., headquartered in Hawthorne, NY, presently conducts technical services for its inorganic, classical, and high performance Cromophtal® and Irgazin® organic pigments in Ardsley, NY. Technical support for the Monastral Quinacridone pigment line, acquired from Du Pont, is presently located at the Du Pont Chestnut Run facility.

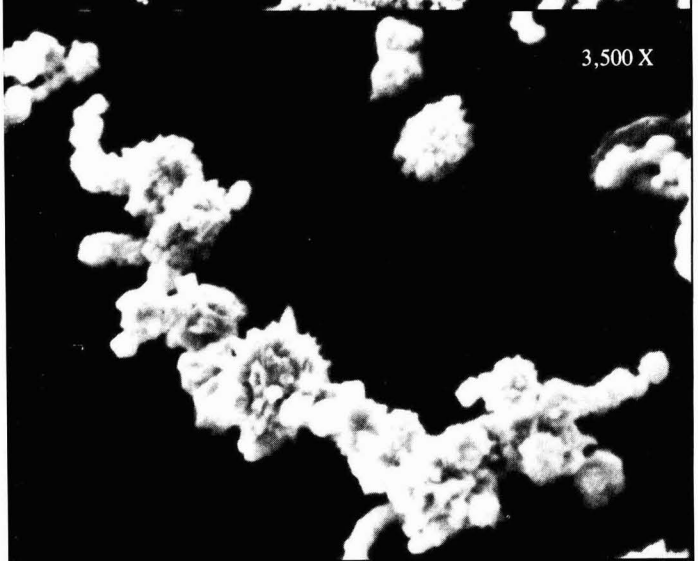
The consolidation also includes the establishment of a Quinacridone research and development laboratory at the Newport site. Monastral Quinacridone pigment development work is now conducted at the nearby Du Pont Jackson Laboratories. The consolidation to Newport will be completed within the next two months.

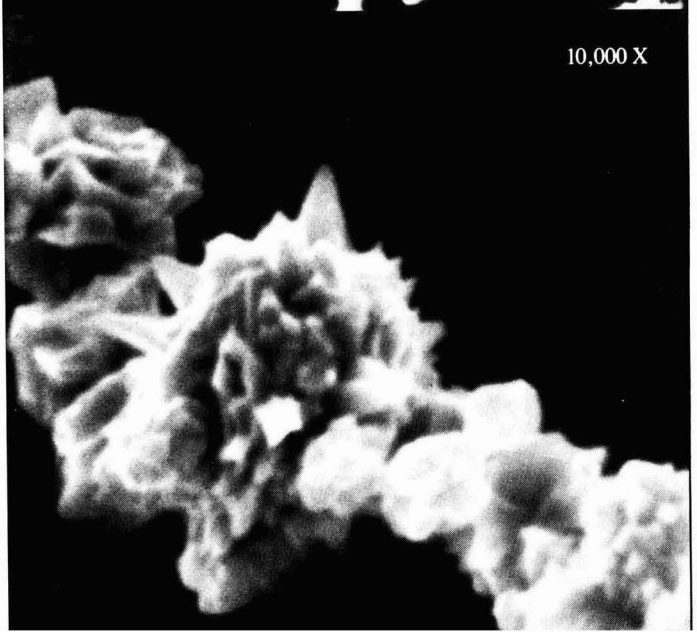
The Newport consolidation will not affect CIBA-GEIGY technical services for the general industrial and trade sales coatings, inks, plastics and fibers markets, which will remain in Ardsley.

Sadolin of America Inc. Purchases Paint Products Co.

Sadolin of America Inc., a North-Carolina-based corporation, has purchased majority shares in Paint Products Co., of Winston-Salem, NC. The present owners and management of Paint Products Co. will continue to hold a minority ownership in the firm. The company name will be Sadolin Paint Products Inc.







Shield against EM-RF interference with high purity INCO nickel powders.

High purity INCO* nickel powders help you maintain high conductivity during service life. Inco makes high purity nickel powder that is ideal for conductive coatings to shield electronic equipment from electromagnetic interference.

Available as primary nickel and at base metal prices, INCO nickel powders are proven conductive pigments in a variety of binders.

Three density fractions to choose from

Inco's filamentary nickel powders are available in three density fractions: Type 255, Type 270 and Type 287. These three types will match your requirement for conductive pigments.

They are bead and chain structures which come apart with high shear mixing like breaking a string of beads. The individual particles, 1-3 microns in size, can be further comminuted using conventional pigment preparation techniques.

Inco's filamentary nickel powders, when mixed with antioxidants, stabilizers, and wetting agents can be milled or flaked to form stabilized coated particles ready for paint making.

High purity gives you confidence in your product

Inco nickel powders are made from four nines seven nickel carbonyl and are virtually free from metallic impurities. Impurities that could influence the corrosion rate of the dispersed powder.

Easy, dust-free handling and packaging

INCO filamentary nickel powders are packaged in 2.5 cubic foot drums with net nickel weights of 165 lbs or 220 lbs. INCO's filamentary nickel powders are ideal for handling because the filaments overlap. This creates mat-like structures so that dust is eliminated when transferring from drum to mixer.

For your free sample of these high performance nickel powder products from Inco, simply write on your company letterhead to Inco-Sterling Forest, Dept. 15-83, P.O. Box 200, Suffern, N.Y. 10901.

INCO

The International Nickel Company, Inc.,
INCO Sterling Forest, P.O. Box 200, Suffern, N.Y. 10901
(914) 578-5700

*Trademark of the Inco family of companies.

Maintenance Painting of Industrial Plants To Be Focus of SSPC Symposium, Sept. 19-20

The Steel Structures Painting Council (SSPC) will conduct a symposium on "Maintenance Painting of Industrial Plants," on September 19-20, at the William Penn Hotel in Pittsburgh, PA.

Held in conjunction with the SSPC Annual Meeting, scheduled for September 17-18, the symposium will feature a variety of strategies for dealing with maintenance painting, including sessions dealing with in-house maintenance programs and programs aided by consultants or contractors. Additional sessions will feature paint materials and innovations in the technology.

For further information and registration materials, contact Harold Hower, Symposium Coordinator, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213.

ITC Ban of Imported Lead Chromate Pigments Upheld

The U.S. Court of Appeals for the Federal Circuit in Washington, DC, has upheld a decision by the U.S. International Trade Commission to ban imports of silica-encapsulated lead chromate pigments from Japan.

The ITC ruled in April 1983 that colored pigments imported by Toho Ganryo Kogyo K.K. and its U.S. distributors infringed a Du Pont Company patent for "Krolor" pigment colors, and the ITC banned the import of these products.

Du Pont sued Toho Ganryo and Nihon Inorganic Color and Chemical Co., Ltd., in Japan in 1981 for infringing Du Pont's Japanese patents for "Krolor." Those suits have not been decided.

Du Pont sold most patent rights for "Krolor," to Heubach, Inc., as part of the company's withdrawal from the colored pigments business. Du Pont continues to own the patents for "Krolor" in Japan.

Sylvachem Corp. Headquarters Relocates to Jacksonville

Sylvachem Corp. has moved its headquarters from Panama City to Jacksonville, FL. In addition, the firm's research and development, and technical service groups will be relocating to Jacksonville upon completion of a new technical center.

Sylvachem is the supplier of tall-oil-based rosin tackifiers used primarily in hot melt and pressure sensitive adhesives and is a producer of epoxy curing agents used in the coatings and adhesives industries. Product lines include a line of upgraded rosins, tall oil fatty acids, dimer acids, reactive and non-reactive polyamides, distilled tall oils and specialty blends.

Sylvachem Corp. is part of the Organic Chemicals group of SCM Corp.'s Chemical Div.

Valspar to Acquire Mobil Chemical's Domestic and Canadian Coatings Business

The Valspar Corporation and Mobil Chemical Co. have entered into an agreement for Valspar to acquire Mobil Chemical's domestic and Canadian coatings business, purchasing the assets for $90-$100 million. Valspar is a Minneapolis-based coatings company; Mobil Chemical is a division of Mobil Oil Corp.

In calendar year 1983, sales of Mobil Coatings, which are primarily for industrial applications, amounted to approximately $180 million, excluding the coatings businesses in Mexico and Europe, which are not included in the acquisition. There are nine Mobil coatings plants in the United States and one in Toronto, Canada.

For its fiscal year ended October 31, 1983, Valspar reported sales of $162 million, of which 26% were industrial coatings, 58% consumer coatings, and 16% special products. Valspar presently has 11 manufacturing plants, all in the United States.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Preliminary Program

CHICAGO '84

62nd ANNUAL MEETING
49th PAINT INDUSTRIES' SHOW

CONRAD HILTON HOTEL • OCTOBER 24, 25, 26

Preliminary Program

WEDNESDAY, OCTOBER 24

OPENING SESSION
GRAND BALLROOM
(9:45)

Sixty-Second Annual Meeting of the Federation of Societies for Coatings Technology opened by President Terryl Johnson

Invocation and In Memoriam

Welcome: Fred Foote, President of Chicago Society for Coatings Technology

Richard M. Hille, Chairman of the Host Committee

Darlene R. Brezinski, Chairman of the Program Committee

Deryk R. Pawsey, Chairman of the Paint Industries' Show Committee

Introduction of Distinguished Guests

INTRODUCTORY ADDRESS
(10:15-11:00)

Address by Patrick Buchanan, political strategist and syndicated columnist.

E.W. FASIG KEYNOTE ADDRESS
(11:00-11:45)

MEETING THE CHALLENGE OF MANAGING CHANGE—Robert E. Pajor, President and Chief Operating Officer, The Valspar Corporation, Minneapolis, MN.

GRAND BALLROOM
(2:00-4:30)

COLOR AND APPEARANCE CHARACTERIZATION FOR THE COATINGS INDUSTRY—Fred Billmeyer, Jr., Schenectady, NY

BLACK, WHITE, AND EVERYTHING IN BETWEEN—Robert Hillman, Sears Merchandise Group, Chicago, IL

COLOR HARMONY—Joy Turner Luke, Studio 231, Sperryville, VA

THE CHALLENGE OF AUTOMOTIVE COLOR: A PERSONAL EPILOGUE—Sol Panush, United Technologies Inmont, Southfield, MI

OBJECTIVE PREDICTORS OF PAINT APPEAL—Gregory W. Cermak, Societal Analysis Dept., General Motors Research Laboratories, Warren, MI, and Monica H. Verma, Paint Materials Group, Fisher Body Div., General Motors Corp., Warren, MI

WALDORF ROOM
(2:00-4:30)

AN ANALYSIS AND PREDICTION OF ROLL-SPATTER FROM LATEX PAINTS—Debora Flanagan Massouda, Dept. of Chemical Engineering, University of Delaware, Newark, DE (A Roon Awards Competition paper)

ACOUSTIC EMISSION IN THE TESTING OF SURFACE COATINGS—T. A. Strivens, ICI (Paints Div.) PLC, Berkshire, United Kingdom

A RAPID METHOD OF PREDICTING COATING DURABILITY USING ELECTRON SPIN RESONANCE—John L. Gerlock, Polymer Science Dept., Ford Motor Company, Dearborn, MI (A Roon Awards Competition paper.)

SCANNING LASER ACOUSTIC MICROSCOPY STUDY OF THE INTERNAL STRUCTURE OF LATEX PAINT FILMS—C. Peter Chiang and T. K. Rehfeldt, The Sherwin-Williams Company, Chicago, IL

SOLVENT EVAPORATION TIME, IS IT MEANINGFUL?—Harold L. Jackson, E. I. du Pont de Nemours & Co., Inc., Wilmington, DE

BEVERLY ROOM
(2:00-5:00)

SPONTANEOUS COMBUSTION OF SURFACE COATINGS—Los Angeles Society for Coatings Technology.

RENEWABLE RESOURCES FOR THE COATINGS INDUSTRY PART II: A REALISTIC ASSESSMENT—Chicago Society for Coatings Technology.

PICTORIAL REPRESENTATION OF IN-FLIGHT PARTICLES DURING SPRAYING OF WATER-BASED POLYMERS—Houston Society for Coatings Technology. Presented by Ken Confer, Sunbelt Chemicals, Inc., Houston, TX

FACTORS AFFECTING APPLICATION & MARKETABILITY OF WATER-BORNE INDUSTRIAL ENAMELS—Dallas Society for Coatings Technology. Presented by R. C. Pierrehumbert, Union Carbide Corp., Garland, TX

COATING COMPOSITIONS BASED ON ACRYLIC-POLYURETHANE INTERPENETRATING POLYMER NETWORKS—Detroit Society for Coatings Technology. Presented by P. I. Kordomenos, Ford Motor Co., Mt. Clemens, MI

BLOCK RESISTANCE OF GLOSS LATEX ENAMELS AND WATER REDUCIBLE COATINGS—Los Angeles Society for Coatings Technology.

THURSDAY, OCTOBER 25

GRAND BALLROOM
(9:00-12:00)

VOLUME CONCENTRATIONS OF (MAGNETIC) PIGMENTS—H. F. Huisman, PD Magnetics B.V., Oosterhout, The Netherlands (A Roon Awards Competition paper)

DISPERSION OF (MAGNETIC) PIGMENT POWDERS IN ORGANIC LIQUIDS—H. F. Huisman, PD Magnetics B.V., Oosterhout, The Netherlands (A Roon Awards Competition paper)

HYPERDISPERSANTS IN PAINTS - A NEW ROUTE—J. F. Bridges, ICI Americas Inc., Wilmington, DE

NEW ISOINDOLINE PIGMENTS FOR HIGH QUALITY APPLICATIONS—J. von der Crone, CIBA-GEIGY SA, Fribourg, Switzerland. (Presented on behalf of FATIPEC: Federation of Associations of Technicians in the Paint, Varnish, Lacquer and Printing Ink Industries of Continental Europe).

STABILIZATION OF AQUEOUS OXIDE PIGMENT DISPERSIONS—William H. Morrison, Jr., E. I. du Pont de Nemours & Co., Inc., Wilmington, DE (A Roon Awards Competition paper)

A CONVENIENT PREPARATION OF ACRYLIC-URETHANE NONAQUEOUS DISPERSIONS—A. N. Theodore, Ford Motor Co., Dearborn, MI

MANUFACTURING COMMITTEE SEMINAR ON FILTRATION AND PAINT STRAINING
WALDORF ROOM
(9:00-12:00)

Panel of speakers will discuss various types of filtration equipment.

BEVERLY ROOM
(9:00-12:00)

VISCOSITY OF OLIGOMER SOLUTIONS—Zeno W. Wicks, Jr., Gregory F. Jacobs, I-Chyang Lin, Eric H. Urruti and Lucy G. Fitzgerald, Polymers and Coatings Department, North Dakota State University, Fargo, ND (A Roon Awards Competition paper)

ASTM VISCOSITY METHODS: WHERE'S THE PRECISION?—Clifford Schoff, PPG Industries, Inc., Allison Park, PA

UNIQUE RHEOLOGY CONTROL COMPONENT FOR SOLVENT BASED COATINGS SYSTEMS—John S. Perz, The Lubrizol Corp., Wickliffe, OH

NEW CELLULOSIC POLYMERS FOR RHEOLOGY CONTROL OF LATEX PAINTS—Kathryn G. Shaw, Hercules Incorporated, Wilmington, DE

THE PREPARATION OF ACRYLIC OLIGOMERS FOR HIGH-SOLIDS COATINGS USING HYDROXY-FUNCTIONAL MERCAPTAN CHAIN TRANSFER AGENTS—R. A. Gray, Phillips Research Center, Phillips Petroleum Co., Bartlesville, OK

A NOVEL APPROACH TO HIGH SOLIDS COATINGS IN AUTOMOTIVE PRIMERS—Richard K. Sammel and John P. Seymour, CIBA-GEIGY Corp., Ardsley, NY (A Roon Awards Competion paper)

WALDORF ROOM
(2:00-4:00)

HYDROLYTIC STABILITY OF OLIGOESTERS IN SIMULATED WATER-REDUCIBLE COATING FORMULATIONS—Frank N. Jones, Polymers and Coatings Dept., North Dakota State University, Fargo, ND

WATER-BORNE COATINGS BASED ON EPOXY ALKANOLAMINE RESINS—S.B.A. Qaderi, Ford Motor Co., Dearborn, MI

DESIGN AND CHEMISTRY OF A MODIFIED EPOXY VEHICLE FOR AQUEOUS COATING SYSTEMS—Jaine B. Lucas, Dow Chemical U.S.A., Freeport, TX, and Robin A. Withers and Patrick H. Martin, Dow Chemical U.S.A., Walnut Creek, CA (A Roon Awards Competition paper)

BRANCHED POLYETHER/ESTER OLIGOMERS FOR WATER REDUCIBLE COATINGS—Tosco Misev, Chemical Pharmaceutical Cosmetic Industry ALKALOID, Skopje, Yugoslavia, and Frank N. Jones and Seshan Gopalakrishnan, Polymers and Coatings Department, North Dakota State University, Fargo, ND

GRAND BALLROOM
(2:00-5:00)

DETERMINATION OF THE COMPOSITION OF HETEROGENEOUS SURFACES BY CONTACT ANGLE DISTRIBUTIONS—G. Dale Cheever, Polymers Dept., General Motors Research Laboratories, Warren, MI

DEPENDENT SCATTERING THEORY: A NEW APPROACH TO PREDICTING SCATTERING IN PAINTS—Susan Fitzwater and John W. Hook, III, The Rohm and Haas Co., Spring House, PA (A Roon Awards Competition paper)

A NEW COMPUTATIONAL METHOD FOR DETERMINING THE SHEAR RATE DEPENDENT VISCOSITY OF COATINGS—Hong-Hsiang Kuo, Polymers Dept., General Motors Research Laboratories, Warren, MI

ACCELERATION SHIFT FACTOR AND ITS USE IN EVALUATING WEATHERING DATA—John A. Simms, E. I. du Pont de Nemours & Co., Inc., Wilmington, DE

PHYSICO CHEMICAL FACTORS IN THE PERFORMANCE OF POLYMER-METAL BONDS—S. Ponce, D. Gamet and H. P. Schreiber, Ecole Polytechnique, Montreal, Que.

KINETICS OF THE ALCOHOLYSIS OF ORTHOSILICATES—David J. Oostendorp and James O. Stoffer, Dept. of Chemistry, University of Missouri-Rolla, Rolla, MO (A Roon Awards Competition paper)

THURSDAY, OCTOBER 25

Continued

BEVERLY ROOM
(2:00-4:30)

DETERIORATED WOODEN SURFACES - THEIR INFLUENCE ON THE DURABILITY OF COATING SYSTEMS—Kaare Kleive, A/S Jotungruppen, Sandefjord, Norway (Presented on behalf of SLF: Federation of Scandinavian Paint and Varnish Technologists)

NEW PROGRESS IN THE STABILIZATION OF AUTOMOTIVE PAINTS—L. Avar—Sandoz Ltd., Basel, Switzerland

THE PREDICTION OF THE SERVICE LIFE OF COATINGS ON STEEL: PART I - PROCEDURE FOR QUANTITATIVE EVALUATION OF COATINGS DEFECTS—Jonathan W. Martin and Mary E. McKnight, Center for Building Technology, National Bureau of Standards, Washington, DC

THE PREDICTION OF THE SERVICE LIFE OF COATINGS ON STEEL: PART II - QUANTITATIVE PREDICTION OF THE SERVICE LIFE OF A COATING SYSTEM—Jonathan W. Martin and Mary E. McKnight, Center for Building Technology, National Bureau of Standards, Washington, DC

THE PREDICTION OF THE SERVICE LIFE OF COATINGS ON STEEL: PART III - CATEGORIZING THE PERFORMANCE OF COATING SYSTEMS ON THE BASIS OF THEIR CORROSION AND BLISTER PATTERNS—Jonathan W. Martin and Mary E. McKnight, Center for Building Technology, National Bureau of Standards, Washington, DC

FRIDAY, OCTOBER 26

WALDORF ROOM
(9:00-10:30)

ISOCYANATOETHYL METHACRYLATE: A LATENT CROSSLINKER FOR COATING AND ADHESIVE RESINS—Paul E. Cranley, The Dow Chemical Co., Midland, MI

THERMOPLASTIC COPOLYESTER-BAKING ENAMELS AND LACQUERS—Philip A. Reitano and Eugene Franklin, Kay-Fries, Inc., Dynamit Nobel of America Inc., Rockleigh, NJ

LOW TEMPERATURE CROSSLINKING STUDIES: INSERTION REACTIONS INVOLVING TITANIUM ALKOXIDES AND ISOCYANATE CONTAINING POLYMERS—John C. Graham and Ta-Wei Wang, Dept. of Interdisciplinary Technology, Eastern Michigan University, Ypsilanti, MI (A Roon Awards Competition paper)

MATTIELLO MEMORIAL LECTURE
GRAND BALLROOM
(10:30-11:30)

READING THE SIGNALS OF SOCIETY: TECHNOLOGY PUSH OR MARKET PULL—Dr. Thomas J. Miranda, Staff Scientist, Whirlpool Corporation, Benton Harbor, MI

AWARDS LUNCHEON
BOULEVARD ROOM
(12:00)

Presentation of these awards: George Baugh Heckel . . . Paint Show . . . Roon Foundation . . . American Paint & Coatings Journal/A.F. Voss . . . Materials Marketing Associates . . . Program Committee . . . Ernest T. Trigg.

Featured Speaker: Dr. Ronald L. Willoughby, practicing psychiatrist and author of the soon-to-be published book, "How to Laugh at Your Neurosis."

ANNUAL BUSINESS MEETING
WALDORF ROOM
(3:00-4:00)

Annual Business Meeting of the Federation.

Installation of Officers, 1984-85.

OTHER CONVENTION INFORMATION

PAINT INDUSTRIES' SHOW

The 49th Paint Industries' Show will be held in conjunction with the Annual Meeting. The 1984 Paint Show is the largest in Federation history and will utilize all exhibit space in the Conrad Hilton (North, East, and West Halls, Continental Room, and International Ballroom).

The Show is the only national exhibit of raw materials and equipment used in the manufacture of paints and related coatings, and participating firms will have their top technical personnel on hand to discuss the latest developments in coatings manufacturing technology.

Exhibit hours will be 12:00 to 5:30 pm on Wednesday, October 24; 9:30 am to 5:30 pm on Thursday, October 25; and 9:30 am to 3:00 pm on Friday, October 26.

REGISTRATION FEES

Advance registration is available for $50 for members and $65 for non-members. Fee for spouses activities is $35 in advance.

Once again there will be a special registration fee of $25 each for retired members and their spouses. This applies to advance registration only.

On-site registration fees will be $60 full time and $40 one day for members. Non-member fees will be $75 full time and $50 one day. Spouses registration will be $45 on-site.

Registration forms were mailed to all members and are included in this issue (see pages 27-32).

SPOUSES ACTIVITIES

Included in the spouses registration fee will be a get-acquainted champagne social on Wednesday afternoon; continental breakfast on Thursday and Friday at the Conrad Hilton; and a tour of Chicago with lunch featuring a unique and dazzling show of fashions by Chicago's leading designers.

FEDERATION LUNCHEON

The Annual Federation Luncheon will be held Friday at the Conrad Hilton Hotel.

Presentations will be made to the recipients of the George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation) and the Flynn Awards (firms judged to have the best exhibit booths in the 1984 Paint Industries' Show).

HEADQUARTERS HOTEL

The Conrad Hilton will serve as headquarters hotel. Other hotels with blocks of rooms set aside for the Annual Meeting are the Americana Congress, Continental, Essex Inn, Hyatt Regency, McCormick Center, and Palmer House.

ROOM RESERVATIONS

All requests for rooms and suites must be sent to the Federation office on the official housing form which has been mailed to all members and is included in this issue (see pages 27-32). Additional housing forms are available from the Federation headquarters office.

BOARD MEETING

The Fall Board of Directors Meeting of the Federation will be held at the Conrad Hilton Hotel on Tuesday, October 23.

SPEAKERS' BREAKFAST

A breakfast and briefing for each day's program participants will be held at the Conrad Hilton on Wednesday, Thursday, and Friday.

PUBLICATION OF PAPERS

No *Proceedings* is offered of papers presented at the Annual Meeting, nor are reprints of presentations available. The JOURNAL OF COATINGS TECHNOLOGY has prior rights to the publication of all papers presented at the Annual Meeting, and will publish those papers submitted to the JCT and passed by the Editorial Review Board.

PROGRAM STEERING COMMITTEE

Chairperson Darlene Brezinski, DeSoto, Inc., Des Plaines, IL; Joseph A. Vasta (*Vice-Chairman*), of DuPont Co., Wilmington, DE; Gordon P. Bierwagen, of Sherwin-Williams Co., Chicago, IL; G. Dale Cheever, of General Motors, Warren, MI; Loren Hill, of Monsanto Co., Indian Orchard, MA; Joseph V. Koleske, of Union Carbide Corp., S. Charleston, WV; and Clifford Schoff, of PPG Industries, Inc., Allison Park, PA.

HOST COMMITTEE

Members of the Chicago Society are serving on the Host Committee under the General Chairmanship of Richard M. Hille, of General Paint and Chemical Co., Cary, IL. Assisting him are: (*Assistant GC and Luncheon*) John T. Vandeberg, of DeSoto, Inc., Des Plaines, IL; (*Program Operations*) Gus W. Leep, of Seymour of Sycamore, Inc., Sycamore, IL; (*Information Services*) Amanda Wentzel, of DeSoto, Inc., Des Plaines, IL; (*FSCT Exhibit*) Victor M. Willis, of Sherwin-Williams Co., Chicago, IL; (*Registration*) Evans Angelos, of Kraft Chemical Co., Inc., Melrose Park, IL; and (*Spouses*) Claudia Hille and Donna Vandeberg.

NPCA MEETS SAME WEEK

The National Paint & Coatings Association will hold its Annual Meeting on October 22-24, at the Palmer House.

The back-to-back scheduling of Association and Federation events provides coatings industry personnel with a full week of programming, specifically geared to their interests.

1984 Paint Industries' Show

Current List of Exhibitors

Aceto Chemical Co., Inc.
Advanced Coatings Technologies, Inc.
Air Products & Chemicals, Inc.
Alcan Ingot and Powders
C. M. Ambrose Co.
American Hoechst Corp.
Amoco Chemicals Corp.
Angus Chemical Co.
Applied Color Systems, Inc.
Arco Chemical Co.
Armstrong Containers
Ashland Chemical Co.
Atlas Electrical Devices Co.

B.A.G. Corp.
BASF Wyandotte Corp.
Battelle Memorial Institute
Bausch and Lomb, Inc.
Beltron Corp.
Berol Chemicals, Inc.
Blackmer Pump Div., Dover Corp.
Bonar Industries, Inc.
Brookfield Engineering Labs., Inc.
Buckman Laboratories, Inc.
Buhler-Miag, Inc.
Burgess Pigment Co.
Byk-Chemie USA, Inc.

Cabot Corp., Cab-O-Sil Div.
Calgon Corp., Div. Merck & Co.
Canada Talc Ltd.
Cargill, Inc.
CDI Dispersions
Celanese Chemical Co., Inc.
Celanese Specialty Resins
CEM Corp.
Certified Equipment & Mfg. Co.
Chemical & Engineering News (ACS)
Chemische Werke Huls AG
Chicago Boiler Co.
Clawson Tank Co.
Color Corp. of America
Columbian Chemicals Co.
Commercial Filters
Consolidated Packaging Machinery Corp.
Continental Fibre Drum Co.
Cordova Chemical Co.
Cosan Chemical Corp.

Daniel Products Co.
Data Decisions
DataLogix
Degussa Corp.
University of Detroit
Diamond Shamrock Corp.
Disti, Inc.
D/L Laboratories
Dominion Colour Co.
Dow Chemical USA
Dow Corning Corp.
Draiswerke, Inc.
Drew Chemical Corp.
DSET Laboratories, Inc.
DuPont Co.

Eastern Michigan University
Eastman Chemical Products, Inc.
Ebonex Corp.
Eiger Machinery, Inc.
Elcometer, Inc.
EM Chemicals
Engelhard Corp., Mins. & Chems. Div.
Epworth Manufacturing Co., Inc.
Erwin Software Co.
Exxon Corp.

Fawcett Co., Inc.
Fed. Socs. Coatings Technology
Filter Specialists, Inc.
Finish Engineering Co., Inc.
Flexbin Corp.
Freeport Kaolin Co.
Fricke Enterprises

GAF Corp.
Georgia Kaolin Co., Inc.
Globe Trading Co.
Goldschmidt Chemical Corp.
W.R. Grace & Co., Davison Chem. Div.
Graco, Inc.

Halox Pigments, Div. Hammond Lead Prods.
Harshaw/Filtrol Partnership
Helios Container Systems
Henkel Corp., Polymers Div.
Hercules Incorporated
Heubach, Inc.
Hilton-Davis Chemical Group
Hockmeyer Equipment Corp.
J. M. Huber Corp.
Hunter Associates Lab., Inc.

ICI Americas, Inc.
Ideal Manufacturing & Sales Corp.
Industrial Finishing Magazine
Int'l. Minerals & Chemicals Corp.
Interstab Chemicals, Inc.
ISC Alloys Ltd.

S.C. Johnson & Son, Inc.

Kay-Fries, Inc., Chem. Div.
Kay Publishing Co. Ltd.
Kenrich Petrochemicals, Inc.
Kent State University
Kinetic Dispersion Corp.
King Industries, Inc.
Kraft Chemical Co.
KTA-Tator, Inc.

Labelette Co.
Letica Corp.
Liquid Controls Corp.
Lorama Chemicals, Inc.

3M, Commercial Chemicals Div.
Macbeth Div., Kollmorgen Corp.
Manchem Incorporated
Manville-Filtration & Minerals
McCloskey Varnish Co.
McWhorter, Inc., Color Corp. of America
Mearl Corp.
Micromeritics Instrument Corp.
Miller Paint Equipment, Inc.
Mineral Pigments Corp.
MiniFIBERS, Inc.
Minolta Corp.
Mobay Chemical Corp.
Modern Paint and Coatings
Morehouse Industries, Inc.
Myers Engineering

Nalco Chemical Co.
National Assn. of Corrosion Engineers
National Paint and Coatings Assn.
Netzsch Incorporated
Neville Chemical Co.
NL Chemicals/NL Industries, Inc.
North Dakota State University
Nuodex, Inc.

O'Brien Industrial Equipment Co.
Ottawa Silica Co.

Pacific Anchor Chemical Corp.
Pacific Scientific Co., Gardner/Neotec
Parallax Computer Corp.
Penn Color, Inc.
Pennsylvania Glass Sand Corp.
Pfizer, Inc., MPM Div.
Plastican, Inc.
Polyvinyl Chemical Industries, Inc.
PPG Industries, Inc.
PRA Laboratories, Inc.
Premier Mill Corp.

Q-Panel Co.

Reichard-Coulston, Inc.
Reichhold Chemicals, Inc.
Rohm and Haas Co.
Russell Finex, Inc.

Sanyo-Kokusaku Pulp Co. Ltd.
Schold Machine Co.
Semi-Bulk Systems, Inc.
Shamrock Chemicals Corp.
Shell Chemical Co.
Sherwin-Williams Chemicals
Silberline Manufacturing Co., Inc.
South Florida Test Service, Inc.
Southern Clay Products, an ECCA Co.
University of Southern Mississippi
Spartan Color Corp.
Spencer Kellogg Div. of Textron, Inc.
Standard Container Co.
Steel Structures Painting Council
Sun Chemical Corp., Pigments Div.
Synray Corp.

Tammsco, Inc.
Technology Marketing Corp.
Thibaut & Walker Co., Inc.
Troy Chemical Corp., Inc.

Union Camp Corp.
Union Carbide Corp.
Union Carbide Corp., Specialty Polymers & Composites Div.
Union Chemicals Div., Union Oil Co.
Union Process, Inc.
United Catalysts, Inc.
Universal Color Dispersions

R. T. Vanderbilt Co., Inc.
Verlan Limited
Viking Pump Div., Houdaille Ind.
Vorti-Siv Div., M&M Machine, Inc.

Wacker Chemical Co.
Warren Rupp Co.
Welco Products & Itasco Ind.
Wilden Pump & Engineering Co.
Witco Chemical Corp.

Zeelan Industries, Inc.
Zorelco Limited

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Housing and Advance Registration Forms

62nd ANNUAL MEETING
49th PAINT INDUSTRIES' SHOW

CONRAD HILTON HOTEL • OCTOBER 24, 25, 26

1984 ADVANCE REGISTRATION

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1315 Walnut St., Philadelphia, PA 19107

C	Office Use Only
U	Date received _____
	Amount $ _____
V	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 SEPTEMBER 17. NONE WILL BE ACCEPTED AFTER THAT DATE.

A $10.00 charge will be made for cancellations received prior to September 17. 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

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

_____
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 ONLY)

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 ONLY)

KK ☐ Management/ Administration

LL ☐ Manufacturing and Engineering

MM ☐ Quality Control

NN ☐ Research and Development

PP ☐ Technical Sales Servic

QQ ☐ Sales and Marketing

RR ☐ Consultant

SS ☐ Educator/Student/ Librarian

TT ☐ Other

SPOUSES REGISTRATION AND INFORMATION FOR REGISTRATION BADGE:

D ☐ SPOUSE $35.00

SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

H ☐ $25.00

NICKNAME

NAME

ADDRESS

CITY STATE

MAILING ZONE COUNTRY (OTHER THAN U.S.)

TICKETS FOR FEDERATION LUNCHEON, FRIDAY, OCTOBER 26 (@ $20.00)

Z ☐ NUMBER REQUIRED: _____ $20.00 EACH.

A CHECK IN THE AMOUNT OF:

$ _____

IS ENCLOSED

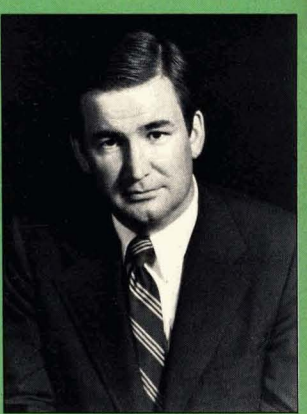
1984 Annual Meeting
Paint Industries' Show
October 24, 25, 26
Conrad Hilton Hotel
Chicago, Illinois

OPENING SESSION
Wednesday, October 24

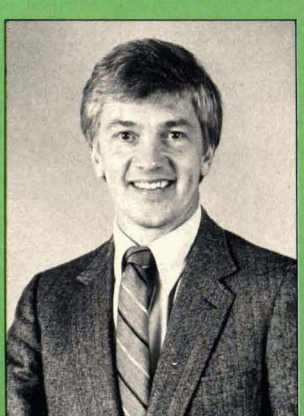
"The 1984 Elections"

Pat Buchanan

A leading strategist and syndicated columnist, Pat Buchanan will draw on his years of political experience as he addresses the Opening Session of the Annual Meeting. Mr. Buchanan served as senior staff assistant, press secretary, and speech writer during the "Nixon Years," from the comeback campaign to the final days of Nixon's Presidency in 1974.



Pat Buchanan



Robert E. Pajor

Keynote Address

"Meeting the Challenge of Managing Change"

Robert E. Pajor

Robert E. Pajor, the Keynote Speaker of the Annual Meeting is President and Chief Operating Officer of the Valspar Corp. He joined Valspar's Industrial Coatings Division in 1970, and has held the positions of Sales Manager, Marketing Manager, and Vice-President and General Manager of the division. Mr. Pajor was named Executive Vice-President of the corporation in 1981 and was elected to his present position the following year.

FSCT 1984 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
CONRAD HILTON HOTEL, CHICAGO, ILLINOIS
OCTOBER 24, 25, 26 (Wednesday, Thursday, Friday)
APPLICATION FOR HOTEL ACCOMMODATIONS

MAIL TO: **Fed. Socs. Coatings Tech.**
1315 Walnut St.—Dept. H
Philadelphia, PA 19107

Please indicate below the type of accommodations requested and choice of hotels. All reservations will be processed by the Housing Bureau of the Chicago Convention & Visitors Bureau. Hotel assignments will be made in accordance with prevailing availability. The Housing Bureau will send you an acknowledgment, noting the hotel to which you have been assigned. The confirmation of your reservation will come to you directly from the hotel, to whom you must direct all inquiries.

All reservations will be held until 6:00 p.m. and none can be guaranteed after September 28.

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 AND ADDRESSES OF ROOM OCCUPANTS AND DATES OF ARRIVAL/DEPARTURE

Type of Room	Name	Address	Dates Arrive	Depart

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

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

Name _____

Company _____

Address _____

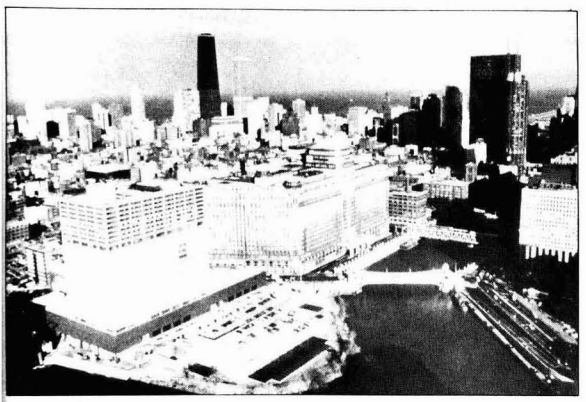
City _____ State or Province _____

Country _____ Mailing Code _____

Telephone _____

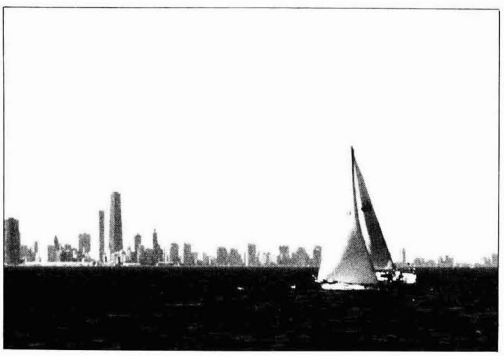
Note: Requests for accommodations at the Conrad Hilton will be limited to five rooms per company. A parlor counts as one room.

Chicago

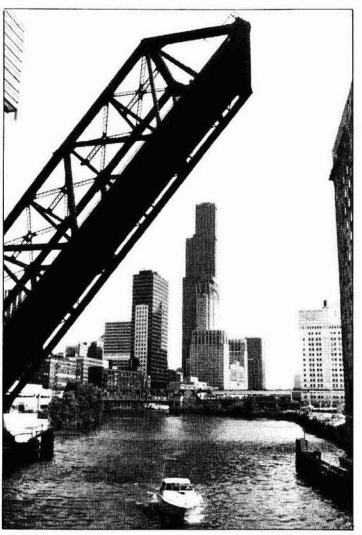


The Apparel Center, Expocenter/Chicago and the Merchandise Mart

Skyline, including the Sears Tower, Burnham and Monroe Harbor, the John G. Shedd Aquarium, and the Field Museum of Natural History



View of the skyline from a sail boat on Lake Michigan



Bridge opening along the Chicago River for a sail boat, with the Sears Tower in the background

Panorama of Chicago's skyline, Soldier Field, Merrill C. Meigs Field, and McCormick Place

Photos Courtesy of Chicago Convention and Tourism Bureau

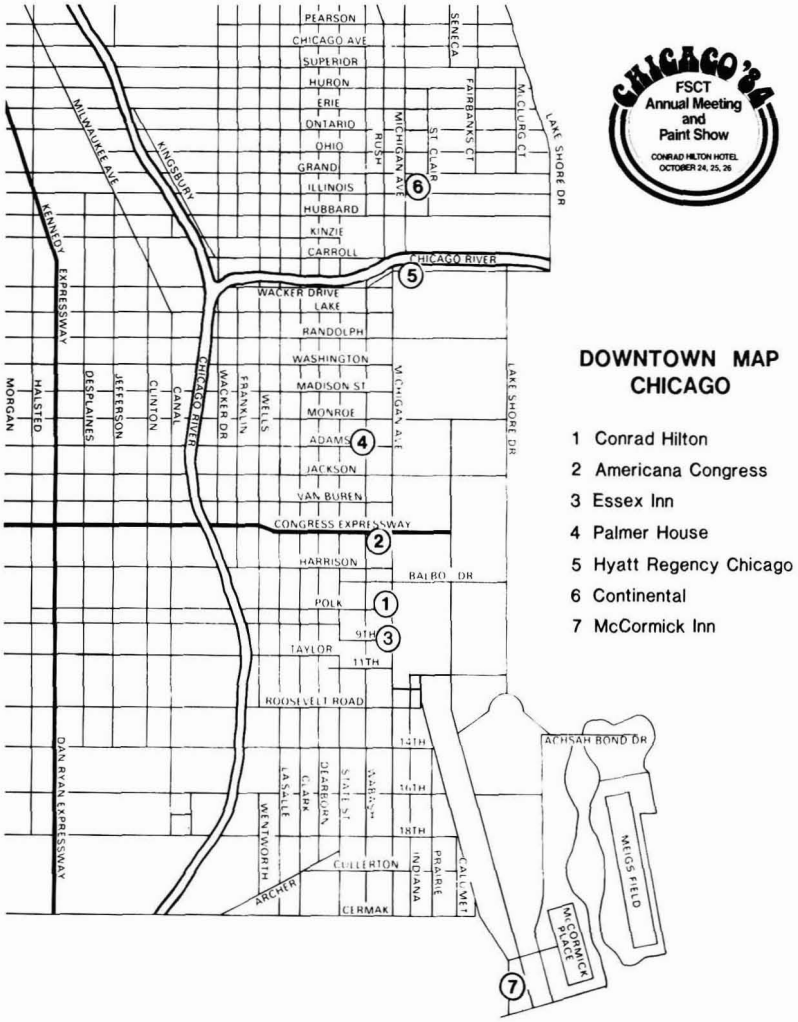
HOTEL INFORMATION AND RATES

All Room Rates Are Subject to a City and State Tax of 9.1%.

Hotel	Singles	Doubles Twin	Parlor & 1 Bedroom	Parlor & 2 Bedrooms
***Conrad Hilton**	65-71-82-86-97	81-97-98-102-113	100 to 355	255 to 475
***Conrad Hilton Towers**	82-102	98-118	"	"
Americana Congress	55	65	85 to 300	175 to 400
Continental	70	85	175 to 240	240 to 450
Essex Inn	46-54-60-66	56-64-70-76		
Hyatt Regency	94-104-114-124	109-119-129-139	175 to 525	275 to 625
McCormick Center	68-78-86-96-104	80-90-98-108-116		
†Palmer House	75-90-105-115-130	95-110-125-135-150	165 &up	395 & up

* Requests for accommodations at the Conrad Hilton will be limited to five rooms per company. A parlor counts as one room. Additional reservations will be assigned to other cooperating hotels.

† Reservations for the Palmer House will be accepted for arrival beginning Wednesday only.



CHICAGO '84
FSCT
Annual Meeting
and
Paint Show
CONRAD HILTON HOTEL
OCTOBER 24, 25, 26

DOWNTOWN MAP CHICAGO

1 Conrad Hilton
2 Americana Congress
3 Essex Inn
4 Palmer House
5 Hyatt Regency Chicago
6 Continental
7 McCormick Inn

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Spring 1984 Board of Directors Meeting

Thirty-four members and 29 guests attended the Spring Meeting of the Board of Directors of the Federation of Societies for Coatings Technology, on May 18, 1984, in Louisville, KY.

The following were in attendance:

Officers

President ..... Terryl F. Johnson
President-Elect ..... Joseph A. Bauer
Treasurer ..... William Mirick

Society Representatives

Baltimore ..... James A. McCormick
Birmingham ..... David Lovegrove
Chicago ..... John T. Vandeberg
C-D-I-C ..... Lloyd Reindl
Cleveland ..... Fred G. Schwab
Dallas ..... Carlos Dorris
Detroit ..... Harry B. Majcher
Golden Gate ..... Barry Adler
Houston ..... Willy C.P. Busch
Kansas City ..... Normon Hon
Los Angeles ..... Dermont G. Cromwell
Louisville ..... James Hoeck
Mexico ..... Antonio Pina
Montreal ..... Horace Philipp
New England ..... Daniel Toombs
New York ..... Saul Spindel
Pacific Northwest ..... Deryk R. Pawsey
Philadelphia ..... Carl W. Fuller
Piedmont ..... Gary Marshall
Pittsburgh ..... Edward Vandevort
Rocky Mountain ..... James E. Peterson
Southern ..... Berger Justen
St. Louis ..... Thomas Fitzgerald, Sr.
Toronto ..... Kurt F. Weitz
Western New York ..... Thomas Hill

Other Members

A. Clarke Boyce ..... Toronto
Morris Coffino ..... New York
William Dunn ..... Toronto
Neil S. Estrada ..... Golden Gate
Ted Favata ..... Golden Gate
Al Heitkamp ..... Northwestern

Guests

Charles Fisher, of Reliance Universal, Inc., and Ray Connor, who are President and Technical Director, respectively, of the National Paint and Coatings Association.

Royal A. Brown, Federation Technical Advisor.

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

Edward Thomasson, Vice-President of the Louisville Society.

The following Society officers attended the orientation meeting the previous day: Frank Gerhardt, of Baltimore; Martin Balow, of Chicago; Madelyn Harding, of Cleveland; Ashwin Parikh, of Dallas; William Passeno, of Detroit; Robert Miller, of Golden Gate; Arthur McDermott, of Houston; Michael Gildon, of Los Angeles; Jerry Morris, of Louisville; Maureen Lein, of New England; William Georgov, of Philadelphia; Michael Davis, of Piedmont; Joseph Mascia, of Pittsburgh; Charles Grubbs, of St. Louis; and Sal Sanfilippo, of Southern.

Staff

Frank J. Borrelle, Executive Vice-President; Thomas A. Kocis, Director of Field Services; Rosemary Falvey; Director of Meetings and Conventions; and Robert F. Ziegler, Editor of JOURNAL OF COATINGS TECHNOLOGY.

Board members in attendance included (left to right): Ted Favata (Member-at-Large); Tony Pina (Mexico); Horace Philipp (Montreal); and Jim Hoeck (Louisville)

Mr. Borrelle called the roll of members and reported all present except the Society Representative from the Northwestern Society.

The report of the Fall 1983 Board of Directors meeting was approved as published in the January 1984 JOURNAL OF COATINGS TECHNOLOGY.

In Memorium

A moment of silence was observed in memory of Walter F. Kuster, FSCT President 1942–43, who died February 9, 1984.

Report of Officers And Staff

PRESIDENT JOHNSON

The Federation has reached the mid-year point and is operating within budget so we can say "all is well."

Two very important items have presented themselves: first, the PRI Trustees have assessed the goals, objectives, and finances of PRI and have presented their recommendations to the Board for consideration at the May Board meeting; second, the Ad Hoc committee studying Federation Office Space has held two meetings and have also presented their report to the Board.

The most enjoyable part of being President is visiting the Constituent Societies. So far it has been my privilege to attend the Northwestern, New England, Cleveland, Golden Gate and New York Society meetings, have lunch with the Rocky Mountain Society Executive Committee, and attend the Southern Annual Meeting and Southwestern Paint Convention. The Pacific Northwest Symposium will be attended in May.

Plans for the Annual Meeting and Paint Industries' Show are rolling right along. Program Chairperson Darlene Brezinski and Paint Show Chairman Deryk Pawsey have most of the pieces in place to make this year's event the best ever.

TERRYL JOHNSON,
President

PRESIDENT-ELECT BAUER

As President-Elect, I have two areas of responsibility—the visiting of the local Societies and the selection of 1984–1985 Committee Chairmen. I have completed my Society visits and will be making committee selections in the near future.

I made three Society visits: Detroit, St. Louis, and Pittsburgh, together with staff. In Pittsburgh, we checked out the facilities for Spring Week in 1986.

The Federation hosted the JPICC (Joint Paint Industry Coordinating Committee) meeting in Philadelphia on March 27 and 28. I enjoyed it and all members had positive comments on the economy in 1984.

I am chairman of the Ad Hoc Committee on Federation Office Building. We had two meetings and will have a report for the Board of Directors' spring meeting recommending purchasing of an office condominium in downtown Philadelphia.

Last, but not least is our Staff in Philadelphia. They are a group of real professionals. They really make our job as Officers easy.

JOSEPH A. BAUER,
President-Elect

TREASURER MIRICK

The primary duty of your Treasurer is to monitor the finances of both the Federation and the Paint Research Institute.

The first quarter report of the Federation is in order and it indicated that we are operating within the 1984 budget. The task of the Treasurer is made easy due to the dedicated Staff at the Federation Headquarters.

Due to the recommendations to be made at this meeting by the PRI Trustees, no formal budget was prepared for PRI.

As Treasurer, I have represented the Federation at:

(1) The Paint Research Institute Trustees meeting in January
(2) The Joint Paint Industry Coordinating Committee Meeting in March
(3) A Society visit to the Western New York Society where we were joined by Executive Committee members of the Toronto Society
(4) The two meetings of the Ad Hoc Committee on Federation Office Space.

I have appreciated the assistance of the Federation Staff during this learning period.

WILLIAM MIRICK,
Treasurer

EXECUTIVE VICE-PRESIDENT BORRELLE

1983 WAS A GOOD YEAR

All Federation activities in 1983 were successful and produced another good year. In February 1984, as in recent previous years, a transfer of funds was made from operations to the investment trust. So far in 1984, we are on target again.

1984 BUDGET

In January, the Finance and Executive Committees approved a budget of $1,447,000. The income/expense allocations are:

Income: Publications—37%; Annual Meeting and Paint Show—50%; Membership Dues—7%; Educational Activities—2%; and Miscellaneous—4%.

Expense: Headquarters Office/Administration—38%; Publications—30%; Annual Meeting and Paint Show—18%; Educational Activities—6%; and Officer/Board/Committees—8%.

Publications

JCT: Advertising page sales zoomed so in 1983 that income was 34% in excess of the budget.

Year Book: The 1984 edition was mailed on February 29. Thanks are extended to the Society Treasurers and Rosemary Falvey and other staffers for another early release of the annual directory.

Series Units: The Publications Advisory Board (Dr. Thomas J. Miranda, Chairman) is making fine progress with the "new" Series on Coatings Technology. More than half of the authors for the 40-title series have been assigned by the Co-Editors, Dr. Miranda and Dr. Darlene Brezinski.

Brochure on Paint Quality: Sales of the Southern Society's "Latex Interior Flat Paint" have trickled off. The draft of the sequel on "Exterior" is nearing completion and will be submitted to the Federation for review and approval.

Membership Services

The names of 6,749 members (4,582 Active, 1,781 Associate, 386 Other) were published in the 1984 *Year Book*. The growth (29) from the 1983 edition would be higher if there were not so many late-paying members.

The Federation Activites brochure was updated and reprinted. Copies of this, and the literature brochure, go to each new member along with a letter of welcome from yours truly.

The Societies have been notified that sticker labels, denoting 25- and 50-year membership, are available from the Federation office.

It is a real pleasure for the Federation to present (via the Societies) special pins and pens to members who attain 50-year membership.

Annual Meeting and Paint Show

The 1983 AM&PS in Montreal—and the first outside the U.S.—was a big success. The Show was the largest with 176 exhibitors in 40,110 net square feet. Registered attendance was 5,688.

The 1984 Show will be another record-breaker. Utilizing five exhibit halls on three levels of the Conrad Hilton Hotel in Chicago, the Show will have more than 190 exhibitors in 42,000+ net square feet.

Because renovations in the hotel have reduced the number of available rooms to about 1,000, several additional hotels have to be used and they are more scattered than heretofore.

Committee Liaison

National meetings of the Federation/Society Technical and Educational Committees were sponsored again this year, as was a meeting of the Federation Manufacturing Committee. Tom Kocis, Director of Field Services, will report on these and other activities.

Technical Advisor

We have enjoyed working with Roy Brown toward a successful Manufacturing Seminar and the Paint Proficiency Testing Program now available under Federation sponsorship through Collaborative Testing Services. Both Roy and Tom will cover these in their reports.

Spring Week

The Federation's first "Spring Week" takes place from May 15–18 in Louisville. There will be the Manufacturing Seminar on the 15th and 16th; Society Officers meeting on the 17th; and the Board meeting on the 18th. The Louisville Society, and several companies in the area, have cooperated to extend super hospitality to the visiting Federationers and I thank them in advance, for the Federation.

Spring Week (May 1985) will be in Baltimore. In May 1986, Pittsburgh is the site.

JPICC

The Federation hosted the annual meeting of the Joint Paint Industry Coordinating Committee (FSCT, NPCA, NDPA, PDCA), March 26–27, in Philadelphia.

One of the four—Painting and Decorating Contractors of America—will celebrate its 100th anniversary during the first week of May. President Terryl Johnson and yours truly will represent the Federation at the event in New York.

Federation Exhibits

The Federation exhibited at the annual "Corrosion Show" of the National Association of Corrosion Engineers, New Orleans, April 2–5. Tom and Bob Ziegler reported a lot of interest in the Federation booth, the last being in 1980.

We will also exhibit at the New England Society's "Coatings Tech Expo," May 16–17. Lorraine Ledford and Kathy Wikiera are in charge.

Federation Offices

Since it appears that we cannot remain at our present location, I, in the company of our real estate consultant, have looked at both rental and ownership possibilities in the downtown area. The office condominium is a new and interesting approach. We will, of course, abide by the committee's decision.

Officer/Staff Visits

Officer/Staff visits so far this administrative year have been to the monthly meetings of: Montreal, Baltimore, Northwestern, New England, Detroit, New York, Golden Gate, St. Louis, Pittsburgh, and Western New York. Because of time

Board members include (left to right): Barry Adler (Golden Gate); Harry Majcher (Detroit); Carlos Dorris (Dallas); and Fred Schwab (Cleveland)

and travel constraints, the visit to Rocky Mountain was confined to a luncheon meeting of their officers and President Terryl Johnson.

We also attended the 50th anniversary meeting of Southern and the Southwestern Paint Convention.

Federation Staff

Members of the staff are: Audrey Boozer, Marie Eichler, Rosemary Falvey, Kathryn Ferko, Linda Hanratty, Tom Kocis, Lorraine Ledford, Dorothy Robinson, Mary Sorbello, Patricia Viola, Kathy Wikiera, and Bob Ziegler. Pat, the new Associate Editor of the JCT, was with us previously from February 1979 through November 1980, and we are glad to have her back.

In mid-September, Rosemary will mark her 25th anniversary as a member of the Federation staff.

Frank J. Borrelle
Executive Vice-President

DIRECTOR OF FIELD SERVICES KOCIS

Committee Activities

Manufacturing—Committee met on March 21, in St. Louis, to discuss current and proposed activities.

Final critique of Kansas City Society's revised and updated A/V program on "Operation of a Vertical Sandmill" was accommodated and the production approved for addition to the Federation library. Copies of the slides, tape, and accompanying script, have been produced and are now available for sale.

List of suggested topics for production of additional slide/tape programs is being compiled.

Program presentation on filtration applications is being developed for the Annual Meeting; discussions will be designed to fit a 2-½ to 3-hour session.

Committee is also pursuing arrangements for a proposed plant tour in conjunction with the AM in Chicago. This would be held on Tuesday, October 23; as with previous tours, would be limited to Steering Committee members and Society Manufacturing Committee Chairmen.

Technical Advisory—A meeting of the TAC with Society Technical Committee Chairmen was held March 28–29, in Minneapolis, which was attended by 22 Society representatives. Focus of discussions was Society projects underway and suggestions for work that might be undertaken to supplement current activities.

Included were discussions on ways to further cooperative Society projects, similar to the work being done on testing of paints formulated with polymers containing chemically attached mildewcides (8 Societies), as well as the round-robin testing which was conducted by 19 Societies as a preliminary to the Federation-sponsored Proficiency Testing Program.

Reports of Society Technical Committee activity, as submitted, will be published in a forthcoming issue of JCT.

Program—Theme for the '84 Annual Meeting programming is "Appearance and Protection—Essential to Our Lifestyle," which will stress the many advanced technologies and scientific disciplines utilized by the industry to produce coatings that beautify and protect. The Program Committee is developing two sessions—one on appearance, the other on protection—to assure that the theme is adequately addressed.

Early planning and publicity have generated a substantial number of manuscript offerings, and early indications point to a plentiful complement of top-quality presentations for the Chicago event.

The Committee also plans several additional features, e.g., poster sessions and motion picture showings.

Educational—Steering Committee met with Educational Committee representatives from 16 Societies on April 6, in Cleveland.

Among feature agenda items discussed was promotion of coatings career opportunities, as well as improving the industry image—"telling the coatings story." This has been a topic of discussion for this group for the last several years, and it was felt that a start should be made, and refinements added along the way.

Accordingly, a draft will be developed by staff (for distribution to all Steering Committee members and Society Educational Committee Chairmen for review), to be the narrative for a slide/tape program. It will be a broad overview discussion on paint and coatings, aimed at the high school level student; this program could then be revised/refined to serve as a career promotion presentation. The draft is to be developed over the next few months, with the aim of a finished program (slides and tape) to be completed later this year.

Reports on Society educational activities, as submitted, will be published in a forthcoming issue of JCT.

Annual update of "Guide to Coatings Courses" was published in January.

Miscellaneous

Initial arrangements have been completed for Symposium on Color and Appearance Instrumentation, scheduled for April 17–18, 1985, in Pittsburgh. This event, co-sponsored by the Federation, Manufacturers Council on Color and Appearance, and Inter-Society Color Council was previously held in 1978 and 1981 . . . Annual update of "Talks Available" being readied for publication . . . Standard on Adhesion Resistance has been added to "Pictorial Standards on Coatings Defects" manual . . . Assisting Advisory Board in development of new Series on Coatings Technology—authors have been selected for 21 of the 40 booklets, and writing is currently underway on 13 of them . . . Staff support provided for publicity, programming, and on-site arrangements for Manufacturing Seminar; liaison and staff support also provided for activities of Environmental Control, Corrosion, and Roon, AP&CJ, Trigg, and MMA Awards Committees.

Thomas A. Kocis
Director of Field Services

TECHNICAL ADVISOR BROWN

FSCT Second National Seminar

The Federation's second national seminar, "Producing Paint Efficiently, Safely and Economically", is ready for presentation at the Louisville Convention Center on May 15–16, 1984. We expect the seminar to be a successful one and that it will be a valuable contribution to the paint and coatings industry.

Proficiency Testing Program

We have believed for a long time that our industry needs a Proficiency Testing Program. The Paper and Rubber Industries have had such programs for several years. Programs on Color Testing and on Forensic Technical Examinations have also been in existence for many years.

The program which we will conduct in cooperation with Collaborative Testing Services, Inc., of McLean, VA, will allow

companies to compare the level and precision of their paint testing with that of others in their industry. The program will provide a check on both instrument calibration and operator efficiency. Reliable testing is basic to good quality control. The objective of the program is to improve the reliability of paint and coatings testing and to encourage the development of more reproducible test methods. The Federation Proficiency Testing Program is open to paint manufacturers, raw material suppliers, commercial labs, paint users, and anyone interested in the testing of paint products. Brochures describing the program are available from Federation headquarters.

Cooperative Work by Society Technical Committees

Mildew Research: Practical research on mildew prevention is being conducted by the Technical Committees of eight Societies. Stable paint formulations plus quantities of "active" and "blank" emulsion polymers were sent to the eight Societies for use in manufacturing experimental paints and preparing exposure panels. The paint formulas and polymers were developed by members of the Mildew Consortium of PRI.

We are trying to determine by exterior exposure panels whether a mildewcide chemically attached to the polymer will provide mildew resistance in a paint, and whether the mildew resistance will last longer than the same mildewcide incorporated as a stir-in additive. We may be getting some results from this work by the coming summer as some panels will have been exposed six months to one year by that time. A brief report of work by Societies was published in the JCT [see May issue, p. 30].

Preliminary Testing Program: As a forerunner to the Federation Proficiency Testing Program, the Technical Advisory Committee decided to conduct a round-robin test exercise. Each member of the TAC and each Society Technical Committee Chairman was asked to participate. A pint sample of white baking enamel was sent to each participant along with copies of the two test methods to be used.

Each cooperator was asked to perform two tests and to send the test results to the Technical Advisor. Tests run were Volatile Content (ASTM D-2369) and Stormer Viscosity (ASTM D-562). Nineteen sets of results were received. Test results were compiled and sent to each cooperator. Our experience with this preliminary program was discussed at the March 28-29, 1984 meeting of the TAC and Society Technical Committee Chairmen held in Minneapolis. This program served to show the range of deviations in test results when different laboratories test the same paint product. It also served to promote the interest in the Federation Proficiency Testing Program soon to be started.

PRI Questionnaire Results

"What Did the PRI Questionnaire Tell Us" was published in the December 1983 edition of the Journal of Coatings Technology. This article describes the information received in the 276 replies to the PRI questionnaire submitted to our industry in 1982. The opinions expressed by technical, management and sales personnel from paint manufacturers, raw material suppliers and others makes for interesting reading.

This compilation of ideas regarding the types of research most needed by our industry should provide a valuable reference source to all interested parties. Reprints of the article may be obtained from Federation headquarters.

Committees

Attended were the recent meetings of the Technical Advisory, the Manufacturing and the Educational Committees of the Federation. It is evident that cooperative projects in which several Societies can participate generates interest among those involved, as well as providing a valuable service to our industry. We are working to generate new projects and new ideas which can be utilized by these committees. All suggestions are welcome.

Royal A. Brown,
Technical Advisor

Representing their Societies at the meeting were (left to right): Lloyd Reindl (CDIC); John Vandeberg (Chicago); David Lovegrove (Birmingham); and Jim McCormick (Baltimore)

Paint Research Institute

PRESIDENT MIRANDA

At the January 5, 1984 meeting of the Board of Trustees, the Trustees voted to recommend to the Executive Committee and Board of Directors that PRI be dissolved and that in its place a Professional Development Committee be organized comprising the present Trustees of PRI.

In order to place this action in perspective, let me provide some background which led to this action.

The Paint Research Institute was formed at a time when many paint companies did not or could not conduct fundamental research in the coatings field. PRI filled this need and was funded and supported by contributions and by the Roon Foundation. Over the years, several factors arose which caused Society members to question PRI goals and accomplishments. These were:

- Relevance of PRI research to practical coating needs.
- Difficulty of the rank and file to understand PRI research results.
- An apparent indifference of PRI managers to adequately address Society concerns.
- Increasing cost of research and fellowships and more firms doing their own fundamental research.
- Declining Society support; major Societies withholding PRI contributions.
- Disenchantment with PRI.

In an effort to improve PRI effectiveness, Dr. Raymond Myers, Research Director, embarked on a new consortium approach to PRI problems. In this effort he identified and structured a major Mildew Program and obtained sponsors to carry out research in this important area of coatings. One result was the synthesis of a polymer which had mildewcidal properties and could be formulated into a paint.

A program was structured to obtain test results on this polymer, but many delays and poor management resulted in many inconclusive results and confusion. Meanwhile, control

Honored guest at the Board meeting was Charles Fisher, President of the National Paint & Coatings Association, who presented an update of NPCA activities and government regulations

of the Consortium slipped away from the PRI to the Program Manager of the Mildew Program since they were funding the program.

At that time, I became a Trustee and later President of the Paint Research Institute and analyzed the state of affairs of the organization. It was clearly apparent that research costs were escalating, support was declining and the administrative costs were totally out of line. We were spending half of our funds on administration. It was time to kill a dead horse!

As a result, I proposed to the trustees that PRI be dissolved; a request which was respectfully turned down. Instead, the Trustees recommended streamlining PRI objectives and reducing the number of fellowships to favor large grants with professors of proven research results records. Also apparent was the critical need for more funds and as soon as possible, if PRI was to survive. The Trustees also voted to disassociate PRI from the Mildew Consortium as that has progressed beyond the aegis of the PRI.

At the October 11, 1983 meeting of the Board of Directors of the Federation, I asked for support in raising funds for PRI in which key Societies would serve as a nucleus for fund acquisition. This was greeted with enthusiastic silence! Meanwhile, large Societies voted to discontinue support for the Paint Research Institute.

With the above background, it became obvious that unless a large infusion of money and support was pumped into PRI, it's days as a research granting organization were numbered.

At the January 5, 1984 meeting of the Trustees a recommendation was voted to dissolve PRI, complete its outstanding obligations and cease to exist. The Roon Awards could be transferred to another Society function, i.e., the Roon Committee, to continue competition for papers at the Annual Meeting. The Trustees recommended that to fill the gap, a Professional Development Committee be formed to effectively determine and then fill the needs of the membership not presently served by the Federation.

As an example, this committee could sponsor seminars, short courses and workshops during the year and at the Annual Meeting. This committee would preserve the nucleus of PRI Trustees whose service to the Federation and the industry is a valued resource.

The Trustees feel very strongly about this proposed committee and stress the urgency to maintain some continuity to the work of PRI and the Trustee group.

The Executive Committee of the Federation did not approve this proposal as submitted, much to the chagrin of the Trustees!!

My sincere thanks to the Board of Trustees and its Officers for serving PRI and the Federation and for having the foresight and courage to recognize the impending demise of PRI and taking an appropriate action. Thanks are also due to those who supported PRI over the years as grantees, Trustees and supporters.

Dr. Seymore Hochberg performed in an excellent manner during his tenure as Executive Director and to him go my best wishes.

Thanks are also due to the Federation Staff for their continued support.

THOMAS J. MIRANDA,
President

Following the presentation of Dr. Miranda's report, the recommendations of the Executive Committee (from their January 27, 1984 meeting) were presented to the Board for their action. These recommendations were:

(1) That PRI not be dissolve, but kept alive for the sole purpose of maintaining the "Roon Fund;" and that PRI no longer continue its research-granting activities.
(2) That the name, "Paint Research Institute," be changed to "Roon Fund."
(3) That the principal and interest of the "Roon Fund" be distributed in a manner consistent with the educational and research objectives stated in the PRI Charter.
(4) That the Board of Directors (the stockholders of PRI) elect the Executive Committee as Trustees of the "Roon Fund," with the intention that they would retain the Investment Committee to manage the Fund.

Upon motion duly made and seconded, the recommendations of the Executive Committee were approved by the Board.

The change in name of the Paint Research Institute to "The Roon Fund" is now subject to approval by the PRI Board of Trustees.

Ad Hoc Committee On Federation Office

The last report of this committee routed to the Board of Directors was in the report of the Executive Committee meeting

of January 27, 1984. The recommendations of the committee, at that time, were:

(1) That the Federation office be located in Philadelphia.

(2) That the size of the office be from 6,000 to 8,000 sf.

(3) That the Federation not become involved in any limited partnership arrangement.

(4) That the possibilities of remaining at 1315 Walnut St. be investigated, along with other rental space in the downtown area.

(5) That we continue discussions regarding the purchase of office space in the condominium office building being renovated at 1608 Walnut St.

The committee met again in Philadelphia on March 27, 1984, along with Jack McCombs, our real estate consultant. At this meeting we reviewed the rental situation at the present office and two other office buildings in the area.

We learned that no suitable small buildings are available for purchase. And—we personally visited the office condominium building at 1608 Walnut St. It is located about four blocks from the present office.

After a careful study of the possibilities regarding the future of the Federation office, we recommend to the Board of Directors that the Federation purchase 8,000 sf on the 14th floor of 1608 Walnut St. (the old Sun Oil headquarters). The building has been entered in the National Register of Historic Places kept by the United States Dept. of the Interior.

The purchase price of the 8,000 sf is $170 per sf. 6,000 sf will be utilized for the Federation office; the other 2,000 is there for future growth—but for the initial years—will be rented at approx. $20 sf.

We are convinced that the purchase of condominium office space is in the best interests of the Federation because:

(1) We stabilize our rental costs.

(2) After a few years, the costs decrease and will continue that pattern as the years go by.

(3) We build equity, instead of paying rent.

In summary then, we recommend that the Federation Board of Directors approve the purchase of office condominium space as indicated. The purchase is, of course, subject to review and approval of all paperwork and details by our attorney and real estate consultant and the availability of a tenant for the 2,000 sf within a reasonable length of time. The management of 1608 Walnut will make some arrangement regarding the current office lease at 1315 Walnut which expires in October 1985. (The time of relocation will have to be worked out).

Many thanks to my committee for a job well done. They are: Treasurer William Mirick; Investment Committee Chairman and Board Member Neil S. Estrada; Investment Committee member and Board member Moe Coffino; and EVP Frank J. Borrelle.

JOSEPH A. BAUER,
Chairman

Following considerable discussion of this report, a motion was made, seconded, and approved that the recommendations of the Ad Hoc Committee (which were also recommended by the Executive Committee) be accepted and that the Executive Committee continue negotiations toward the purchase of office condominium space—conditioned upon approval of final terms by the Board.

Amendments To By-Laws

Withdrawn

ARTICLE III—ORGANIZATION
C.—Duties of President

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

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

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

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

[*Due to the changes in PRI previously discussed at the Board meeting, a motion was duly made, seconded, and approved that this amendment be withdrawn from any further consideration.*]

Presented for First Reading

ARTICLE V—COMMITTEES
A.—Nominating Committee

WHEREAS the Federation Executive Committee has recommended that the Executive Vice-President be a member of the Nominating Committee, be it

RESOLVED that By-Laws Article V, Section A, Paragraph (1) be amended as follows:

"(1) The President shall appoint a Nominating Committee consisting of immediate Past-President or the most recent available Past-President as Chairman; one other Past-President; three members of the Board of Directors who are not officers, at least two of whom shall be Society Representatives; and the Executive Vice-President. The committee appointments, except the Chairman and the Executive Vice-President, shall be subject to confirmation by the Executive Committee."

Comment: Members of the By-Laws Committee believe that this proposal is illegal in that the Executive Vice-President

From left to right: Berger Justen (Southern); Tom Fitzgerald, Sr. (St. Louis); Kurt Weitz (Toronto); and Tom Hill (Western New York)

is not, himself, a member of the Federation and therefore cannot serve as a voting member of a committee. See Article I, of the By-Laws, wherein membership in the Federation is defined.

As an alternative, in order to accomplish the basic purpose of the above proposal, they recommend the following amendment, adding a new Section C to Article V, which would also provide legal status to current practice of staff participation in committee work:

ARTICLE V—COMMITTEES
C.—Staff Participation

"The Executive Vice-President or his staff representative shall give advice and counsel while participating in the work of the Nominating Committee, all Standing Committees, and all other committees unless specifically disallowed by action of the Executive Committee. The staff participant shall not vote in any matter to be decided by any committee."

[*The recommendations of the By-Laws Committee were accepted and upon motion duly made, seconded, and approved the new Section C of Article V was passed for first reading. It will be presented for adoption at the Board meeting of October 23, 1984.*]

Review of Actions Of Executive Committee

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

The actions of the Executive Committee (at meetings of October 14, 1983 and January 27, 1984) were included with the minutes mailed previously to Board Members. The actions at the May 16, 1984 meeting of the Executive Committee were presented to the Board during the present meeting.)

The actions of the committee presented to the Board—excluding By-Laws re Staff Participation, Change in Name of PRI, and Ad Hoc Committee on Federation Office (which were already discussed)—are as follows:

OCTOBER 14, 1983

That the Ad Hoc Committee on the Federation Office/Building be composed of: President-Elect Joseph A. Bauer, Chairman; Treasurer William Mirick; Board member and Investment Committee Chairman Neil S. Estrada; Board member and Investment Committee member Moe Coffino; and EVP Frank J. Borrelle.

Board members include (left to right): Carl Fuller (Philadelphia); Gary Marshall (Piedmont); Ed Vandevort (Pittsburgh); and Jim Peterson (Rocky Mountain)

Board members (left to right): "Duke" Cromwell (Los Angeles); Norman Hon (Kansas City); and Willy Busch (Houston)

That the Federation's initial "Spring Week" be held during the week of May 13, 1984, in Louisville, KY. A seminar on "Manufacturing" will be on the 15th and 16th; the Society Officers' meeting on the 17th; and the Board of Directors meeting on the 18th.

That $39,000 be appropriated to Federation Committees, Account 677, during 1984.

That $9,000 be appropriated to the Educational Committee, Account 750, during 1984.

That Federation staff salaries be increased, effective November 1983, and that the salary budget for 1984 be set at $324,000.

That the services of Royal A. Brown as Federation Technical Advisor be continued from January through December 1984.

JANUARY 27, 1984

That a five-year investment program be established to fund a non-qualified deferred compensation plan for Frank J. Borrelle, EVP.

That President Johnson appoint an ad hoc committee to determine the research and educational areas in which the Federation should be engaged.

That several committees be consolidated, as stated in the minutes.

That the Liaison Committee be composed of recent Past-Presidents and one member of the Birmingham Club.

That the new dates for the 1988 AM&PS be October 19-21, for reasons stated in the minutes.

That M/M Joseph A. Bauer and M/M Frank J. Borrelle represent the Federation at the 50th Anniversary Meeting of the Birmingham Club in 1985.

That the Program Committee's request for a special Tuesday session at the 1984 AM&PS be respectfully denied.

That the permanent Trustees to the Federation's Pension Plan be Past-President Howard Jerome and EVP Frank J. Borrelle.

That the Federation Estimated Statement of Income ($1,487,000) and Expense ($1,397,100) for 1983 be accepted.

That the seven recommendations of the Finance Committee be accepted.

That the 1984 Operating Budget of the Federation be:

Income	$1,447,000
Expense	1,407,100

That the 1991 Annual Meeting and Paint Show be held in Toronto, Ont., Canada, November 4–6.

That an appropriation up to $12,000 be approved to retain a consultant to analyze Federation membership, publications, convention, and other services for the purpose of determining how they can be improved through computerization.

[*All of the above-cited actions of the Executive Committee were approved by the Board of Directors on May 18, 1984.*]

Nominations

The Nominating Committee places the following persons in nomination for office with terms to become effective October 27, 1984:

President-Elect: William Mirick, of CDIC Society (Battelle Memorial Institute). One-year term. He is currently Treasurer.

Treasurer: Carlos Dorris, of Dallas Society (Jones-Blair Co.). One-year term.

Executive Committee: Saul Spindel, of New York Society (D/L Laboratories, Inc.). Three-year term.

Board of Directors (Members-at-Large): James Geiger, of Southern Society (Sun Coatings); Richard Keifer, of Philadelphia Society (McCloskey Varnish Co.). Two-year term for each.

Board of Directors (Past-President Member): Michael Malaga, of Cleveland Society (Consultant). Two-year term.

Elections will take place during the Board of Directors meeting on October 23, 1984, in Chicago.

Members of the Nominating Committee are: Past-President John Oates, and Society Representatives Norman Hon, Berger Justen, and Harry Majcher.

A. CLARKE BOYCE,
Chairman

Mr. McCormick placed John Emmerling, of the Baltimore Society (Lenmar, Inc.), in nomination as a Member-at-Large on the Board of Directors (two-year term).

There will therefore be three candidates for the two available positions on the Board.

Society Business

INVITATION FROM HOUSTON SOCIETY

Mr. Busch, on behalf of the Houston Society, extended an invitation to the Federation to hold the 1993 Annual Meeting and Paint Show in Houston, on the occasion of the Society's 50th Anniversary. [*The AM&PS was held in Houston in 1977 and will be in Dallas in 1987.*]

New Business

FEDERATION HONORARY MEMBERSHIP FOR PAST-PRESIDENT J.C. LESLIE

J.C. Leslie, a Past-President of the Federation (1974–75) and the Kansas City Society, was proposed by the Society for Federation Honorary Membership. As specified in Standing Rules II, the Secretaries of each Society and the Board of Directors were advised of the nomination.

By unanimous vote, the Board of Directors elected Mr. Leslie a Federation Honorary Member.

1985 FSCT SEMINAR

Technical Advisor Roy Brown proposed that the program of the 1985 Federation Seminar (to be held during FSCT Spring Week, May 12–16, in Baltimore) combine topics relating to painting specifiers (architects), contractors, and manufacturers. Mr. Brown would contact these three groups to develop a program with speakers who are knowledgeable in these areas, creating a dialogue which would benefit all.

The Board agreed with this theme and Mr. Brown was instructed to proceed.

Committee Reports

DEFINITIONS

For a better second edition, we need help to update and improve some of the weaker definitions in the *Paint/Coatings Dictionary*. We will offer a specialist on the definitions in question a complimentary copy of our present dictionary for his or her efforts.

STANLEY LESOTA,
Chairman

EDUCATIONAL

The annual Educators' Luncheon was held in conjunction with the 1983 Annual Meeting in Montreal. The meeting was presided over by J. A. Hoeck, Chairman of the Educational Committee.

This meeting serves as a meeting place for the exchange of ideas to promote and improve our educational commitment to the coatings industry.

At this meeting, we had the opportunity to meet Dr. Robson Storey, a recent addition to the staff of the University of Southern Mississippi. We also had the pleasure of meeting Dr. Peter Rodak, of Toronto, who gave an impressive report on the activities of the George Brown College of Applied Arts and Technology.

The Federation Board of Directors approved a total of $20,000 for the Scholarship Fund for the 1984–85 academic year. These funds have been awarded to the following institutions: University of Southern Mississippi—$6,000; North Dakota State University—6,000; University of Missouri-Rolla—3,000; University of Detroit—2,000; Kent State University—2,000; and Eastern Michigan University—1,000.

The annual educational meeting was held on Friday, April 6, at Cleveland's Sheraton Hopkins Airport Inn, and was presided over by the Vice-Chairman Ted Favata.

Highlights of the meeting were: (a) Review of Federation and Society Scholarship programs; (b) Reports on the annual activities in each Society; and (c) Report on promoting coatings career opportunities.

JAMES A. HOECK,
Chairman

ENVIRONMENTAL CONTROL

The Environmental Control Committee requested from the Federation and was granted funds to hold a committee meeting and trip to a hazardous waste disposal facility in the Chicago area. Because of lack of interest, however, no meeting will be held.

I have attended one meeting of the Hazardous Waste/Water Quality Task Force and two meetings of the Air Quality Task Force of the NPCA. I am also working with the State of New York Dept. of Environmental Conservation as part of a committee of six paint manufacturers to help formulate a regulation for V.O.C. emissions in New York City.

SIDNEY J. RUBIN,
Chairman

MANUFACTURING

The Federation Manufacturing Steering Committee met March 21, 1984 in St. Louis. The attendance was excellent and a full agenda was covered during the meeting.

The prime topic was a discussion of the subject matter for a Manufacturing Committee Seminar at the Annual Meeting in Chicago in October. The Committee's final decision was the following topic: "Filtration Technology: The final manufacturing safeguard to protect your coating's appearance."

Speakers are now being selected to address various aspects of the entire subject area of filtration. The committee is working with the Federation Program Committee in this regard and, it was felt, this topic is very appropriate for the theme of this year's Annual Meeting.

The Manufacturing Committee's seminar at the '83 Annual Meeting was critiqued. This program, on tank cleaning, solvent recycling, and reclamation techniques, was judged to be very successful with good participation and excellent attendance. The committee also reviewed the plant visitation conducted at the NL Industries titanium dioxide plant in Varennes, Quebec. This too was judged highly successful; our hosts from NL were extremely warm and cooperative. Plans have been made to continue plant visitations in conjunction with the Annual Meeting with a tour this year through the new Ace plant in suburban Chicago.

The committee also spent some time reviewing current audio-visual projects. An excellent A/V on sand-mills is finally released and added to the Federation's catalog, thanks to the efforts of the Kansas City Society.

The Manufacturing Committee has completed another successful year and is flourishing. We now have representatives from a broad spectrum geographically and in experience within the industry.

RICHARD E. MAX,
Chairman

MEMBERSHIP

The Membership Committee submits the following report to the Board of Directors:

These figures are based upon the listings shown in the 1983-1984 *YearBooks*.

(a) The total membership is virtually unchanged showing an overall increase of five new members.
(b) Active membership increased by 20 members.
(c) Both Associate and others showed a slight drop.

Increases: Twelve (12) Societies reported increases over 1983; Chicago was first again showing an increase of 46 new members; Detroit was second with 27 new members; Piedmont was next with 20 new members followed by Pacific N.W. and Golden Gate with 15 and 14, respectively.

Congratulations for a job well done.

Decreases: Ten Societies reported decreases, the largest being Montreal followed by New England and Toronto. Both Societies in Canada have been effected by the merger of several paint operations. The S-W plant in Montreal is closing this fall.

It is hoped that more people have registered, but being late in doing so missed publication in the *YearBook*.

On behalf of the Membership Committee I would like to express our appreciation to all of the Society Membership Chairmen. Keep up the good work, let us know of your successes so that we can share your ideas with others.

R. H. STEVENSON,
Chairman

ANNUAL MEETING PROGRAM

The committee proceeded early in December 1983 with establishing the theme for the 1984 Annual Meeting which will be held in Chicago. The theme, "Appearance and Protection—Essential to our Lifestyle," stresses that the coatings industry is a vital but unrecognized resource which uses many advanced technologies and scientific disciplines to produce coatings that beautify and protect. Speakers have been invited and presentations solicited which address the central theme. Thus far, response in terms of abstracts and letters of intent, is excellent—over 25 papers. Papers will be reviewed at the end of May to select those which will be contributing to the program.

DARLENE BREZINSKI,
Chairman

PUBLICATIONS

A joint meeting of the Publications Committee and the Editorial Review Board was held in Washington, D.C. on April 11, 1984. The following were discussed:

Review Procedures: Review of manuscripts has improved over the last time. In most cases, reviewers are returning manuscripts within the time set by the Editor.

Technical Paper Supply: We have an adequate supply of manuscripts and anticipate a good return from the Annual Meeting and from the Roon Award papers. In addition we are soliciting papers from outside meetings, i.e., American Chemical Society and other sources. We are also reprinting articles from foreign journals.

Journal Features: "Humbug From Hillman" continues to be popular and we urge readers to provide input to this successful column. Earl Hill proposed a crossword puzzle feature which was favorably accepted.

A computer page is also under consideration and will be followed up by Dr. Darlene Brezinski.

There was some discussion on having a current topics page.

Book Reviews: Book reviews are continuing.

Federation Booklets: As of April 10, 1984, 13 booklets are being written. The Editors expect to have four manuscripts in hand by the end of this year.

Joseph Vasta reported that he has 15 papers committed for this year's Roon Awards.

Representation of Publications Committee on the Federation Board of Directors was discussed. The Chairman feels that the Publications Committee should be represented on the Board.

The chairman expressed his sincere thanks to the members of both committees for their dedicated efforts on behalf of the Federation.

THOMAS J. MIRANDA,
Chairman

ROON AWARDS

The Roon Awards Committee actively promoted and encouraged the submission of papers of high appeal and technical quality by prominent members of our industry and academia, for the Roon Awards. A total of 15 participants, submitting abstracts, has been achieved and have agreed to participate.

We anticipate a heavy turnout for the Roon Awards papers this year, because of the distinguished personages involved.

JOSEPH A. VASTA,
Chairman

TECHNICAL ADVISORY

The Technical Advisory Committee met on March 28–29 in Minneapolis. The importance that the Chairmen of the various Society Technical Committee Chairpersons place upon this meeting was underscored by the high level of participation. Twenty-two representatives were in attendance out of a possible 26.

Each of the representatives reported on the activities of his or her respective Societies and, based upon their comments, it appears that there is an increased awareness on the part of Federation members with regard to the value of participation in Technical Committee activities.

In addition to the reports of the Chairpersons, there were reports from Roy Brown, Federation Technical Advisor, on the Proficiency Testing Program as well as the status of the efforts of the various Societies that are working on the PRI biocide-containing (biomer) project.

Robert Ziegler, JCT Editor, reminded all that Technical Committees have an opportunity to publish reports on the status of their work, either on an interim basis or as a final report. "JCT stands ready to assist," he said.

SAUL SPINDEL,
Chairman

TECHNICAL INFORMATION SYSTEMS

The Technical Information Systems Committee (TISCO) continues to assist the Federation and its members in the retrieval of technical information.

As in previous years, TISCO compiled the 1983 Annual Subject Index to the JOURNAL OF COATINGS TECHNOLOGY.

TISCO would like to suggest that a Cumulative Subject Index to the JCT (perhaps for a five-year period) would be useful to JCT readers, and would be willing to prepare such a compilation. This compilation could be printed and distributed as a separate, or could be included in an issue of JCT.

The TISCO Chairman, assisted by members of the Cleveland Society, is compiling an update to "Technical Computer Applications in the Coatings Industry: A Bibliography—1968–79," published in the November 1980 issue of the JCT.

HELEN SKOWRONSKA,
Chairman

DELEGATE TO THE NACE

This Delegate attended the Annual Meeting of the Association, which took place in New Orleans, Louisiana, on April 2–6, 1984. The meeting was called, for short, "CORROSION 84," and represented, as usual, a gigantic assemblage of papers, symposia, lectures, meetings, and exhibits covering every aspect of this discipline. More than 360 papers were presented, and over 5000 attendees from the U.S. and abroad provided the interest of representing a broad cross-section of professional specialization and expertise.

Although Coatings represent only a small fraction of the activities of the Association, several symposia presenting distinguished speakers covered numerous topics of theoretical and practical interest to the Federation membership. These included:

Research Symposium on Corrosion Control by Coatings, chaired by Dr. H. Leidheiser, and including papers on Cathodic Blistering of Marine Coatings in Salt Solutions, Use of High-Frequency Dielectric Spectroscopy in Studies of Water in Organic Coatings, Evaluation of Protection by Organic Coatings with Electrochemical and NDE Techniques, Studies of the Corrosion of Coated Metals with AC Impedance Measurements, A Non-destructive Look at the Coating/Metal Substrate Interface using Scanning Infrared Thermography, Early Detection of Corrosion of Steel Under Protective Coatings Using Thermal-Wave Microscopy, Use of Laser Raman Spectroscopy in Studies of Phosphate Conversion Coatings, Pitting Corrosion of Anodic Aluminum and Silicon Carbide/Aluminum Composites, and Some Studies of the Coating/Metal Interface Using Surface Analysis Techniques.

A technical symposium was sponsored by the Committee T-1G on the subject of Protective Coatings for Oilfield Use, and included presentations on Repair and Maintenance of Protective Coating Systems of Offshore Platforms, Preparation of Contaminated Steel Surfaces, Internal Coating of Oilfield Tanks, Coating Systems for Demanding Atmospheres, Advances on Fluorocarbon Coatings, Amine Inhibitors, and Fluoroelastomers for Oilfield Service.

Another symposium, this one sponsored by Group Committee T-6, was dedicated entirely to Polyurethane Coatings, and covered subjects related to urethanes in Protective Coatings, Floor Coatings, Elastomeric Linings for Steel Hopper Cars, Coatings for Foam Insulation, Pipe Coating with Coal-Tar Urethanes, Rheology of High-Build Coatings, Corrosion-Resistant Primers, Coatings for Bridges, and the Effect of Polyols.

A session sponsored by Committee T-10D was dedicated to Pipeline Coatings, and included papers on performance case history and testing.

Group Committee T-6, on Protective Coatings and Linings sponsored, in addition to a full committee meeting, meetings of the following sub-committees:

T-6A, Coatings and Linings for Immersion Service; T-6A-53, Electroless Nickel Coatings; T-6A-56, Linings for Hopper Cars; T-6G, Surface Preparation; T-6H, Coating Materials for Atmospheric Service; T-6Q, Quality Assurance; and T-6Q-10, Coatings Performance.

The facilities of the Rivergate Exhibition Center were an appropriate venue for the Corrosion Show, where more than

200 exhibitors displayed the latest in corrosion protection by coatings and impressed current, as well as sophisticated measurement and computing instrumentation.

THOMAS GINSBERG,
Delegate

DELEGATE TO THE SSPC

The last meeting of SSPC was held at the Holiday Inn in Cocoa Beach, FL during December 5-7, 1983. Fifteen committees met and 131 members, guests and staff attended the three-day business meeting. 23% are members of the Federation.

SURFACE PREPARATION

Surface Preparation Specifications—The 1982 specifications have caused a great deal of controversy. Therefore, a Steering Committee was formed to review the specifications. This committee includes representatives of engineering firms, the marine industry, steel fabricators, suppliers of abrasives and blast cleaning equipment, coating applicators, and coating manufacturers, both those who favor and those who oppose the 1982 specifications. Thus far Draft #5 of SSPC-SP10 "Near-White Blast Cleaning" has been prepared. Drafts for SSPC-SP5, SP6 and SP7 will now be prepared and all four will be submitted for ballot in 1984.

Sand Blasting—The name has been changed to "Dry Abrasive Blast Cleaning." A group has been formed to investigate the health aspects of using sand as an abrasive.

Abrasives—The SNAME 023-1 Procedure "Study of Procedures for Abrasive Evaluation" has been reviewed and will be used as a starting point for developing test methods and acceptance criteria for the chemical and physical testing of abrasives and abrasive breakdown during use.

Wet Blast Cleaning—A document of Wet Blast Cleaning has been prepared and will be submitted for publication in 1984.

Work on the preparation of a specification for wet blast cleaned surfaces will be initiated.

WATER-BORNE EPOXY

Draft #2 of the following specifications were reviewed and modified as agreed upon: SSPC-PS-XWBE1X, "The Coat Water-Borne Epoxy Painting System"; SSPC-Paint-XWBE1X, "Water-Borne Epoxy Primer for Steel Surfaces"; SSPC-Paint-XWBE2X, "Water-Borne Epoxy Exterior Topcoat."

ZINC RICH PAINTS

(a) The following recently published guides and specifications were reviewed:
SSPC-PS Guide 12.00, "Guide for Selecting Zinc-Rich Painting Systems."
SSPC-PS 12.01, "One-Coat Zinc-Rich Painting System."
SSPC-Paint 20, "Zinc-Rich Primers (Type I—Inorganic & Type II—Organic)."

Editorial revisions of PS Guide 12.00 and Paint 20 will be made to make them consistent with each other.

(b) Draft #2 of SSPC-Guide XTZRPX-83P, "Guide to Topcoating Zinc-Rich Primers," was reviewed and modified. Draft #3 will be prepared to eliminate the criticisms expressed.

(c) Work on the preparation of a specification on thin film "Pre-Construction Zinc-Rich Primers" will be initiated.

(d) The draft of the "Test Method to Determine the Slip Coefficient for Coatings Used in Bolted Joints" was reviewed. The revised test method will be submitted for publication.

VINYLS

Draft #2 of SSPC XHV1X-83P, "High-Build Vinyl Topcoat for Zinc-Rich Primers," was reviewed. There is a problem in that the control formula is not commercially acceptable. Other more acceptable control formulas will be investigated.

MARINE COATINGS

(a) The Maritime Administration Standard Specifications for Merchant Ship Construction were reviewed. These will be used as the basis for preparation of a guide to ship owners and shipyards for new ship construction.

(b) Record keeping forms for tracking paint problems in shipbuilding were discussed. A document including typical forms and an explanation of their importance and proper use will be prepared.

MAINTENANCE REPAINTING

Draft #1, "Preliminary Checklist for Maintenance Painting," was distributed and reviewed as a basis for preparation of a comprehensive guide. The topics to be investigated include the following:

(a) Objective of Maintenance Painting
(b) Oversee Survey/Inspection
(c) Corrective Action Required
(d) Procedures for Corrective Action
(e) Preparation of Contract/Work Orders
(f) Troubleshooting During Repainting
(g) Follow-up Activities

INTER-SOCIETY COOPERATION IN PAINTING OF STEEL

The following organizations will cooperate in improving the painting of steel:

(a) AISC
(b) AISI
(c) ASTM—Committee D-33 "Protective Coatings and Linings Work for Power Generation Facilities"
—Subcommittee D01.46 "Industrial Protective Coatings"
(d) ILZRO—Coatings Research
(e) ISO
(f) Lead Industries Association
(g) Maritime Administration
(h) Mellon Institute
(i) NACE
(j) U.S. Navy CEL
(k) Zinc Institute

PROTECTIVE COATINGS INSPECTION MANUAL

Draft #4 of the manual outline was reviewed. The manual will be prepared in cooperation with AISC, ASTM, FSCT, and NACE. A list of potential authors will be reviewed and those chosen will be approached to prepare specific chapters in the manual. A Glossary of terms will be included as an appendix.

NEW SPECIFYING METHODS

(a) A questionnaire to survey the industry concerning accelerated test methods used to set standards for coating

acceptance has been prepared and will be circulated to other SSPC committees, as well as to the industry.

(b) Work was initiated on the outline of the guide to be developed after the survey returns have been received and compiled.

Mildewcides

A presentation was made of the joint Navy-SSPC project on mildewcides, including test plans.

FHWA Bridge Painting Research

(a) Progress on improvement of field reliability of high performance coatings was reviewed, particularly work on measuring the degree of cure of inorganic zinc-rich primers.

(b) Progress on the NBS program to develop a more reliable accelerated test procedure was also reviewed. An attempt is being made to develop a reliability analysis of the effect of high humidity, at three temperatures, on an alkyd and on an acrylic coating.

(c) The research work on adopting cavitating water jet technology to clean structural steel has been completed. Removal rates to SSPC-SP6 have been only about 36 square feet per hour using a pressure of 15,000 psi and 4 gallons of water per minute.

(d) A dozen coatings are being evaluated for non-blast cleaned surfaces using accelerated laboratory tests. Of these, four have been chosen for outdoor exposure.

(e) The following studies will be initiated in 1984: (1) Maintenance Coating of Weathering Steel; (2) Coating Inspectors Training Course; (3) Protective Coatings for Bridge Steel; and (4) Hot-Dip Galvanizing for Exposed Structural and Miscellaneous Steel.

PACE I, II, III

(a) The PACE I six years report will be issued early in 1984.

(b) FHWa has extended PACE II until the end of 1988. This will allow reporting the results of five years of exposure. In the meantime, the accelerated test results and two year exposure data will be reported in 1985. The final task will be an evaluation of the following six coatings systems at five bridges sites:

(1) Inorganic zinc-rich
(2) Organic zinc-rich
(3) Alternative pigment alkyd
(4) California specification waterborne
(5) Moisture cure urethane
(6) Vinyl

(c) It is anticipated that PACE III coatings will be applied and exposed in 1986. A major problem is the high cost including the extra work involved—$5,000 per sample. Consequently, it will be necessary to solicit funds to support the program. The program will be titled "Advances in Coatings Technology for Steel."

New Publications

The following SSPC publications are in process: "Guidelines for Centrifugal Blast Cleaning"; "Inspection Manual"; "Failure Analysis"; "Surface Preparation Manual"; "Painting Public Structures"; and "Journal of Protective Coatings and Linings."

New Member Orientation

(a) The work done by SSPC was discussed.

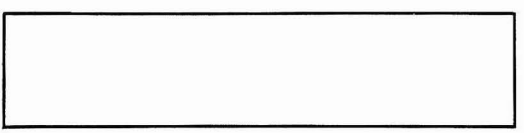
(b) A membership fee of $40.00 has been established. Individual members nominated by SSPC Patron Members will pay only $20.00.

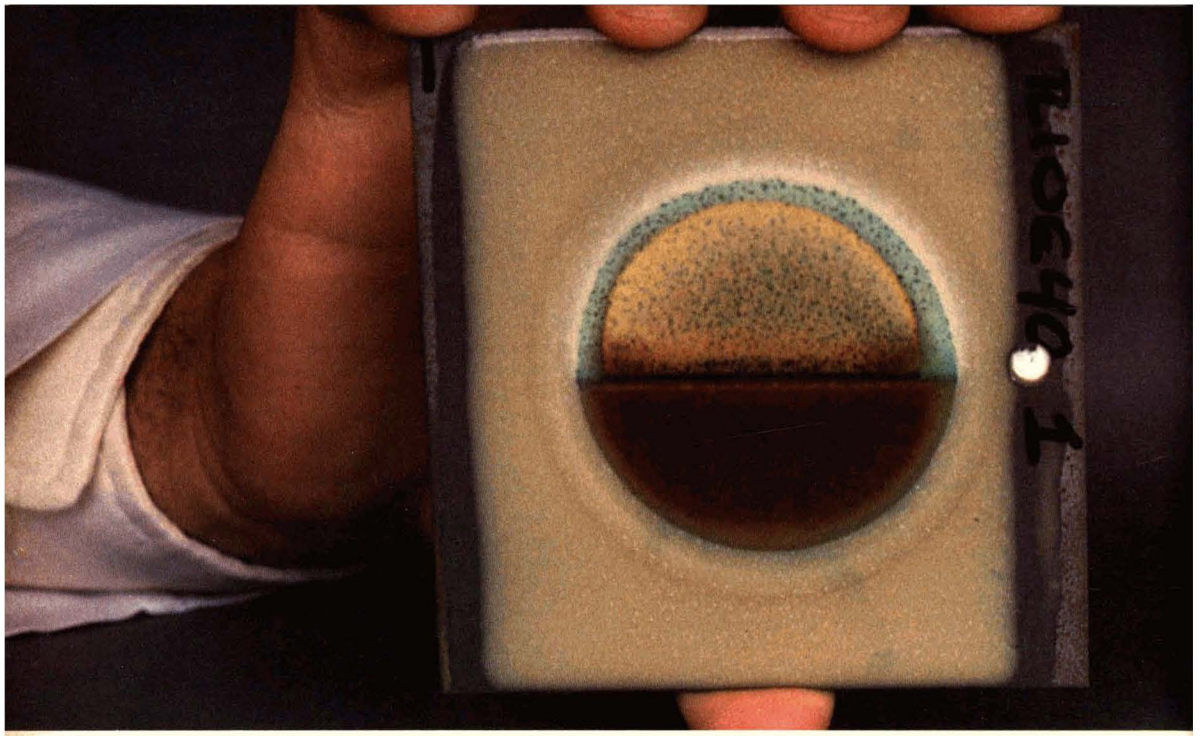
(c) New members were invited to participate in SSPC activities, also to author chapters for the Inspection Manual and articles for the Journal of Protective Coatings and Linings.

Planning 1984 Symposium

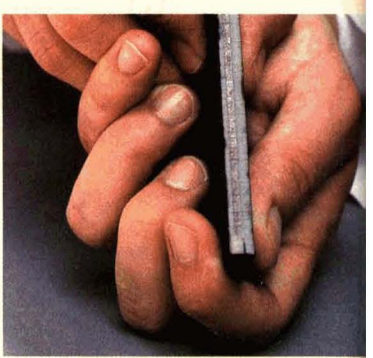
The next meeting of the SSPC will be held at the William Penn Hotel in Pittsburgh during September 17-20, 1984. The committee meetings will be held on September 17-18 and a Symposium on "Maintenance Painting of Industrial Buildings" will be held on September 19-20.

Sidney B. Levinson,
Delegate





CIBA-GEIGY epoxy hardeners vs. the toughest applications around.



Encapsulated in our XU 252 and XU 264 system, this strip of steel was immersed in a 50% sulfuric acid bath for two hours at room temperature then, without rinsing, put into a 350° oven for 30 minutes. This was followed by quenching in sulfuric acid. After 10 such cycles, there was slight surface charring—but no penetration.

You can now formulate practical, durable coatings for such difficult applications as pollution control equipment.

Conditions are so hostile inside a coal-burning utility's flue gas desulfurization unit that, until today, no completely satisfactory coating has existed. Traditional coatings for carbon steel have been too brittle. And exotic alloys have been too costly.

Now, however, there is an answer. An answer that, for the first time, allows you to formulate an organic coating with the characteristics you need to meet the demands of this particularly difficult application.

In 14 days of continuous exposure in an Atlas Cell, refluxing 50% sulfuric acid had virtually no effect on the combination of our XU 252 epoxy resin and XU 264 epoxy hardener. After only four days, however, a conventional system was completely destroyed.

Start with a high performance resin.

Our system begins with XU 252, a high performance epoxy resin that has already proven its worth against chlorinated solvents, ethanol, methanol, aromatic amines, acids, caustic and ammonia—and proved it under a wide range of service temperatures.

But you require more than a high performance resin to formulate a superior coating. You also need a high technology hardener that can produce the desired physical qualities in the cured system.

Combine with a high technology hardener.

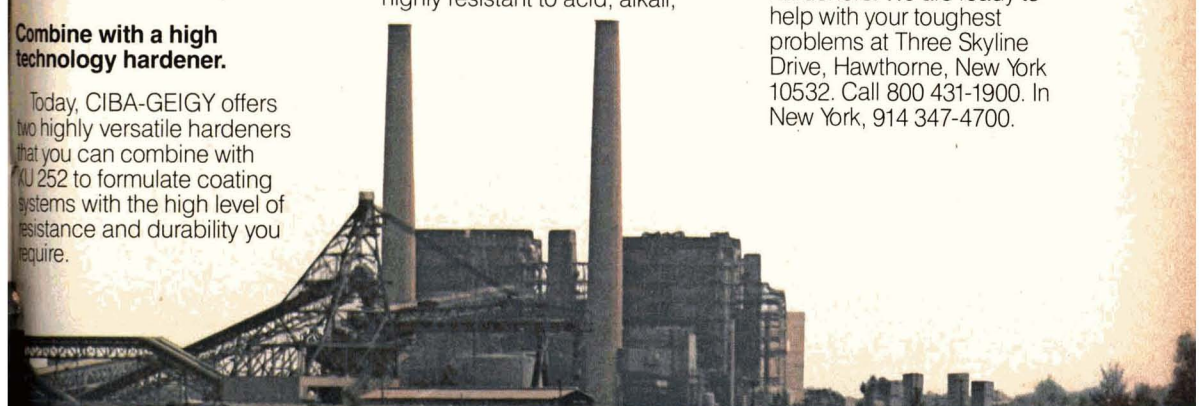
Today, CIBA-GEIGY offers two highly versatile hardeners that you can combine with XU 252 to formulate coating systems with the high level of resistance and durability you require.

The first, XU 264, is a toughened aromatic amine-based epoxy hardener that is particularly suitable for high temperature service. It provides good flexibility, superior toughness, and excellent resistance to sulfuric acid—properties that make it the ideal hardener for use in high performance coatings for the scrubbers, ducts and stacks in flue gas desulfurization units.

The second of these new products, XU 265, is a liquid hardener that cures epoxy resins into coatings that are highly resistant to acid, alkali, solvents and chemicals. In combination with XU 252, it produces a coating system that is widely used, for example, in tanks, processing plants and transmission pipes.

Add in responsive service.

So when you are faced with the toughest applications, and need to formulate the toughest coating systems, we believe the choice of a supplier is clear. The CIBA-GEIGY Resins Department—the one source that combines high technology specialty resins and hardeners. We are ready to help with your toughest problems at Three Skyline Drive, Hawthorne, New York 10532. Call 800 431-1900. In New York, 914 347-4700.



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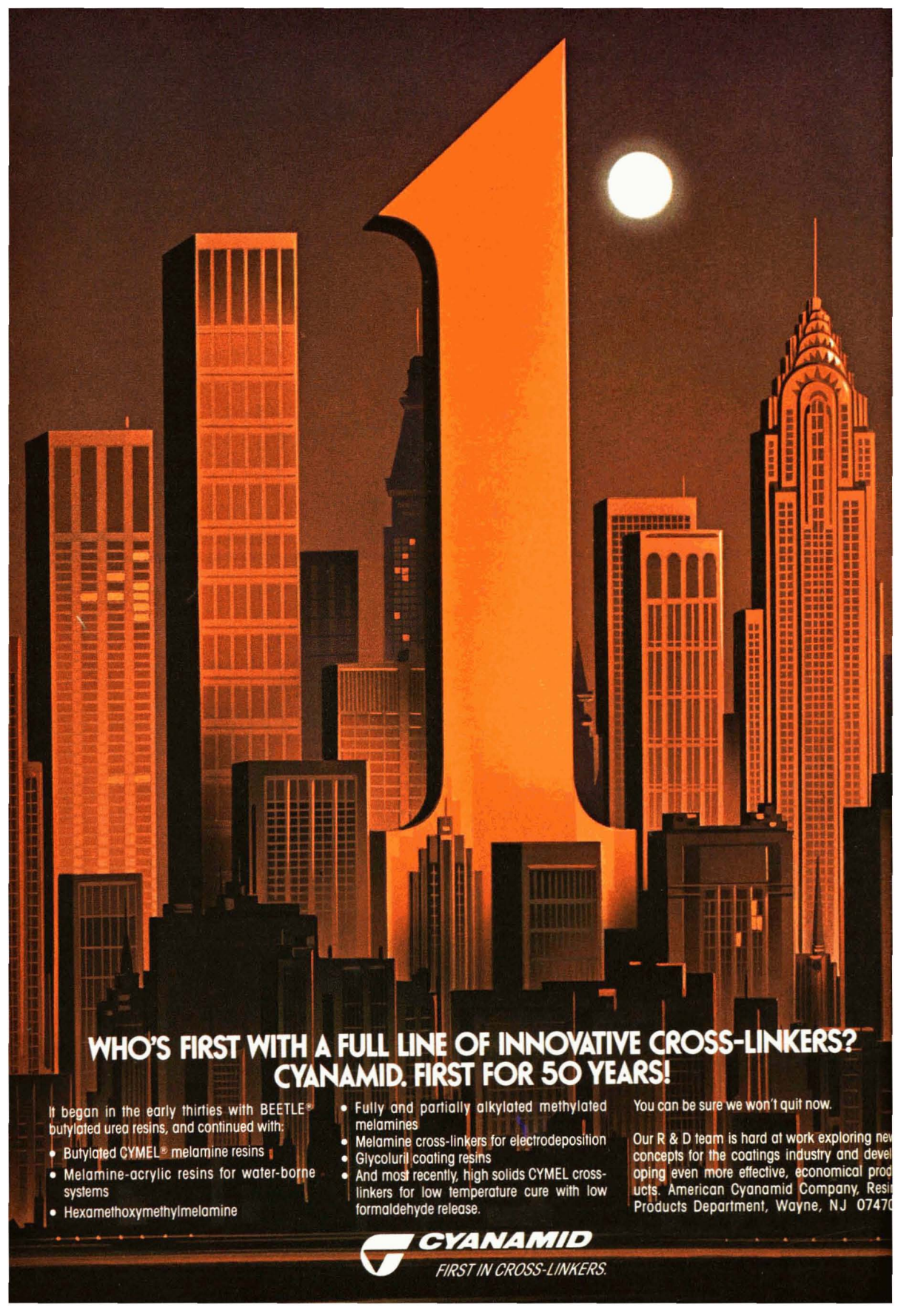

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FIRST IN CROSS-LINKERS.

Comparison of Acrylated Oligomers In Wood Finishes

W. Jerry Morris
Celanese Specialty Resins Company*

Oligomeric resins designed for UV/EB curable coatings which offer a broad latitude for formulating wood finishes have been developed. Several epoxy and urethane based oligomers were compared to determine suitable polymers for coatings on wood substrates. Film properties such as abrasion resistance, adhesion, hardness, tensile strength, and chemical resistance were determined on filled particle board, oak flooring, and redwood floor substrates. Factors that may influence the abrasion resistance of a wood finish such as oligomer type, molecular weight, and crosslink density were explored. The effect of trifunctional monomers compared to di- and monofunctional monomers was determined. A suggested starting formula is presented along with film properties for the best performing oligomers on the three substrates.

INTRODUCTION

Ultraviolet/electron beam (UV/EB) curable coatings have been used in wood finishes over the past 15 years. The bulk of this use has been a filler/sealer for composition board. These systems consist primarily of an unsaturated polyester resin and an inert filler diluted with styrene monomer to a viscosity which allows proper penetration of the substrate. Some acrylic resins and polyester-acrylic blends are also used.[1] The filled board is then topcoated with a clear or pigmented system, or a printed paper is laminated to the filled board and then topcoated. The purpose of this type process is generally to make an inexpensive substitute for natural wood paneling or furniture.

Estimates for the current U.S. production of all coatings for wood and composition flat stock is approximately 7 million dry gallons. It is further estimated that 270,000 gallons are currently UV or EB cured. The bulk of this market still utilizes thermally cured coatings.[2] The purpose of this paper is to present a comparison of the two major types of UV/EB curable coatings available for wood and composition flat stock, and to demonstrate the overall performance of these coatings. The market growth for wood and composition flat stock coatings through 1992 is estimated at 71% or approximately to 12 million dry gallons.[2] With the many advantages offered by low energy conversion coatings, such as reduced solvent and emission control costs, it is reasonable to expect a high percentage of this growth to be UV/EB curable systems. Also, as current equipment becomes obsolete and should energy shortages reappear in the latter stages of this decade, it is further anticipated that a larger percentage of the current market volume will convert to UV/EB curable systems. One of the most important factors to influence this new growth opportunity is the development of new, improved UV/EB curable resins to provide the performance incentive to make the switch from conventional systems. It is anticipated that the unsaturated polyesters will remain a major component of fillers due to their lower cost. However, acrylics should get a larger share of the filler market due to increased productivity because of faster cure response.[3] The epoxy based and urethane based acrylate functional resins are expected to be important components of paper to wood laminating adhesives, and topcoats, for improved durability and aesthetic appeal. Both pigmented topcoats for filled particle board and clear systems for natural wood substrates are required.

The advantages of UV/EB curable systems are well known and will only be listed here.[4-6]

(1) Low energy requirements/cost savings;
(2) Rapid cure/high productivity;
(3) High gloss/ultra smooth surfaces;
(4) Reduced solvent emissions;

*P.O. Box 99038, Louisville, KY 40299.

Table 1—Acrylated Urethane Oligomers

Oligomer	Functionality	Mw	Wt/Double Bond[a]	Viscosity @ 150°F (Brookfield)	Type
U-100	2	639	319.5	800 cps	Aliphatic, low Mw polyether
U-200	3	939	313	5,600 cps	Aliphatic, hydroxy acrylate isocyanate
U-300	3	1052	350.7	2,785 cps	Aliphatic, low Mw polyether
U-400[b]	2.2	1527	694	5,000 cps	Aromatic, TDI, polyether
U-500	2	1580	790	9,900 cps	Aromatic, TDI, polyether
U-600	2.5	1598	639.2	88,000 cps	Aliphatic, blend, polyether urethanes
U-700	2.5	1621	648.4	27,000 cps	Aliphatic, blend, polyether urethanes
U-800	3	1715	571	27,650 cps	Aliphatic, polyether
U-900	2	1760	880	10,125 cps	Aliphatic, polyether

(a) $\text{Wt./Double Bond} = \frac{\text{Mw}}{\text{Functionality}}$

(b) Signifies commercially available resin, all others are experimental only.

(5) Conservation of floor space; and

(6) Unique performance—low heat generation, low coat weight.

There are also disadvantages to UV/EB curable systems which need to be considered before changing curing methods.[4,6] The problem of gloss control in wood finishes is particularly difficult. To reduce gloss, high pigment loading is often required.[7] Another method known as a "dual cure" has also shown positive results.[8] Even though the average price of UV/EB curable coatings is higher than conventional systems, improved productivity, lower energy consumption, and the lack of solvent handling and recovery costs allow for cost competitive systems.

The chemistry of UV/EB curable systems has been discussed in many publications.[7,9-12] The coatings may consist of low to medium molecular weight resins called oligomers, multifunctional and monofunctional monomers, additives, pigments, and in the case of UV cured systems, photosensitizers and/or photoinitiators. The most common functionality is acrylic and the basic chemistry associated with UV/EB curing is free radical polymerization. Polymerization occurs "instantaneously" upon exposure to UV light or electron beam source. The mechanisms of UV cure and electron beam cure are slightly different, however, and the end result from either is a highly crosslinked polymeric film.[13-15] With UV systems the choice of photoinitiator is important because it affects cure response, surface cure vs through cure, as well as final coating properties such as yellowing.[16-18] The oligomer usually determines the desired final properties of the coating, and thus, is a critical component of the UV/EB system. Many oligomers and monomers may cause eye or skin irritation and should be handled with care. It has been proven through experience that good industrial hygiene practices can minimize any risk involved in the handling and storage of these materials.[19,20]

OLIGOMERIC ACRYLATE RESINS

The oligomers evaluated in this study are urethane and epoxy based acrylates.[21] Other acrylated resins are available such as acrylated polyester oligomers and acrylated acrylic polymers. However, to limit the number of variables and scope of the evaluation, these resins are not evaluated in this study.[22-24]

Table 2—Acrylated Epoxy Oligomers

Oligomer	Functionality	Mw	Wt/Double Bond	Viscosity @ 150°F (Brookfield)	Type
E-100[a]	2	524	262	2,000 cps	Aromatic diglycidyl ether Bisphenol A acrylate (DGEBA)
E-200	2	682	341	1,060 cps	Aliphatic saturated DGEBA
E-300[a]	2	834	471	2,100 cps	Aromatic modified DGEBA
E-400[a]	2	840	420	4,500 cps	Aromatic modified DGEBA
E-500	3	873	291	38,100 cps	Aromatic novalac epoxy tri-acrylate
E-600	2	1192	596	2,250 cps	Aromatic polymeric DGEBA in 30 percent HPMA
E-700	2	2012	1,006	7,600 cps	Aromatic polymeric DGEBA in 30 percent HPMA

(a) Signifies commercially available resin, all others are experimental only.

The final coating properties can be varied by changing the oligomer type, i.e., urethane based or epoxy based. Properties can also be varied by changing the following factors within the oligomer structure: degree of functionality, molecular weight, aliphatic character vs aromatic character of the isocyanate, polyol type, and epoxy resin. In general, UV/EB cured acrylated epoxies have excellent chemical resistance, hardness, tensile strength, and lower costs. In comparison, UV/EB cured acrylated urethanes have an excellent balance of flexibility with toughness, abrasion resistance, and weatherability (aliphatic types). Aromatic urethanes are usually cost competitive with acrylated epoxies. Although they are not evaluated in this study, it should be noted that resin combinations can be used to improve total cost performance for specific applications. The final coating properties are greatly affected by the choice of multifunctional monomers and monofunctional diluents, as will be described later in this discussion.

EXPERIMENTAL

The acrylated oligomers shown in *Tables* 1 and 2 that are commercially available are noted. The experimental oligomers were prepared strictly for the purpose of this evaluation. They are not available commercially. All coatings were UV cured using a Fusion® UV Curing Unit, Model F-440, with two 300 watt per linear inch mercury vapor lamps. All were cured with two passes under the lamps at a rate of 25 ft per minute. Those resins which were not tack free were not evaluated further. No electron beam curable systems were evaluated. The results may be different with EB cure due to generally more extensive crosslinking than UV cured systems.

All formulations consisting of oligomers, monomers, and photoinitiator were prepared by heating the oligomers to approximately 60° C followed by addition of the lower viscosity monomers under slight agitation. The photoinitiator used in this study was hydroxycyclohexylphenyl ketone. (See Appendix.) This initiator was chosen for its generally excellent cure response and non-yellowing properties.

Multifunctional acrylates and their effect on the coating properties were evaluated in conjunction with each oligomer. Trimethylolpropane triacrylate (TMPTA) and tripropyleneglycol diacrylate (TRPGDA) were evaluated as crosslinkers. Ethoxyethoxyethyl acrylate (EOEOEA) and N-vinyl-2-pyrrolidone (N-VP) were evaluated as reactive diluents. (See Appendix.)

Other additives, such as wetting agents, slip agents, pigments and defoamers, were not included due to their effect on final coating properties. In all cases the applied coatings wet the wood substrates sufficiently to give a smooth uniform film for testing.

The oak and redwood substrates used in this study were unfinished flooring planks available from most home improvement centers. The composition board was prefilled using an acrylic UV curable filler and sanded on a commercial line. The substrates were used as received with no pre-coating treatment.

All coatings were applied by a hand drawdown to the various substrates using a smooth Meyer rod, which typically yields a 0.5 mil film. An excellent summary of test methods for film properties of radiation cured coatings was recently published by Pasternack.[25] An indication of degree of cure can be determined by the MEK solvent resistance. This test is conducted by soaking a felt cloth in MEK and attaching it around the ball on a two-pound ballpeen hammer. Using the pressure created by the hammer alone, the cloth is rubbed back and forth across the panels. One double rub is equal to wiping back and forth one time. Adhesion to the substrates is determined by the crosshatch method using cellophane adhesive tape, ASTM number D3359-83. Mechanical properties such as tensile strength and elongation were determined with a Universal Testing Unit,* operating at 50% per minute strain rate (1 in. per minute with an initial gap separation of 2 in.). Ambient conditions of 25°C, and 50% relative humidity were constant throughout the evaluation period. Sample thickness was determined for each sample with a value of 0.425 mils being the approximate mid-range. The chemical resistance of the films was determined via a six-hour soak in each solvent listed. The abrasion resistance was determined on a Taber Abraser, Model E-4010, using CS-17 wheels with a 1000 g load. The abrasion resistance is reported as a wear factor determined by the following calculation:

$$\frac{\text{1000 cycles standard}}{\text{\# of cycles in test}} \times \text{mg wt loss} = \frac{\text{Wear Factor}}{\text{(cs-17 wheels/1000 load)}}$$

All samples were run for 1000 cycles. Duplicate tests were run to insure reproducibility.

RESULTS AND DISCUSSION

As can be seen from *Tables* 1 and 2, the theoretical molecular weight of these resins range from 639 to 1760 for the urethanes and from 524 to 2012 for the epoxy-based acrylates. Several experimental urethane oligomers were evaluated (not shown in tables) that ranged in molecular weight from 2000 to 21,000. Those oligomers with a molecular weight higher than 2000 and based on linear polyols, or where the isocyanate functional urethane prepolymer consists of several repeating polyol-isocyanate units, were tacky after cure and thus had no abrasion resistance. The indication is that the extremely high molecular weight oligomers lost their hardness and tended to be tacky. The high viscosity of reactive oligomers makes them difficult to formulate, especially in 100% solids coatings that can be applied by conventional application methods. The viscosities of the urethanes are slightly higher than the epoxy-based oligomers. However, each requires heating and dilution with monomers in order to handle.

Fusion is a registered tradename of Fusion Systems Corp., Rockville, MD.

*Supplied by Instron Corp., Canton, MA.

Table 3—Tensile Strength and Elongation with Increasing Wt/Double Bond

Oligomers	Wt/Double Bond	Functionality	Tensile Strength psi	Elongation %
Urethane Acrylates				
U-200	313	3	7155	5.3
U-800	571	3	6560	6.8
U-600	639	2.5	1416	13.6
U-700	648	2.5	973	26.8
U-400	694	2	672	30
U-900	880	2	864	33
Epoxy Acrylates				
E-100	262	2	4912	1
E-300	417	2	3084	5
E-400	420	2	3956	9
E-600	596	2	1958	2.25
E-700	1006	2	2192	2

The epoxy-based acrylates generally have higher solvent resistance, faster cure speed, greater hardness, and higher tensile strength than the urethane acrylates. This can be attributed to crosslink density. The urethane based acrylates will generally have more flexibility and elongation than the epoxy-based acrylates. The functionality and calculated weight per double bond is given for each resin. *Table* 3 shows the tensile strength and elongation for some of the oligomers. The resins are arranged in increasing weight per double bond. It can be seen that the urethane acrylates have a higher percentage elongation and lower tensile strength for difunctional oligomers. The trifunctional urethanes with low weight per double bonds have equal or higher tensile strengths than the difunctional epoxy-based oligomers. This is a function of the crosslink density.

Table 4—Chemical Resistance of UV Coatings

Chemical Resistance—6 Hours @ 25°C

Oligomer	Sulfuric Acid 10%	Sodium Hydroxide 10%	Acetic Acid 10%	Methyl Ethyl Ketone	Ethanol	Detergent 10%
E-100	Mod	Mod	NE	NE	NE	NE
E-200	NE	NE	Mod	NE	Sl	NE
E-300	Mod	Se	Mod	NE	NE	Sl
E-400	NE	Mod	Mod	NE	NE	NE
E-500	NE	NE	NE	NE	NE	NE
E-600	Sl	Mod	Mod	NE	NE	NE
E-700	Sl	Sl	Sl	NE	NE	NE
E-800	NE	NE	NE	Se	NE	NE
U-100	Sl	NE	Mod	NE	NE	NE
U-200	Sl	Mod	Sl	NE	NE	NE
U-300	Sl	Sl	Mod	NE	NE	NE
U-400	Mod	NE	Se	Sl	NE	NE
U-500	Mod	NE	Se	Mod	Se	NE
U-600	Se	Sl	Se	Mod	Mod	NE
U-700	Mod	Mod	Mod	NE	NE	NE
U-800	Sl	NE	Se	NE	NE	NE
U-900	Mod	Sl	Se	Sl	NE	NE

Legend: NE = No Effect; Sl = Slight Effect; Mod = Moderate Effect; Se = Severe Effect.

The resistance to various solvents and chemicals is shown in *Table* 4. In evaluating this table it can be seen that the UV cured oligomers all have generally good resistance to MEK, ethanol, and household detergent. Acrylated resins have, in general, poorer resistance to acids and strong caustic solution. The epoxy based acrylates, at the top of the chart, appear to have more resistance than the rest of the group to all solvents. It is theorized that this is likely due to the starting epoxy resins excellent chemical resistance and the high crosslink density of the cured film. The one oligomer that shows no effect, as expected, is the trifunctional acrylate novolac epoxy resin. The base resin in this case has extraordinary chemical resistance, plus it has a very high crosslink density when fully cured.

When attempting to formulate UV curable coatings for wood finishes, it is important to know the coating properties that result from combining the oligomers with various multifunctional and monofunctional monomers. The hardness, gloss, adhesion, and abrasion resistance are all important properties which are dependent on the monomer choice as well as the oligomer. It is obvious that the physical properties of the oligomers, and subsequent formulations, such as tensile strength, elongation, and chemical resistance are good indicators of the coatings toughness and durability. However, a key property for finishes on wood and composition flat stock is abrasion resistance. A wood floor, for example, must have excellent durability. The oligomers' contribution to abrasion resistance is significant. However, it is impossible to determine the oligomer effect on abrasion without studying it in monomer blends.

Figure 1 shows the abrasion wear factor as a function of the molecular weight for the urethane acrylates in 70/30 blends made with TMPTA, TRPGDA, and EOEOEA, respectively. There is no apparent direct relationship between molecular weight and abrasion resistance. The effect of the increased crosslink density of the cured film can readily be seen by comparing the trifunctional TMPTA vs the difunctional TRPGDA and the monofunctional EOEOEA. The TRPGDA and EOEOEA monomers have similar effects on abrasion.

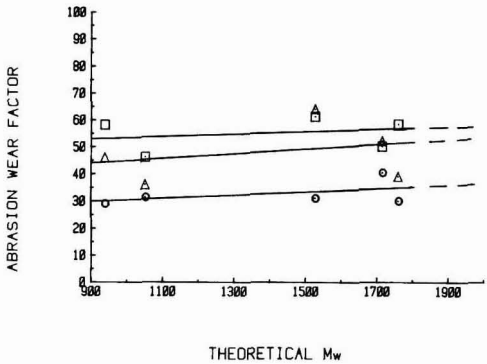

Figure 1—Urethane acrylates. Legend: ○ = 30% TMPTA; □ = 30% TRPGDA; △ = 30% EOEOEA

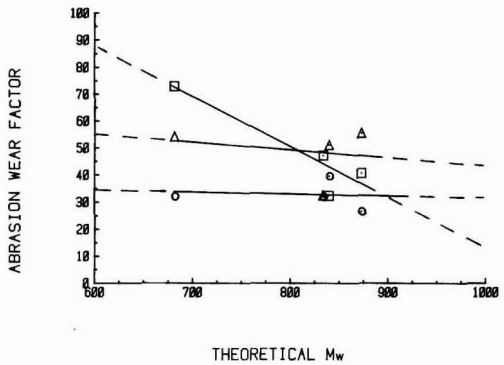

Figure 2—Epoxy acrylates. Legend: ○ = 30% TMPTA; □ = 30% TRPGDA; △ = 30% EOEOEA

This phenomenon also occurs in the case of the epoxy systems, as can be seen in *Figure* 2. The EOEOEA and TRPGDA appear to reverse the expected trend, indicating that TRPGDA is a poor choice if abrasion resistance is a key property. The TRPGDA is a linear molecule with a relatively large distance between the double bonds. This contributes to a more flexible, softer polymer. It is suggested that the abrasion resistance may be improved in certain systems by using a short chain monofunctional monomer instead of a flexible difunctional monomer like TRPGDA. This data would also suggest that a monomer like hexanediol diacrylate (HDODA) would be a better choice for a difunctional monomer because of the short distance between the double bonds.

It can be seen from *Figure* 2 that with the epoxy acrylates, the TMPTA systems also have the best abrasion resistance. The TMPTA has a low weight per double bond with three crosslinking sites. The data indicates that high crosslink density is an important factor in developing good abrasion resistance. This agrees favorably with conclusions drawn by Tu comparing PETA vs TMPTA for abrasion resistance.[26] The TMPTA gives a higher crosslink density than either of the other two monomers, TRPGDA and EOEOEA.

If the negative effect of TRPGDA is taken into account, the molecular weight of the epoxy based acrylates apparently has no direct effect on the abrasion resistance. The epoxy with the best abrasion resistance is the trifunctional material which is consistent with the discussion on crosslink density of the cured films.

Figure 3 shows the relationship between weight per double bond and the abrasion resistance of the epoxy acrylates vs the urethane acrylates blended with a trifunctional monomer. It can be seen that generally these blends have similar abrasion resistance. The 30% TMPTA monomer appears to mask the effect of the oligomer to a certain degree. However, the resins with the lowest weight per double bond have the best overall abrasion resistance. There is definite agreement that the higher crosslink density improves abrasion and that epoxy acrylates are more dependent on weight per double bond.

By comparing this data, it appears that urethanes generally have better abrasion resistance than the epoxy based acrylates. It also appears that certain oligomers will have good abrasion resistance, yet will not necessarily show great improvement whether formulated with tri- or monofunctional monomers. For oligomers with a functionality of 2, abrasion appears to be dependent on monomer choice, and again, could be a function of overall crosslink density of the cured film. There also appears to be some synergism between specific resins and monomers that may result in unexpected improvements in abrasion resistance. One possible explanation for this behavior is that different oligomer and monomer polymerization rates could result in varying degrees of crosslink density and polymer linearity. However, this has not been substantiated.

In formulating these resins, one would use TMPTA or other suitable trifunctional crosslinkers in conjunction with a monofunctional monomer for viscosity reduction. *Figure* 4 indicates that N-VP is likely a better choice of monofunctional diluent due to improved abrasion resistance. It also has high reactivity, good film hardness, and is an excellent viscosity reducer. These results with N-VP are in agreement with available literature.[26]

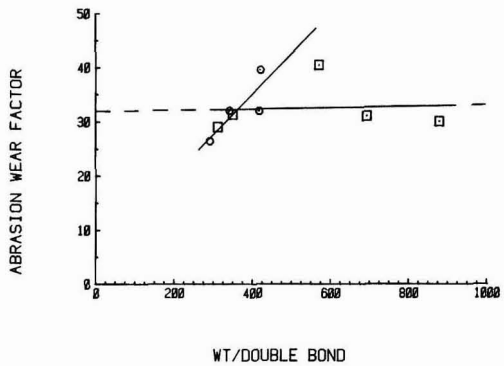

Figure 3—Urethane vs epoxy acrylates. Legend: ○ = Epoxy/TMPTA—30%; □ = Urethane/TMPTA—30%

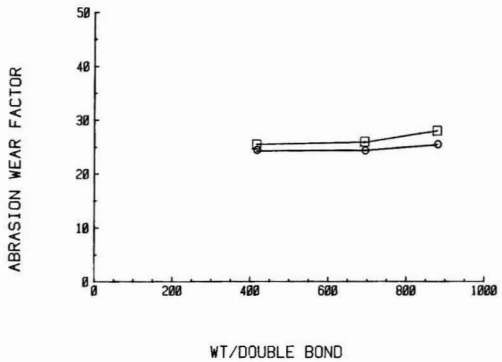

Figure 4—Abrasion resistance n-VP vs EOEOEA. Legend: ○ = 30% n-VP; □ = 30% EOEOEA

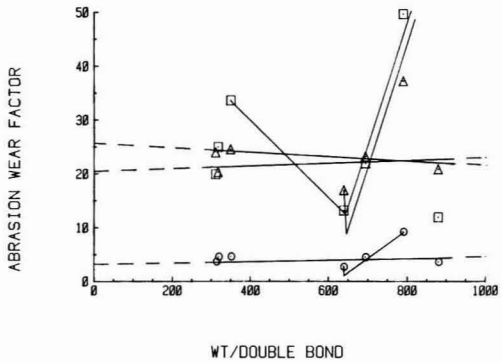

Figure 5—Urethane acrylates—formulated. Legend: ○ = Urethane/PB; □ = Urethane/Oak; △ = Urethane/Redwood

A second round of abrasion resistance tests were performed using those oligomers in *Tables* 1 and 2 and that have shown improved abrasion resistance. Oligomers U-700, U-600, U-300, E-100, E-600, and E-700 were added to our study based on anticipated good performance due to their higher functionality. It was also desirable to evaluate higher molecular weight epoxy acrylates. A formula containing 50% resin, 30% TMPTA, 15% N-VP, and 2pph of photoinitiator was chosen as an optimum formula for testing. The only exceptions to this are the formulations with E-600 and E-700 where the monomers are decreased to account for the diluent in the resin. The E-500 has excellent abrasion resistance, but is not included further due to formulation instability.

Figure 5 is the graph of the weight per double bond vs the abrasion wear factor for the urethane acrylates. There is a significant difference in abrasion resistance dependent on substrate. Again, there does not appear to be any direct relationship between abrasion resistance and molecular weight. There is also no discernible relationship between weight per double bond and abrasion resistance. The total crosslink density of the formulation could be masking any individual effect of the oligomer functionality. The best overall abrasion resistance appears to be exhibited by the formulations with U-700 and U-900 on all the substrates. The significant increase in abrasion resistance around 650 wt/double bond demonstrates the effect of increased crosslink density.

Figure 6 compares the epoxy acrylates in our starting formula on each of the substrates. There is a clear difference in the effect of the substrates on the abrasion resistance. There is not a clear relationship between molecular weight or weight per double bond and abrasion resistance. The very high molecular weight oligomer, E-700, is equaled in performance by the low molecular weight DGEBA-acrylate with a weight per double bond of 262 vs 1006. The ultimate crosslink density of the E-100 formulation may be equalizing the abrasion resistance. *Figure* 7 compares the urethane acrylates directly with the epoxy acrylates on filled particle board. All systems gave reasonably good abrasion resistance. Each oligomer generally falls in the same order of abrasion resistance on the three substrates. It appears that oligomers with functionality greater than 2 and a molecular weight of 1200 to 1800 are the best choice for optimum coating properties. The sharp improvement in abrasion resistance shown in *Figure* 5 around a weight/double bond of 650 indicates that a

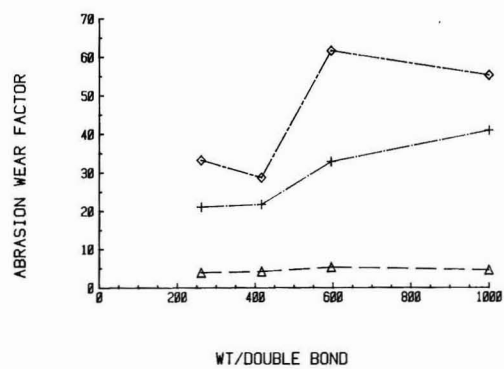

Figure 6—Epoxy acrylates—formulated. Legend: △ = Epoxy/PB; + = Epoxy/Oak; ◇ = Epoxy/Redwood

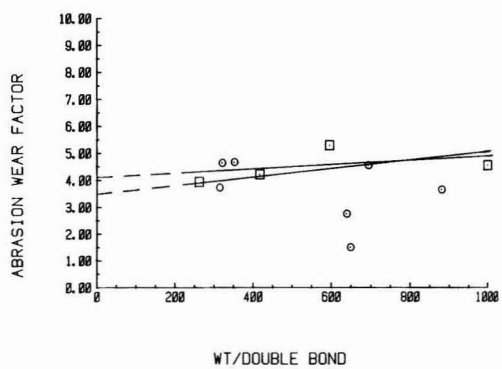

Figure 7—Formulated oligomers on particleboard. Legend: □ = Epoxy/PB; ○ = Urethane/PB

compromise, balancing molecular weight with functionality, is the best lead to get optimum abrasion.

Based on the data, the general order of decreasing abrasion resistance for the best five oligomers studied is as follows: U-700, U-600, U-900, U-200, and U-400. This list is made up entirely of urethane acrylates. The epoxy acrylate systems should not be excluded entirely because they may offer enough abrasion at a lower cost to justify giving up incremental abrasion resistance. The overall best oligomer for abrasion resistance is an aliphatic, 2.5 functional urethane of moderate molecular weight. In developing coating formulations for wood finishes, our data indicates that this oligomer would offer the best combination of abrasion and physical properties.

Another factor influencing abrasion resistance may be the aromaticity of the oligomer. Except for highly crosslinked systems, the epoxy based acrylates, which are predominantly aromatic, tend to have less abrasion resistance. A direct comparison of oligomers of similar chemistry is difficult because of differences in crosslink density and starting materials. U-900 is very close in chemical structure to U-500 except for the aliphatic isocyanate. In the starting formula, on filled particle board U-900 has an abrasion wear factor of 3.65 vs 9.22 for U-500. Another example is even closer in chemical structure comparing E-100 vs E-200. In a 70/30 blend with TMPTA, the E-200 has an abrasion wear factor of 3.2 vs 7.6 for the same E-100 blend. This data only shows a trend toward improved abrasion resistance with aliphatic character, and indicates possible further evaluations in the future. UV light resistance is another factor in considering aliphatic oligomers over aromatics. Yellowing of the coating is normally associated with aromatic systems.[27-29]

In formulating coatings for wood one must also consider the hardness, gloss, adhesion, etc., as well as the coatings abrasion resistance. The three oligomers offering the best overall coating properties were chosen to demonstrate a suggested starting formula which can be used by the coatings chemist to develop functional as well as decorative, coatings that offer a rapid, pollution free method of curing. The formula contains 50% oligomer, 30% TMPTA, 20% N-VP, and 2 parts per hundred of photoinitiator. This formula allows for the high crosslinking obtainable from the trifunctional monomer and generally produces an optimum viscosity for coating the substrate. The formula is considered only a starting formula and in actual practice would likely be modified extensively by the formulating chemist. *Table* 5 shows the physical and film properties using three acrylated urethanes on oak, redwood, and particle board.

CONCLUSIONS

It has been demonstrated that there are several parameters to consider when formulating wood finishes. The abrasion resistance is primarily determined by the oligomer/monomer blend properties. A combination of high crosslink density coupled with a medium molecular weight oligomer appears to give the optimum abrasion resistance. Trifunctional monomers enhance the coatings' abrasion resistance through increased crosslink density. Multifunctional monomers or monofunctional monomers with long linear chains and/or a large distance between double bonds probably detract from the abrasion resistance. This is true for oligomers as well, and is demonstrated by generally poorer performance of higher molecular weight resins. Aliphatic oligomers tend to have better abrasion resistance and UV light stability than aromatic oligomers. The degree of abrasion resistance of the coating is dependent on the substrate, but coatings with the best abrasion resistance on one substrate will generally have high abrasion resistance on other substrates. Finally, for lower cost systems with moderate abrasion resistance requirements, epoxy acrylates will perform adequately. For finishes requiring high abrasion resistance and good UV light stability, aliphatic urethane acrylates with a functionality greater than two and a moderate molecular weight are recommended.

Table 5—Physical and Film Properties

	U-700—Oak Flooring	U-900—Redwood Flooring	U-400—Particle Board	U-900—Particle Board
Coating Properties				
Viscosity (Brookfield @ 25°C)	3200 cps	2500 cps	900 cps	2500 cps
Gardner color	1 2	1 2	1 2	1 2
Wt gal (lbs)	9.02	8.92	9.19	8.92
Film Properties				
Cure speed	25 ft/min	12 ft/min	12 ft/min	12 ft/min
MEK resistance	200	200	200	200
Adhesion (%)	95	95	85	85
Pencil hardness	7H	2H	4H	5H
60° gloss	80	86	77	72
Resistance to yellowing	Excellent	Excellent	Fair	Excellent
Stain resistance	Good	Good	Good	Good
Abrasion wear factor	13.02	20.80	4.55	3.65
Tensile strength (UV cured film)	2726 psi	1816 psi	2128 psi	1816 psi
Tensile elongation (UV cured film)	2%	2.5%	2%	2.5%

ACKNOWLEDGMENT

The author wishes to thank the following people: B. D. Scott and R. J. Skiscim for their support and experimental aid in the laboratory; Dr. B. K. Christmas, J. P. Hysell, R. R. Shelley, and Dr. R. J. Jackson for their comments and suggestions during the writing of the many drafts of this paper.

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Appendix

(1) Trimethylolpropane Triacrylate (TMPTA); tripropyleneglycol diacrylate (TRPGDA) are supplied by Celanese Chemical Co.
(2) N-Vinylpyrrolidone (N-VP) is a product of GAF Corp.
(3) Ethoxyethoxyethylacrylate (EOEOEA) is a product of Thiokol Corp.
(4) Hydroxycyclohexylphenyl ketone (Irgacure® 184) is a product of CIBA-GEIGY Corp., Ardsley, NY.
(5) Hydroxypropylmethacrylate (HPMA) is a product of Celanese Specialty Resins, Louisville, KY.

An Attempt to Develop A One Coat Emulsion Paint

Leslie A. Simpson
Tioxide Group PLC*

An attempt was made to produce a 45% PVC white emulsion paint that could be easily applied by brush, and exhibits at least 98% contrast ratio after one application. In addition, good film integrity and high stain resistance were required.

To develop this product, formulation variables such as type and amount of titanium dioxide pigment, extender, thickener, and colored pigment were evaluated. It was evident that a paint could not be produced which satisfied all requirements. For example, a one coat white paint was produced by using a significant amount of thickener in order to increase build, but paint viscosity was so high that ease of application was unacceptable. By using small amounts of a colored pigment such as carbon black in order to increase opacity, a paint with a contrast ratio of 98% after one coat was obtained, but inevitably the product was 'off-white.'

Finally, changing the type of titanium dioxide pigment to a heavily coated grade produced a one coat paint but significant staining was evident.

INTRODUCTION

For many years[1] paint manufacturers in the United Kingdom have been interested in the concept of a white one coat emulsion paint which has adequate opacity, whiteness, scrub/stain resistance, flow/leveling, and easy application. The labor/time saving advantage in using such a product is obvious. However, it is felt by many paint manufacturers that if a paint which is claimed to be one coat exhibits, for example, only 90% of its required opacity due to poor application then two coats will have to be applied, which defeats the object of marketing such a paint, and may result in the customer not purchasing the product again. Consequently, a fail-safe one coat paint is necessary, but since many manufacturers think that this is highly unlikely, particularly if it is intended for the D.I.Y. sector, such a product has not been marketed widely in the United Kingdom.

When formulating a one coat emulsion paint the primary factor is opacity development, and there are many ways in which opacity may be increased, several of which are as follows:

(1) Change the grade and type of extender.
(2) Increase the titanium dioxide content while maintaining a constant pigment volume concentration (PVC).
(3) Increase the PVC.
(4) Select a higher opacity grade of titanium dioxide.
(5) Produce a thicker film by reducing the paint's natural spreading rate (NSR).
(6) Incorporate colored pigment.

Obviously, implementing some of the above suggestions will inevitably affect the quality of the paint and will therefore limit its use (e.g., increasing the PVC above critical PVC, will result in an increase in opacity, but also an increase in staining and a decrease in scrub resistance and durability). Consequently, when formulating a one coat emulsion paint, objectives must be defined at the onset of the project, and therefore the work which is reported in this paper which considers the above mentioned routes for increasing opacity is concerned with developing a one coat white paint (PVC = 45%) which has good film integrity and appropriate rheological attributes which are beneficial for flow/leveling and easy application.

EXPERIMENTAL

Paint Formulations

Since several formulation variables were evaluated during this study, it was decided to use a relatively simple

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Presented at the 61st Annual Meeting of the Federation of Societies for Coatings Technology in Montreal, Que., Canada, October 12, 1983.

formulation (PVC = 45%), a typical example of which is given in *Table* 1. Since the type and amount of titanium dioxide pigment, extender, and thickener were the major variables under study, further details will be given in the appropriate Sections. In all cases, a vinyl acetate-acrylic emulsion (56% NV) which has a mean particle size of 0.5 μm was used, and the paint volume solids was maintained at 36.9%.

Table 1—Typical General Purpose Paint Formulation

(PVC = 45%)

	Parts by Weight (%)
Titanium dioxide pigment	21.4
Extender	17.0
Thickener (35% NV)	2.0
Dispersant (40% NV)	0.5
Antifoam	0.1
Fungicide	0.1
Ammonia (0.88)	0.1
Propylene glycol	3.0
Water	24.1
Coalescing solvent	0.9

The ingredients listed above were dispersed for 10 minutes using a Silverson high speed impeller mill, after which the millbase was let down with the following emulsion while hand stirring with a spatula:

Emulsion (56% NV)	30.8

Measurements

OPACITY: To assess the opacity of a given paint, plots of contrast ratio against spreading rate were obtained. Thus, four films of each paint, each of a different thickness, were applied to polyester foil using wire wound applicator bars. After drying for 24 hours, the reflectances of each paint film over standard black and white tiles were measured using a Gardner XL-23 colorimeter equipped with a Y tristimulus filter. Contrast ratios were then calculated as follows:

$$\text{Contrast ratio} = \frac{\text{Reflectance over black tile}}{\text{Reflectance over white tile}} \times 100$$

Using measurements of film weight, specific gravity, and total paint solids, a spreading rate for each film was calculated and plotted against contrast ratio. Thus, knowing the natural spreading rate of the paint (see APPLICATION PROPERTIES), it was possible to determine its contrast ratio after application. Since it is generally considered that a contrast ratio of 98% is necessary for complete hiding for most surfaces, it was decided that this value had to be achieved before the paint could be referred to as a one coat system.

COLOR: A thick film of each paint was applied to a white glazed card using a wire wound applicator bar. After drying for 24 hours, the L, 'a', 'b' values (CIE, 1976) of each film were measured on a Gardner XL-23 colorimeter. A color difference of approximately 0.3 CIELAB units is normally taken to correspond to the minimum difference which can be perceived by the human eye.

APPLICATION PROPERTIES: Application properties of a paint such as the ease by which it can be applied, wet edge time,[2] natural spreading rate, and film thickness uniformity are important from the point of view of the user, and since some of these properties determine film build, they play a vital role in influencing the general optical performance of the paint. The type of applicator used is also an important factor which has to be considered when formulating a paint since the spreading rate obtained will vary depending on whether a brush, roller, or pad is used. With roller application, spatter is also an important application property which is strongly influenced by the type of thickener used.[3] This means that more variables than those mentioned in the Introduction have to be considered. Therefore it was decided to limit the discussion of application technique to that of brushing in this article.

To simulate practical application, all paints were applied to a primed (using a general purpose emulsion paint) 1.2 m × 1.2 m Gyproc™ paper lined plaster board using a 75 mm pig bristle brush. During application, the ease of brushing and wet edge were rated using an arbitrary scale which varied from 1 to 5, where 1 indicates very easy application and excellent wet edge, and 5 represents very difficult application and poor wet edge. After drying, the general appearance of each brush-out was also rated in terms of uniformity of application, flow, and leveling using a scale which varied from A to E, where A represents outstanding appearance and E very poor general appearance. Thus, each paint was given a three figure rating such as 3-B-4, where the first and last numbers represent ease of application and wet edge respectively, and the letter indicates the general appearance of the dried film. (N.B. Several commercial American/Canadian 'one-coat' emulsion paints were evaluated using this procedure, with ratings varying from 2-C-2 to 3-C-4.)

Since the opacity exhibited by the paint after one coat application is obviously important, various methods of determining contrast ratio from the actual brush-out were evaluated. For example, pieces of polyester foil (20 cm × 12.5 cm) were attached to the Gyproc board and painted at the same time as the board. After drying, the coated foil was removed and its contrast ratio measured. It was evident from the results that the opacity values were lower than expected and it was thought that this was because the spreading rate of paint on the polyester foil was greater than that on the Gyproc surface. To confirm this, the coated foils were weighed to determine natural spreading rate (NSR). The weight of paint which had been applied to the standard board, free of polyester foil, was also measured, enabling an NSR to be calculated. In *Figure* 1, the relationship between both natural spreading rates is illustrated using a variety of paints, and it is evident that the spreading rate on the polyester foil is significantly greater, particularly for spreading rates of the order of 15 to 20 m^2/L.

The conclusion was that, since the type of surface painted influences NSR, it was better to determine the weight of paint used for the Gyproc board to calculate an NSR, then to use the contrast ratio versus spreading rate

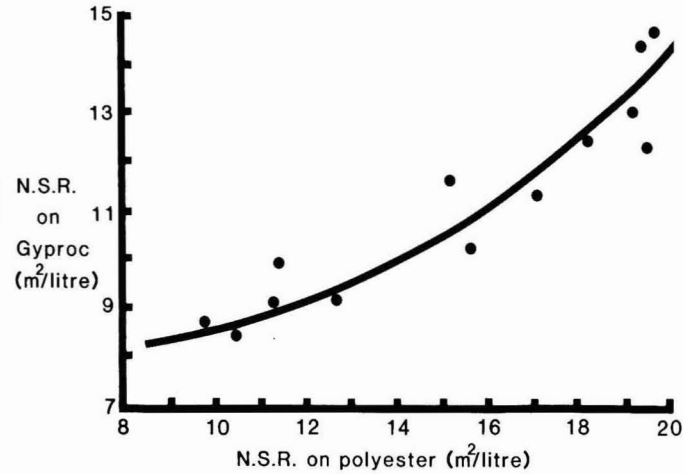

Figure 1—Correlation between natural spreading rates (NSR) for polyester and Gyproc wallboard substrates

plot (as mentioned above) to determine contrast ratio at the paint's natural spreading rate. However, the loss of water from the paint container during application may affect this measurement. To confirm that the weight of paint used during application could be accurately used to calculate NSR, primed lining paper similar in texture to that used on the Gyproc plasterboard was attached to the board and brush painted.

After drying, areas of the painted lining paper were removed and weighed to calculate the weight of paint applied, and hence determine an NSR. It was found that within experimental error, the linear correlation between both measurements was good, suggesting that the technique of weighing the paint container plus brush before and after application was sufficiently accurate to determine spreading rate.

With regard to assessing natural spreading rate, it is important to emphasize that this measurement is extremely operator dependent. For example, a paint with an average NSR of 12 m^2/L was applied by nine different people in the Tioxide Laboratories and it was found that the spreading rate varied by ± 2 m^2/L. Thus, this variation, and possibly others if the applicator or substrate is changed, must be taken into consideration when developing and claiming that an emulsion paint is one coat.

RHEOLOGY: The rheological profile for a one coat emulsion paint requires a compromise in both high-shear and low-shear viscosity. For example, a relatively high high-shear viscosity is required to produce film build (low spreading rate), but if it is excessive, the brush drag will result in wrist/arm fatigue for the painter. A low-shear viscosity or yield point[4] that is too low means that the paint is likely to sag after application, but if the viscosity/yield point is not low enough the paint may hold brush marks rather than flowing and leveling.

To study rheological behavior at high shear rates, which is the region of interest from the point of view of brush application, a Haake RV12 viscometer with cone and plate geometry was used to measure viscosity at 10,000 sec^{-1}. For the low shear rate evaluation, a controlled stress Deer Rheometer with concentric cylinder geometry was employed to determine yield point. To simulate practical application it is obviously necessary in the first instance to subject the paint to high shear (i.e., representing brushing) before measuring its yield point. Therefore, each paint was passed through a 0.8 mm diameter hypodermic needle into the cup of the viscometer, immediately after which yield point was determined.

FLOW AND LEVELING: In addition to measuring yield point for studying flow and leveling, the surface texture of each paint film was quantified. Paints were applied onto glass using a wire wound applicator bar to produce a nominal wet film thickness of 60 μm. After drying for 24 hours, undulations left by the applicator bar were then quantified using a Taylor-Hobson Talysurf™, whose principle involves traversing the paint surface under study with a fine stylus at right angles to the drawdown direction. One parameter which was used to define surface roughness is center-line average[5] (CLA) which is defined as the arithmetical average value of the departure of the surface profile above and below a reference line; a perfectly smooth surface has a CLA value of 0. The lower the CLA value the better is the flow and leveling.

Sagging was also evaluated by determining how thickly the paint could be applied before gravity induced flow produced sag. A Sheen™ sag index applicator which produces strips of paint of thickness varying from 50 to 200μm (by 25μm steps) was used. Thus, paints were applied onto glass using the sag index applicator, after which the test piece was placed in a vertical position with the paint stripes horizontal. Sag index is the lowest film thickness at which a sag of 25% takes place.

STAIN RESISTANCE: Stain resistance/film porosity was assessed by applying a 10% solution of Gilsonite™ in white spirit by brush onto a 25μm thick dry film. After 15 seconds, the solution was washed off with an excess of white spirit and the film allowed to dry. Gilsonite, a dark brown bituminous material, penetrates porous films and

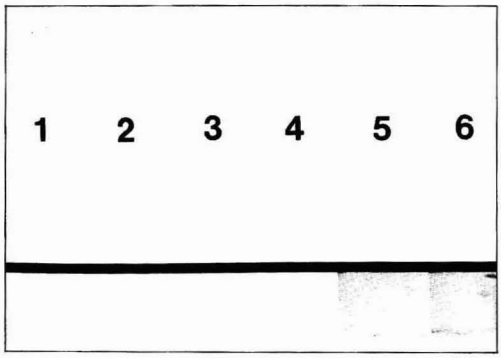

Figure 2—Paint films stained with Gilsonite, which illustrates the arbitrary scale used for stain resistance. (Rating: 1 = no staining; 6 = severe staining)

leaves a stain, the color of which is to some extent related to stain resistance/film porosity. The degree of stain on each film was rated using an arbitrary scale which varied from 1 to 6, where 1 is no staining and 6 severe staining. *Figure* 2 shows a series of stained paint films illustrating each rating.

SCRUB RESISTANCE: For scrub resistance, paints were applied to Leneta™ scrub panels using a wire wound applicator bar to produce a nominal wet film thickness of 60μm. After the films had dried for 72 hours they were tested on an REL™ multihead scrub machine for 2,500 cycles. During the scrubbing period, a flow of tap water covered the panels. The number of cycles at which there were signs of breakdown was noted together with the general appearance of the panels after 2,500 cycles.

RESULTS AND DISCUSSION

Influence of Extender Type and PVC

The type of extender used in a paint will not only affect its color (hence, opacity) and brightness, but also influence the state of pigment dispersion. It is well known[6,7] that the particle size of the extender can have a profound effect on the crowding of titanium dioxide pigment and this will inevitably affect the opacity of the paint. Since fine particle size extenders (i.e., mean diameter <2μm) have the least effect on pigment crowding, three typical materials (calcite, calcined china clay, and blanc fixe) were selected, properties of which are given in *Table* 2. Over the past few years attempts have been made to utilize microvoids[8] as light scattering/opacity promoting centers, and as a result various inorganic/organic vesiculated beads have become available, one example of which was selected. Since this product, detailed in *Table* 2, was based on an acrylic copolymer, it would, in contrast to inorganic vesiculated materials such as glass microspheres, exhibit little light absorption and the color of the bead would have minimal effect on the opacity of the paint.

Table 2—Some Properties of Extenders Studied

Extender	Mean Particle Size (μm)	Oil Absorption (g/100 g)
Calcite	1.5	18
Calcined china clay	2.0	49
Blanc fixe	0.7	13
Vesiculated bead (organic)	0.6	—

Using a general purpose grade of titanium dioxide (pigment A—see *Table* 3) paints were formulated according to the details given in *Table* 1 using the various extenders such that the PVC varied from 20% (no extender) to 60%.

To compare the optical efficiency of all four extenders, contrast ratio for a 20μm thick dry paint film, equivalent to a spreading rate of 18.5 m^2/L, was determined as a function of PVC, the results of which are given in *Figure* 3 together with the stain ratings which are given alongside each result. It can be seen that in the case of blanc fixe and calcite extenders there was no improvement in contrast ratio between PVC's of 20% and 50%, whereas with the calcined china clay a small increase in opacity occurred, most likely due to the fact that the color of the clay played a small role in affecting contrast ratio. (N.B. This was detected by measuring the L value, to be discussed below.) However, it is clearly evident that using vesiculated beads resulted in an increase in opacity, although at 50% PVC and above the difference between this material and the calcined china clay is small. The reason for this is that the critical PVC for the calcined china clay based paint is about 45% (assessed by noting a change in opacity and staining) and therefore at 50% PVC and above, the degree

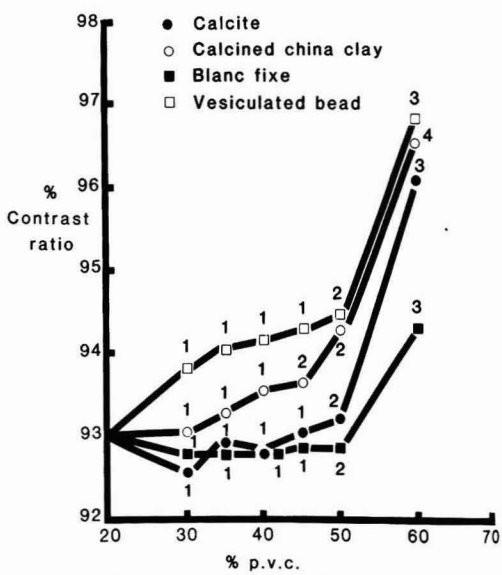

Figure 3—Influence of extender type/PVC on opacity, for 20μm thick paint films. Stain ratings are also given alongside each result where 1 = no staining and 5 = severe staining

Table 3—Typical Properties of Titanium Dioxide Pigments A, B, and C

Pigment	TiO_2 (%)	Inorganic Coating	Specific Gravity	Oil Absorption (g/100 g)
A	93	Alumina and silica	4.05	18
B	85	Alumina and silica	3.80	26
C	80	Alumina and silica	3.75	35

of air entrapment in the film is probably similar to that of the vesiculated bead, from a light scattering viewpoint. In contrast, it is evident from *Figure* 3 that the critical PVC for the blanc fixe, vesiculated bead, and calcite based paints is between 50% and 60%. (N.B. By inspecting the oil absorption data given in *Table* 2, the relatively low critical PVC exhibited by the calcined china clay would be expected.)

From an opacity viewpoint it can be clearly seen from *Figure* 3 that the natural spreading rate for all these paints would have to be lower than 18.5 m^2/L to achieve at least 98% contrast ratio. It was evident from the opacity data that for the calcined china clay based paints, a spreading rate of approximately 16 m^2/L would be needed to achieve 98% contrast ratio for the 60% PVC paint, whereas at 45% PVC, a spreading rate of about 9 m^2/L is required. This suggests that a one coat paint could possibly be formulated at 60% PVC since a relatively high spreading rate is adequate, but since this paint exhibited significant staining, a factor which was not required, it was decided to examine only those paints which were at 45% PVC.

In *Table* 4, natural spreading rate, opacity at natural spreading rate, viscosity at 10,000 sec^{-1}, stain rating, and L, 'a', 'b' values are listed, and it is evident that extender type plays an important role in affecting paint performance. For example, there is a significant variation in paint viscosity at 10,000 sec^{-1} shear rate and associated with this change there is a corresponding variation in NSR (i.e., the higher the viscosity, the lower the spreading rate). It is interesting to note that the vesiculated bead produced a low viscosity/high spreading rate paint, and as a result contrast ratio at NSR was relatively low (95.0%) compared with the calcined china clay extender (97.3%) which produced a paint with the highest viscosity. The application rating for the paint containing vesiculated bead (2-C-3) was better than the calcined china clay based paint (3-C-3) because of its lower high-shear viscosity. Thus, the only way by which the opacity of the paint containing vesiculated bead could be increased would be to reduce the paint's NSR by increasing the thickener level (to be discussed below), but this would result in an increase in raw material cost.

From an optical viewpoint, the results given in *Table* 4 show that the vesiculated bead exhibits the best color (i.e., highest brightness—L, and lowest 'b' value) whereas the calcined china clay is showing the lowest brightness, and as mentioned above, this factor probably contributes towards the higher contrast ratio values illustrated in *Figure* 3.

With regard to film porosity, only the paint containing calcined china clay exhibited any staining (i.e., very slight) at 45% PVC, but this had negligible effect on film integrity since no paints tested showed any signs of breakdown on scrubbing.

By comparing results which are given in *Figure* 3 and *Table* 4 (i.e., order of performance of extender with regard to opacity), it can be seen that the extender type plays a significant role in affecting paint viscosity and that this would appear to be the major factor which determines film build/opacity development. Of the extenders studied, the paint based on calcined china clay exhibited the highest 'applied' opacity, but at 45% PVC the level was not sufficiently high to merit one coat status. Thus, given the same type of titanium dioxide pigment and extender, the spreading rate of the paint would have to be decreased to at least 9.0 m^2/L by increasing, for example, the thickener level, but, as discussed below, this results in an increase in application rating. Alternatively, the PVC of the paint could be increased, as shown in *Figure* 3, which produces an increase in staining. With regard to the latter approach, if a stain rating of 4 could be tolerated, then, as mentioned above, an NSR of at least 16 m^2/L would be needed to achieve 98% contrast ratio, meaning that the viscosity of such a paint would not have to be as high as the 45% PVC paint. This would be advantageous from the point of view of ease of application, but at a high PVC other problems such as a deterioration in wet edge, particularly when the surface to be painted is porous, must be considered when developing a one coat product.

Influence of Grade of Titanium Dioxide Pigment And Amount

The results above indicate that modifications to the standard 45% PVC paint would have to be made to produce a one coat product. One obvious approach is to increase the amount of prime pigment (and increase the raw material cost accordingly), while another method would be to select a higher opacity grade of titanium dioxide pigment.

With regard to higher opacity grades of titanium dioxide, pigment manufacturers[9] apply a greater volume of silica and alumina to the base crystal than is found with a general purpose grade. Thus, with a highly pigmented emulsion paint, where pigment crowding is prevalent, the voluminous coating of silica/alumina on such a pigment

Table 4—Effect of Extender Type on Paint (45% PVC) Performance

Extender	Viscosity at 10,000 sec^{-1} (poise)	NSR (m^2/L)	Contrast Ratio at NSR (%)	Stain Rating	Color L	a	b
Calcite	2.1	13.8	95.1	1	97.2	−0.3	1.9
Calcined china clay	2.6	10.5	97.3	2	96.3	−0.3	1.9
Blanc fixe	1.7	14.7	94.5	1	97.4	−0.4	1.9
Vesiculated bead	1.1	15.9	95.0	1	97.8	−0.4	1.6

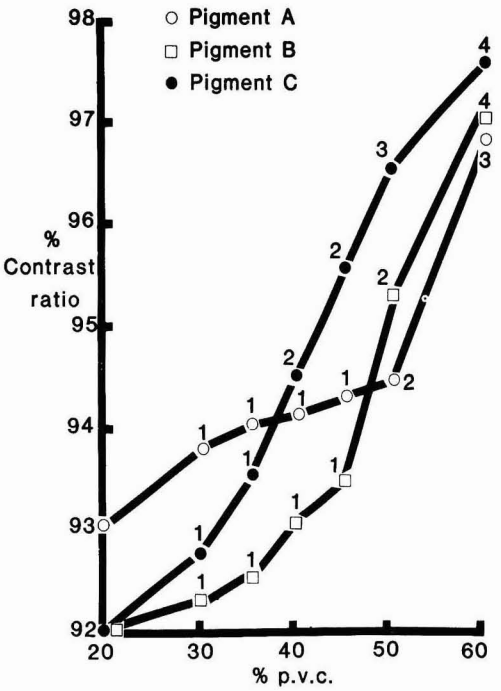

Figure 4—Effect of grade of titanium dioxide pigment/PVC on opacity and staining for 20μm thick paint films (extender = vesiculated bead), where stain ratings are given alongside each result; 1 = no staining and 5 = severe staining

assists in keeping the centers of the titanium dioxide crystals apart. Inevitably, increasing the amount of silica and alumina produces an increase in the pigment's oil absorption/water demand and an obvious decrease in titanium dioxide content.

To illustrate the significance of using such pigments, two grades of titanium dioxide (i.e., pigments B and C) with different amounts of alumina and silica were selected so that their performance could be compared with that of pigment A. Typical properties of the three grades of pigment are given in *Table* 3, where it can be seen that pigment C has the highest level of alumina and silica, and pigment B has a coating level which is between pigments A and C.

Using the basic formulation given in *Table* 1, paints were made using vesiculated bead as the extender, so that PVC's varied from 20% (i.e., no extender) to 60%. For each paint, contrast ratio for a 20μm thick dry paint film (i.e., 18.5 m^2/L spreading rate) was measured, and in *Figure* 4 these values are plotted as a function of PVC. Also, for every paint a stain rating was obtained and this is given alongside each result in *Figure* 4. For PVC's less than 35% it can be seen that pigment A has higher opacity than either pigment B or C, and this is due to the high titanium dioxide content of pigment A dominating the light scattering process. However, as the PVC is increased above 40%, the advantage in using pigment C is evident although there is slight staining at 40% and 45% PVC, whereas with pigments A and B there is none. At 50% PVC, the advantage in using pigment B as opposed to A is clear since the paint based on B exhibits better opacity although similar staining, whereas with pigment C there is a significant advantage in opacity but there is also an increase in staining. The absolute contrast ratio values and stain ratings given in *Figure* 4 will vary depending on the extender selected, but the general profiles will be similar.

Since our particular interest was in formulating a 45% PVC paint, results given in *Table* 5 illustrate the influence of pigment type at this PVC, on paint viscosity (10,000 sec^{-1}), NSR, opacity at NSR, and stain rating when vesiculated bead was used. In addition, a series of paints based on calcined china clay was made, the results of which are given in *Table* 5. Since in the case of the calcined china clay extender, the viscosity of the paint containing pigment C was too high when 2% thickener based on weight of paint was used, the level of thickener was reduced to 1.5% for all three pigments. These results show that irrespective of extender type, pigment C produces a paint with the highest viscosity, pigment A the least, and pigment B is intermediate, and associated with this variation there is a corresponding change in spreading rate. For paints based on vesiculated bead, pigment C exhibits the greatest opacity, as shown in *Figure* 4, although the level is inadequate from a one coat viewpoint. It is also interesting to note that the opacity difference between pigments A and B is not as great as that which is given in *Figure* 4, but this is due to the fact that pigment B has a greater effect on paint viscosity, due to its higher medium/water demand, and subsequent spreading rate. If calcined china clay is used instead of vesiculated bead, it can be seen that there is a significant

Table 5—Influence of Pigment Type on Paint Performance when PVC = 45%

Pigment	Viscosity at 10,000 sec^{-1} (poise)	NSR (m^2/L)	Contrast Ratio at NSR (%)	Stain Rating	Extender Type
A	1.1	15.9	95.0	1	Vesiculated bead
B	1.3	14.0	94.8	1	
C	1.6	12.8	96.8	2	
A	1.7	13.0	96.2	2	Calcined china clay
B	1.9	10.6	98.4	3	
C	2.6	9.7	98.8	3	

Table 6—List of Thickeners Studied

Thickener	Type	% Solids as Received
W	Hydroxyethyl cellulose	100
X	Polyacrylate	22
Y	Polyurethane	55
Z	Polyurethane	35

increase in 'applied' opacity which, as previously mentioned, is primarily the result of an increase in the paint's high-shear viscosity and hence a decrease in spreading rate. It can also be seen that there is an increase in staining which is particularly significant when pigments B and C were used. This point is due to the fact that the calcined china clay, having a greater oil absorption/medium demand compared with the vesiculated bead, will produce a lower critical PVC which will obviously affect film porosity. Since the application ratings for paints based on calcined china clay and pigments A, B, and C were 3-C-3, 3-C-3, and 4-C-3, respectively (note the higher (worse) ease of application rating given to pigment C), it is evident that pigment B would be a suitable choice of pigment to achieve at least 98% contrast ratio. Unfortunately, as mentioned above, the paint film containing this grade of pigment exhibited some staining, although its film integrity was very good since it showed no signs of breakdown on scrubbing. If the opacity exhibited by the paint containing pigment B has to be matched by using pigment A, then, as shown in the next Section (e.g., see *Table* 8), a significant increase in thickener level must be made to reduce spreading rate and this will not only result in an increase in raw material cost (e.g., approximately 8% increase) but the ease of application will become unacceptable.

An alternative method by which the opacity of the paint containing pigment A can be increased is to increase the level of pigment, while maintaining a constant PVC, but this will also produce an increase in raw material cost. To illustrate this approach, the basic formulation given in *Table* 1 was used to make paints using calcined china clay as extender, except the volume concentration of pigment A in the dry film was varied from 15% to 35% by 5% increments. Contrast ratio for a 20μm thick dry paint film (i.e., 18.5 m^2/L spreading rate) was obtained for each paint, the results of which are plotted against volume of prime pigment in *Figure* 5. The raw material cost was also calculated for each paint, and by using the 20% level of prime pigment as standard (representing 100 units) the approximate cost is given in relationship to the standard alongside each result in *Figure* 5. In addition the films were stained and found to have a stain rating of 2, irrespective of pigment loading. It can be seen from these results that increasing the level of pigment A from 15% to 20% has produced a significant improvement in opacity, but on increasing the level of pigment still further, there has been only a small change in opacity. This effect is due to the well-known[10] pigment crowding phenomenon, which is the result of a decrease in the light scattering efficiency of a pigment when its level is increased. From a cost viewpoint it is also evident that there is little to be gained by increasing the level of pigment A above 20%.

With regard to paint performance it can be seen from *Figure* 5 that at a spreading rate of 18.5 m^2/L even the paint containing the greatest amount of titanium dioxide pigment would not merit one coat status. In fact, when all five paints were evaluated it was found that within experimental error there was little difference in high-shear viscosity (i.e., approximately 2.6 poise), application rating (i.e., 3-C-3), and NSR (i.e., approximately 10.5 m^2/L). Thus, the contrast ratio at NSR for the 15%, 20%, 25%, 30%, and 35% paints was found to be 95.7%, 97.3%, 97.4%, 97.5%, and 97.8%, respectively, which indicates that a one coat emulsion paint cannot be obtained by simply increasing the amount of titanium dioxide pigment, particularly when it is a general purpose grade.

Importance of Thickener Type With Regard to Film Build and Flow/Leveling

The results above indicate the importance of paint rheology on film build and hence opacity. It is clear that the type and amount of thickener used in a paint will not only affect film build but will also play an important role in influencing flow and leveling.

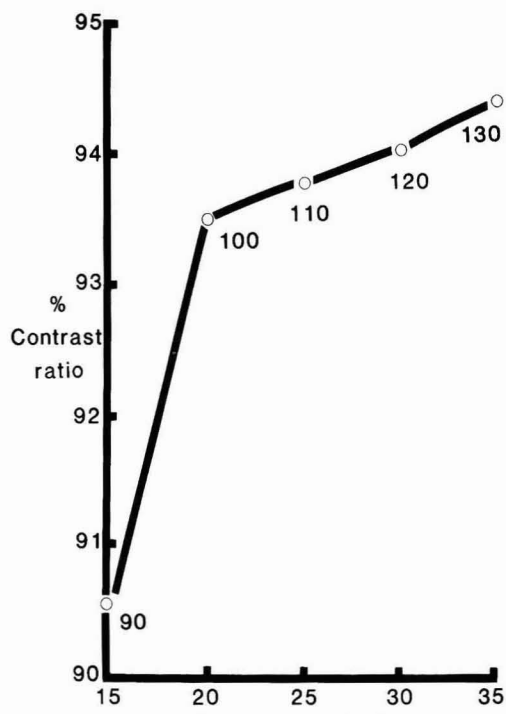

Figure 5—Effect of increasing level of titanium dioxide (pigment A) on opacity (20μm thick paint film) and raw material cost (relative units) using calcined china clay as extender

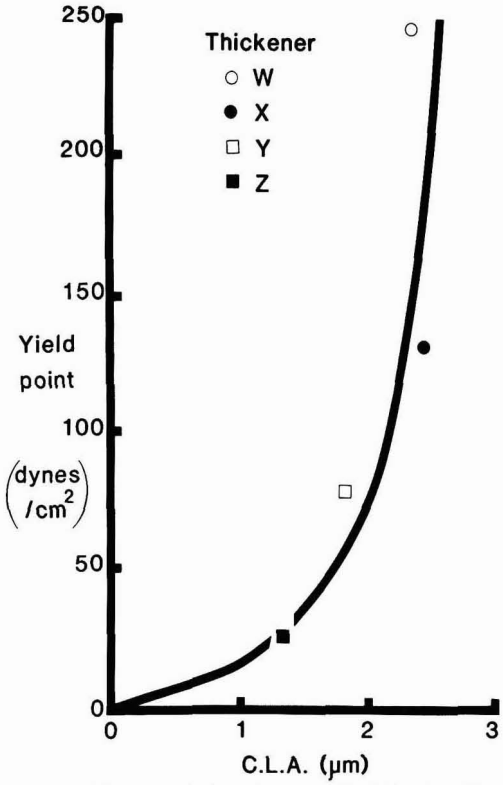

Figure 6—Influence of thickener type on yield point and paint film surface roughness (CLA)

To study the effect of thickener type on these properties, four different commercial thickeners ranging from hydroxyethyl cellulose to a polyurethane were evaluated (see *Table* 6). Using the basic formulation which is outlined in *Table* 1 (pigment A and calcined china clay extender) the amount of each thickener used was adjusted in order to produce a high-shear viscosity of approximately 1.7 poise. Thus, the spreading rate for all four paints would be approximately the same, assuming that high-shear viscosity is the major determining factor. To confirm this, NSR of all four paints was determined, the results of which are given in *Table* 7 together with application ratings and the amount of thickener used in each paint. It can be seen from these results that within experimental error there is little difference in spreading rate, wet edge, and ease of application between the paints, but there is a difference in general appearance rating insofar as the paint based on thickener Z was better than W, X, and Y (i.e., a rating of C compared with D). To confirm that the better general appearance rating given to thickener Z was primarily the result of better flow and leveling, the yield point of each paint and its surface roughness (i.e., CLA) were measured, and these values are plotted in *Figure* 6. The results clearly confirm that by using thickener Z as opposed to W, X, or Y, a paint with a lower yield point has been produced, and consequently flow and leveling were superior since a significantly lower CLA value was recorded. A sag test was also carried out on the paints to determine if the low yield point shown by thickener Z had any detrimental effect, but it was evident that for a 200μm thick wet film all four paints showed no signs of sagging.

Since flow and leveling are important factors with regard to a one coat/high build paint, it is clear that thickener Z is an obvious choice, and therefore further work was confined to this particular thickener.

The opacity values given in *Tables* 4 and 5 indicate that a one coat, stain-free paint could not be easily obtained unless spreading rates of the order of 10 m^2/L and less were obtained. Since the high-shear viscosity of a paint determines spreading rate, an obvious means of achieving a lower spreading rate is to increase the level of thickener. To illustrate this, 45% PVC paints were formulated according to the basic details given in *Table* 1 (pigment A, calcined china clay extender and thickener Z) except the level of thickener was varied from 1.5% to 2.5%, based on weight of paint, by 0.5% steps. *Table* 8 shows the effect of thickener level on paint performance where high-shear viscosity, NSR, opacity at NSR, and application rating are given. The results indicate that as the thickener level is increased there is an inevitable increase in paint viscosity and a corresponding decrease in spreading rate. These two parameters are plotted in *Figure* 7 to illustrate the correlation. Also, it can be seen that a thickener level of 2.5% is required to produce a sufficiently low spreading rate (i.e., 9.0 m^2/L) so that 98% contrast ratio is achieved, but at this level, the ease of application rating is 4. On ease of application, the ratings used covered a broad spectrum of paints (i.e., different high-shear viscosities) and as a result the assessment is not particularly sensitive. However, from a separate evaluation which is not reported in this paper, it was evident that the maximum high-shear viscosity of a paint that could be tolerated for brush

Table 7—Amount of Thickener (as received) Required To Produce Approximately the Same High Shear Viscosity, And its Effect on NSR/Application

Thickener	Amount (on Paint Weight) (%)	Viscosity at 10,000 sec^{-1} (poise)	NSR (m^2/L)	Application Rating
W	1.1	1.70	11.8	3-D-3
X	5.0	1.70	12.0	3-D-3
Y	2.2	1.60	11.0	3-D-3
Z	1.5	1.70	13.0	3-C-3

Table 8—Effect of Thickener (Z) Level on Paint Performance

Amount (on Paint Weight) (%)	Viscosity at 10,000 sec^{-1} (poise)	NSR (m^2/L)	Application Rating	Contrast Ratio at NSR (%)
1.5	1.70	13.0	3-C-3	96.2
2.0	2.60	10.5	3-C-3	97.3
2.5	3.30	9.0	4-C-3	98.0

application was approximately 2.4 poise, and this generally corresponded to paints which had been given a rating of 3. Thus, a rating of 4 means that the paint which contained 2.5% thickener was not acceptable for brushing whereas the paint containing 2.0% thickener would be borderline for application, but even then the spreading rate was not sufficiently low to produce adequate opacity after one coat.

An alternative way by which the viscosity of paint can be slightly modified is to change the amount of propylene glycol, and by doing so perhaps modify the wet edge time of the paint. To examine this option, the basic formulation given in *Table* 1 (pigment A, calcined china clay extender and thickener Z) was used to make paints which contained propylene glycol levels of 0%, 1%, 3%, and 5% on weight of paint. The performance of these paints is illustrated in *Table* 9, where it is evident that increasing the level of glycol produced the expected increase in viscosity, decrease in spreading rate, and corresponding increase in opacity. The viscosity and NSR values have been plotted in *Figure* 7 in order to show the correlation between these two parameters. It can also be seen from *Table* 9 that there has been an improvement in wet edge by increasing glycol level from 0% to 1%, but the effect was not progressive with increasing glycol level. As shown above, these results suggest that as soon as the viscosity of the paint is sufficiently high to produce the required film build opacity (i.e., see 5% propylene glycol level) the ease of application becomes unacceptable. However, one interesting aspect of this work which is specific to the type of thickener (Z) used, was that increasing the level of propylene glycol produced a small decrease in CLA value (i.e., in going from 0% to 5% propylene glycol, CLA decreased by 0.3μm) which indicates that there was a small improvement in flow and leveling.

Increase Opacity by Using Colored Pigment

It is evident from the above that it was difficult to produce a white 45% PVC one coat paint that could be easily applied by brush. Since from an application viewpoint there are constraints on a paint viscosity, this means that 98% contrast ratio cannot be easily achieved by film build. Therefore an alternative way of increasing opacity has to be considered, some examples of which relating to the type and amount of titanium dioxide pigment used have already been discussed. Another approach is to use small quantities of colored pigment which produce an increase in opacity by virtue of their

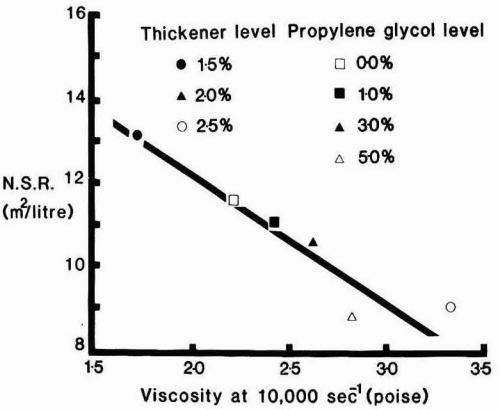

Figure 7—Influence of thickener and propylene glycol levels on paint viscosity and NSR

light absorbing characteristics, but this will inevitably result in an 'off-white' paint. To investigate this possible option, the standard 45% PVC white paint (pigment A, calcined china clay extender and thickener Z) was used as a control to which was added (a) 0.005% phthalocyanine green, (b) 0.005% phthalocyanine blue, and (c) 0.01% carbon black, based on weight of pigment. The levels used were the maximum that could possibly be tolerated before there was any major deterioration in whiteness.

The three colored paints plus the control were evaluated in terms of application, opacity at NSR, and color, and the results are given in *Table* 10. It can be seen that all three toned paints, which have similar application properties, exhibited adequate opacity after one coat, although there is greater room for error in terms of spreading rate for the paint containing carbon black. From a color viewpoint it can be seen from the L, 'a', 'b' values that there are inevitable variations, with the carbon black based paint showing the lowest brightness. (N.B. Several commercial American/Canadian 'white one coat' paints have been evaluated, two of which exhibited L values lower than 91.7.)

Since the paint containing carbon black gave a more than adequate opacity at its NSR (i.e., 10.4 m^2/L) small changes could be made to the formulation in order to reduce raw material cost. For example, it was found that if the thickener level was reduced from 2.0% to 1.7% which produced a 1% raw material cost saving, the high-shear viscosity decreased from 2.6 poise to 1.7 poise,

Table 9—Influence of Propylene Glycol Level on Paint Application Properties

Amount of Propylene Glycol on Paint Weight (%)	Viscosity at 10,000 sec $^{-1}$ (poise)	NSR (m^2/L)	Contrast Ratio at NSR (%)	Application Rating
0	2.2	11.5	96.8	3-C-4
1	2.4	11.0	97.1	3-C-3
3	2.6	10.5	97.3	3-C-3
5	2.8	8.7	98.3	4-C-3

Table 10—Influence of Colored Pigment on Paint Performance

Paint	Application Rating	Contrast Ratio at NSR (%)	Color		
			L	a	b
Control	3-C-3	97.3	96.3	−0.3	1.9
+Green pigment	3-C-3	98.0	95.2	−3.8	0.5
+Blue pigment	3-C-3	98.9	94.2	−4.8	−1.8
+Black pigment	3-C-3	99.7	91.7	−0.7	0.1

thereby assisting ease of application, and the NSR became 12.2 m^2/L. At this spreading rate, the contrast ratio was 98.7%, which is still adequate from a one coat opacity viewpoint.

SUMMARY

Attempts were made to formulate a 45% PVC white emulsion paint that could be easily applied by brush, and produce at least 98% contrast ratio after one coat application. Factors such as pigment type, pigment loading, extender type, thickener type and level were evaluated in order to develop such a product, but the objectives were not completely achieved.

To produce a one coat emulsion paint, the initial parameters would have to be changed. For example, if a stain-free paint is necessary the paint would have to be tinted so as to increase opacity, but in doing so, an 'off-white' paint would be obtained. Alternatively, if white is necessary, then some film porosity is inevitable in order that dry hiding can be used to increase opacity (without necessarily producing a loss of film integrity) and this could be achieved by either selecting an alternative grade of titanium dioxide pigment or possibly increasing the PVC.

ACKNOWLEDGMENT

The author wishes to thank the Directors of Tioxide Group PLC for permission to publish this paper, and Mr. J.P. Richards and Mr. D.J. Rutherford for helpful discussions.

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Pulsed Nuclear Magnetic Resonance Measurement of the Relative and Absolute Linseed Oil Content in Wood

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and

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Pulsed NMR has been applied to the determination of the relative and absolute linseed oil content in trembling aspen wood. Utilizing the oil and wood signals, the weight percent gains could be estimated within ±2% of the values determined gravimetrically. The techniques developed are nondestructive and performed easily and quickly.

INTRODUCTION

Wood is a porous material which tends to absorb many fluids with which it comes into contact. However, the interactions between the wood and the absorbed material are not well understood, despite their great importance in affecting the properties of many coatings, preservatives, stabilizers and the like used in connection with wood. In particular, better understanding of the interaction between wood and coating materials would provide more systematic information with which to design wood coatings and to select and prepare wood for a particular coating application. The ability to measure the amount and type of coating material which has penetrated various distances into the wood substrate is an important part of most such studies.

Many techniques have been used to study the wood-coating interaction. For example, pyrolysis gas-liquid chromatography of varnish-wood systems showed selective migration of coating constituents into the wood, and of wood components into the coating.[1] The quantity of material which migrated, or its composition, could not be determined. Fluorescence microscopy,[1,2] autoradiography[3] and a combination of x-ray emission from tagged molecules and molecular size measurements[4] all gave qualitative evidence that coating vehicles penetrate wood structure, even into the cell walls in some cases. Only the x-ray study gave an estimate of the amount of coating material in the wood, but its accuracy was limited by difficulties inherent in both the molecular tagging and the x-ray counting. Clearly, in these and many similar studies a great deal more information is potentially available if such quantitative determinations could be made with precision.

In this paper we report the application of a pulsed Nuclear Magnetic Resonance (NMR) technique[5] to the determination of the amounts of linseed oil in trembling aspen (*Populus tremuloides* Michx.). Uncured oil contents ranging from 0.25 to 1.0 g/g of dry wood could be quickly and easily measured to within ±2% of the same oil content determined gravimetrically. The measurements of cured oil contents will be presented in a separate publication.

NMR TECHNIQUE

The technique is based on the pulsed NMR signals from ^1H nuclei of the linseed oil and the wood.

Hydrogen nuclei (protons) possess a nuclear magnetic moment associated with their nonzero "spin" or nuclear

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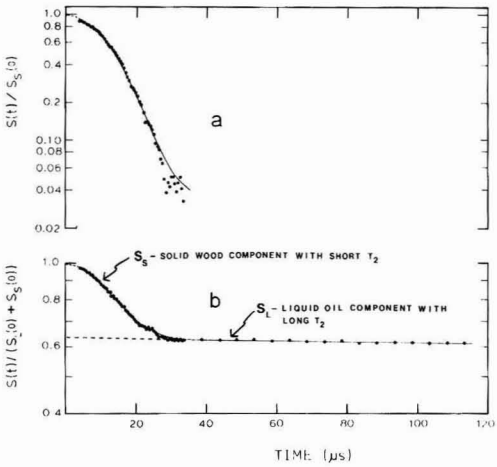

Figure 1—Proton FIDs of wood-oil samples. (a) Oven dried trembling aspen wood. The solid line was calculated assuming a Gaussian line shape. (b) 0.1466 g of oven dried trembling aspen wood containing 0.1500 g of linseed oil. The long and short components can be associated with the oil and wood protons, respectively

angular momentum.[6] Placing these nuclei in a static magnetic field H_0 results in a net alignment of the spins parallel to the static magnetic field. (The classical analogy is that of a compass needle aligned parallel to the earth's magnetic field). The magnetic moment precesses about a direction parallel to H_0 at a frequency

$$\upsilon_0 = \frac{\gamma}{2\pi} H_0 \qquad (1)$$

where $\gamma/2\pi$ is a constant characteristic of the species of nucleus and has the value 4.257 kHz per gauss for protons.[6]

If a second magnetic field H_1 alternating at frequency υ_1, is applied at right angles to the static field H_0, the spin system will absorb power when the resonance condition $\upsilon_1 = \upsilon_0$ is fulfilled. In wideline and high resolution NMR, the absorbed power is monitored as either the field H_0 or the frequency υ_1 is swept through resonance. In practice, field inhomogeneities and variation in local proton environments cause individual nuclei within the sample to experience different local magnetic fields, resulting in the resonance condition being met over a range of fields for the bulk sample, rather than at a single value of the field. Study of the absorption characteristics over this range of fields can give information about proton environments, and measurement of the area under the absorption curves can be related to the number of protons in the sample. This latter result has been used to study the oil content of seeds.[7,8]

In a more recent study[9] of oil content in seeds and also in studies[10,11] of fat content, the pulsed NMR method was found to permit relatively convenient and rapid oil and fat content determinations. The pulsed NMR method, also used in this study, uses a different means of detecting resonance. After the sample is placed in the static magnetic field H_0 and the spins are aligned parallel to H_0, an intense pulse of magnetic field oscillating in resonance (frequency υ_0) is applied at right angles to H_0. With proper selection of the intensity and duration of this pulse, the net magnetization (formerly parallel to H_0) may be rotated by 90° into a plane perpendicular to H_0.[6] Immediately following the pulse, the net magnetization precesses about H_0, inducing, in a coil surrounding the specimen, a detectable voltage proportional to the number of resonant nuclei in the sample. Interactions between spins, and inhomogeneities in H_0, cause individual magnetic moments to have various magnetic environments. The precession frequency therefore varies for the various spins in the sample, resulting in a loss of coherence in the precession. The magnitude of the precessing magnetization therefore decreases resulting in a decay, termed the Free Induction Decay (FID), of the induced voltage to zero with a characteristic time T_2^*. In a perfectly homogeneous magnetic field, the decay is the result of spin-spin interactions only and the characteristic time is labelled T_2. Generally, the more restricted the motion of the molecule containing the resonant nuclei, the shorter the value of T_2.

In principle, the relative numbers of protons in different samples can be obtained by comparing the induced voltage immediately after an infinitesimally narrow pulse for each sample. Using calibration samples containing known numbers of protons allows absolute measurement. However, two complications associated with the wood-coating samples and two inherent in the NMR apparatus must be accounted for. First, both wood and coating material contain protons which contribute to the total signal. Second, wood also may contain water which will contribute to the signal. With presently available NMR apparatus it is not possible to measure the induced voltage immediately after the pulse, nor is it possible to obtain an infinitesimally narrow pulse. Proper handling of the samples can eliminate the second problem, and careful analysis of the FID allows the first and third problems to be overcome completely. The fourth difficulty mentioned above does not present a problem as long as the pulse has a width much less than the natural line width of the NMR signal. In addition, utilizing both oil and wood signals, absolute oil contents may be determined by performing a single NMR experiment only on the sample of interest.

PROCEDURE

Wood

Trembling aspen sapwood was chosen for this work because of its uniform texture and high permeability. Cylindrical samples of length 1.0 cm, diameter 0.6 cm, and mass about 150 mg were cut, with the cylinder axis parallel to the grain, from a small block of wood. The samples were oven dried at 104°C to remove all water which can be removed by oven drying. Previous work has shown that any water left after this procedure gives a pulsed NMR signal indistinguishable from that of the solid components of the wood.[5] All wood samples used were free of gross splitting and checking.

Coating Vehicle

The experiments were performed using raw linseed oil. The raw form was used because paramagnetic species in a boiled oil can complicate the interpretation of the NMR measurements. The linseed oil wood samples were measured while the oil was in liquid form.

Sample Preparation

The oven dried wood samples were weighed and then immersed in various known concentrations of oil in carbon tetrachloride for several days. Samples were then placed in a periodically changed, dry inert gas atmosphere for several more days to remove the CCl_4. After CCl_4 removal, all samples were weighed and sealed in glass tubes.

NMR Measurements

Samples in their glass tubes were placed in the spectrometer coil located in the static magnetic field. The NMR measurements were performed using a homebuilt pulsed NMR spectrometer operating at 40 MHz. All measurements were made at room temperature. It required 12 μs for the receiving system to recover from a 90° r.f. pulse. The FIDs were recorded starting 14 μs after the pulse. In all experiments reported here the wood proton magnetization was refocused into a solid echo at time 2τ using a 90°_x-τ-90°_y pulse sequence.[12] This way part of the information lost during the initial 14 μs was recovered by starting the FID acquisition at time 2τ.

Data acquisition and analysis were performed with a Hewlett-Packard Model 9836 desktop computer interfaced to a Datalab Model 912 transient waveform recorder. To improve signal-to-noise ratio the NMR signals were averaged (a maximum of eight accumulations) in experiments involving the low oil content samples.

RESULTS AND DISCUSSION

Relative Oil Content

Figure 1 shows the proton FID for a sample of (a) oven dried trembling aspen and (b) oven dried trembling aspen containing 1.0 g linseed oil/g wood. The wood proton decay curve was fitted to a simple Gaussian curve with a second moment $M_2 = (11.2 \pm 0.2)\ G^2$, curve (a) of *Figure* 1. The sample containing oil shows two distinct decay times, *Figure* 1, curve (b). A good fit to curve (b), of *Figure* 1, was achieved using the following sum consisting of a Gaussian and an exponential term

$$S(t) = S_I(0) \exp\left(\frac{-t}{T_2^*}\right) + S_S(0) \exp(-M_2 t^2/2) \qquad (2)$$

where $S_I(0)$ and $S_S(0)$ are signal amplitudes of the long or "liquid-like" and short or "solid-like" component, respectively, at $t = 0$ (the middle of the pulse, applied to the sample at thermal equilibrium). The fitting procedure consists of the graphical decomposition of the multicomponent decay curve utilizing the linear least squares method. The parameters so obtained yield $S(t) = 0.64 \exp(-t/5200) + 0.36 \exp(-4.07 \times 10^9 t^2)$ where t is in microseconds. From the slope of the S_S-component $M_2 = (11.4 \pm 0.2)\ G^2$. This second moment agrees very well with that of curve (a). Therefore, it is reasonable to associate the S-component with the wood and the L-component with the oil. Then, in order to measure relative oil content of two samples (e.g., two different wood-oil samples or a wood-oil sample of unknown oil content and an oil sample of known mass), one simply needs to acquire a portion of the L-component in each sample sufficient to make possible the projection of the L-component data to $t = 0$ (i.e., obtain $S_L(0)$ in each case). This approach is valid only if the linseed oil protons do not contribute to the S-component.

The FID amplitudes $S_I(0)$ of neat linseed oil and of linseed oil-wood samples are shown in *Figure* 2, as a function of linseed oil weight. The solid line is obtained from a linear least squares fit of the neat linseed oil data. The graph extrapolates to zero, and the linseed oil-wood samples fall on the same line as the neat oil samples indicating that essentially all of the linseed oil in the wood is represented by $S_L(0)$. However, due to the slight scatter of the linseed oil-wood data, it cannot be ruled out completely that a small number (1 to 2%) of oil molecule protons on molecules closely associated with the wood cell walls contribute to the S-component. In *Figure* 2 the slope of the graph is determined solely by the gain of the spectrometer receiving system, which is maintained constant for the duration of the experiment.

The amount of linseed oil can, therefore, be determined by obtaining $S_L(0)$ of the proton signal in the sample in question and comparing it to $S_L(0)$ from a known amount of linseed oil. This technique is simple, reproducible,

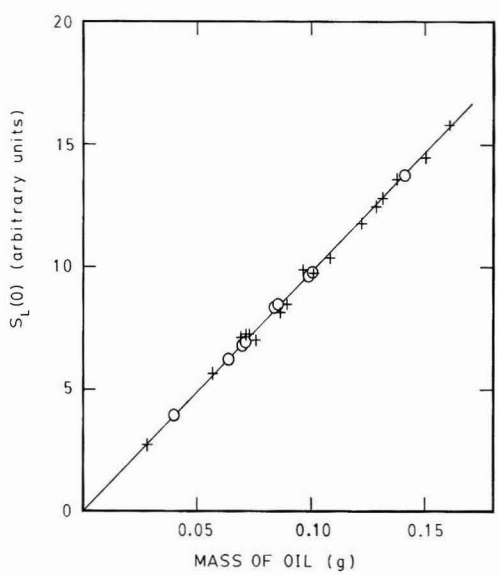

Figure 2—$S_L(0)$ vs grams of oil for samples of neat linseed oil (circles) and samples of linseed oil in trembling aspen wood (crosses). The solid line was calculated from a linear least-squares fit of the neat linseed oil data

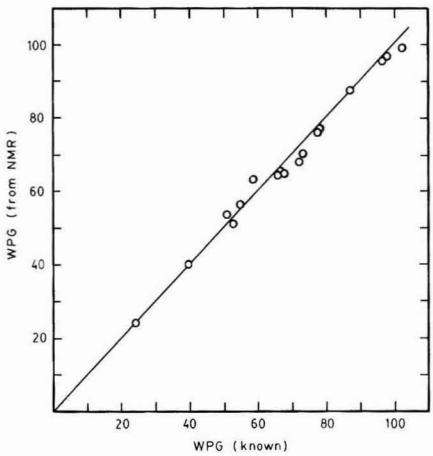

Figure 3—WPG obtained from NMR and total sample weight vs the WPG known from the weights of the oven dried wood and the oil. The solid line was calculated for WPG (from NMR) = WPG (known)

unambiguous, and rapid. It is independent of grain direction, should be independent of wood species, and is independent of temperature as long as the two values of $S_L(0)$ are obtained at the same temperature.

Rather than determining the amount of oil in a given sample relative to a known oil sample, it is often more useful to determine, nondestructively, the weight percent gain (WPG) of the given sample. This is accomplished by weighing the given oil-wood sample ($W_{OIL\text{-}WOOD}$) in addition to determining the amount of oil (W_{OIL}) in it using the above approach. Then WPG = 100 W_{OIL}/($W_{OIL\text{-}WOOD} - W_{OIL}$). The WPG of the samples used in the above experiment were found in this manner and are plotted in *Figure* 3 versus the WPG known from the measured weights of the dry wood samples and of the oil added. The solid line, *Figure* 3, corresponds to WPG (from NMR) = WPG (known). The results given in *Figure* 3 show that the WPG in the range 25% to 100% can be predicted this way within about 5% of a particular known WPG.

The method discussed thus far requires that a portion of $S_L(t)$ be obtained in the two samples such that $S_L(0)$ can be determined for each. However, since the signal coming from the wood has decayed to zero for $t > 40\ \mu s$ (*Figure* 1) it is possible, given certain conditions, to measure relative oil content of two samples by recording their relative signals at some known time more than 40 μs after the pulse. This signal must then be related to the linseed oil signal at time t = 0, which may be done as follows.

The signal amplitude $S_L(0)$ is related to the signal at time t by $S_L(0) = S_L(t) \exp(t/T_2^*)$. The ratio of signals for two samples is then

$$\frac{[S_L(0)]_a}{[S_L(0)]_b} = \frac{[S_L(t_a)]_a \exp[t_a/(T_2^*)_a]}{[S_L(t_b)]_b \exp[t_b/(T_2^*)_b]} \tag{3}$$

where subscripts a and b label the two samples, the signal from sample a being measured at time t_a after the pulse ($t_a > 40\ \mu s$) and decaying with characteristic time $(T_2^*)_a$ and similarly for the signal from sample b.

This ratio is equal to $[S_L(t_a)]_a/[S_L(t_b)]_b$ if $t_a = t_b$ and $(T_2^*)_a = (T_2^*)_b$. The former condition can always be met experimentally, but the latter condition depends on the characteristic decay times of the various samples. This time depends on oil content and also on the grain direction. However, by artificially decreasing the field homogeneity such that $T_2^* \sim 200\ \mu s$ it was found that T_2^* was constant at $(200 \pm 10)\mu s$ over the entire range of oil content used and also at all grain directions (i.e., under these conditions T_2^* is completely determined by the field inhomogeneity). Therefore, the relative oil contents of samples is

$$\frac{(\text{oil content})_a}{(\text{oil content})_b} = \frac{[S_L(0)]_a}{[S_L(0)]_b} = \frac{[S_L(t)]_a}{[S_L(t)]_b} \tag{4}$$

provided $t > 40\ \mu s$. Although this approach requires certain conditions to be met and would, in general, be expected to be somewhat more susceptible to systematic errors compared to the previous method, we feel it deserves mentioning because of simpler signal acquisition (i.e., only one point on the L part of the FID is required).

Absolute Oil Content

Given both $S_L(0)$ and $S_S(0)$ it is possible to determine the absolute oil content and WPG without comparison to an oil sample of known amount. For the oil signal $S_L(0) \propto W_{OIL}\,\sigma_{OIL}$ and for the wood signal $S_S(0) \propto W_{WOOD}\,\sigma_{WOOD}$ where σ_{OIL} and σ_{WOOD} are the respective spin densities. By taking the ratio $S_L(0)/S_S(0)$ the constant of proportionality no longer contributes, so that after replacing the weight ratio with WPG/100 we have

$$\frac{S_L(0)}{S_S(0)} = \left(\frac{\text{WPG}}{100}\right)\frac{\sigma_{OIL}}{\sigma_{WOOD}}. \tag{5}$$

A plot of $S_L(0)/S_S(0)$ versus WPG should yield a straight line with slope $\sigma_{OIL}/100\,\sigma_{WOOD}$. Such a plot is shown in *Figure* 4 for the same samples as used above. A very reasonable fit (solid line in *Figure* 4) to the data was obtained using equation (5). The slope was 0.0175 (i.e., $\sigma_{OIL}/\sigma_{WOOD} = 1.75$). This means that for trembling aspen wood the linseed oil WPG is

$$\text{WPG} = 57.1\,[S_L(0)/S_S(0)]. \tag{6}$$

This approach has the advantage that once the slope (*Figure* 4) is known, the WPG of any given sample can be found by measuring $S_L(0)$ and $S_S(0)$ from the same FID; comparison to a known oil sample is not required. A determination of oil content in an unknown sample can be made in a few seconds.

The signal-to-noise ratio ultimately determines the accuracy of oil content measurements. At concentrations above about 0.5 g/g, a single free induction decay is adequate for most purposes. At lower concentrations it may prove necessary to average the results of several experiments for a signal-to-noise ratio sufficiently large to provide the desired accuracy. This does not represent a great time loss, since a pulse can be applied and a signal observed about once per second. From the curve in *Figure* 4, the uncertainty in the determination of the WPG of an unknown sample appears to be $\pm 2\%$. Simultaneously utilizing oil and wood signals is the preferred method, but it requires that the spectrometer

receiver have a reasonably short deadtime and that the solid echo pulse sequence is available.

To illustrate the use of the technique, we measured the linseed oil distribution in a piece of trembling aspen. This sample had one across-the-grain surface exposed to a linseed oil pressure head of 5 mm. The side surfaces also exposed to the oil were sealed with silicone rubber to restrict uptake to the across-the-grain surface. The wood was left in the oil for four hours. It was then cut into 2 mm slices using a precision saw. In *Figure* 5 the WPG of samples prepared from these wood slices are plotted as a function of distance from the across-the-grain surface that had been in contact with the linseed oil. Due to the small sample sizes used in this experiment (*Figure* 5) the signal from a particular sample was averaged using from 8 to 32 scans, the exact number depending on the sample oil content. The relationship of oil content to distance from the surface is characteristic of a diffusing fluid obeying Fick's second law, where the diffusion coefficient increases with fluid content. A more detailed pulsed NMR investigation of the diffusive behavior of linseed oil in wood will be the topic of a future publication.

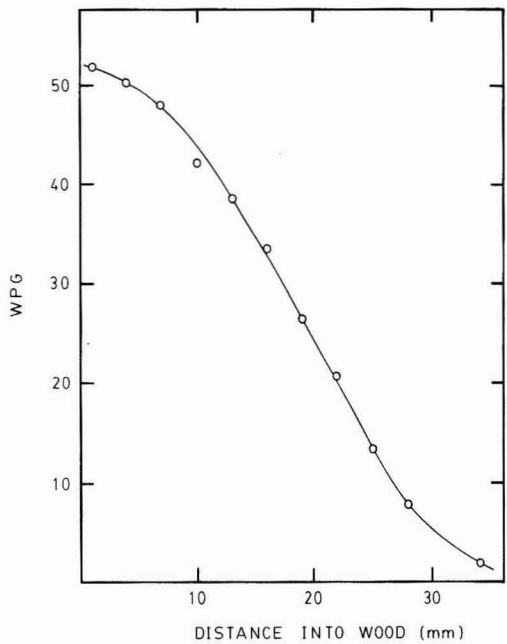

Figure 5—WPG (from NMR) vs distance into trembling aspen wood measured from the across-the-grain surface exposed to linseed oil. The solid line was drawn to aid the eye

CONCLUSIONS

Pulsed NMR techniques for precise determinations of liquid linseed oil contents in wood have been developed. The chief advantages of the relative oil content determination technique are that it is quick, nondestructive, simple to perform and independent of the wood substrate. The approach involving the absolute oil content measurement has similar advantages but depends on the wood substrate. However, it does not require a calibration sample and the receiver gain need be constant only during sample data acquisition. Using this technique, values of WPG were determined to within about ±2%.

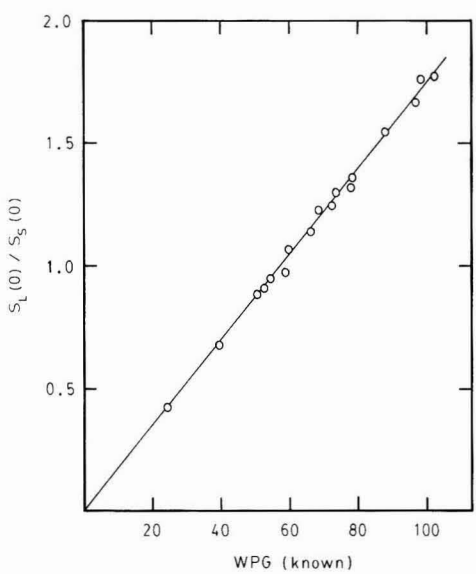

Figure 4—$S_L(0)/S_S(0)$ vs known WPG for trembling aspen-linseed oil samples. The solid line represents a linear least-squares fit to the data using equation (5)

ACKNOWLEDGMENTS

The authors wish to thank F.G. Yeomans and J.L. McBride for assistance with the experiments. This research was supported in part by the Natural Sciences and Engineering Research Council of Canada and by the University of New Brunswick Research Fund.

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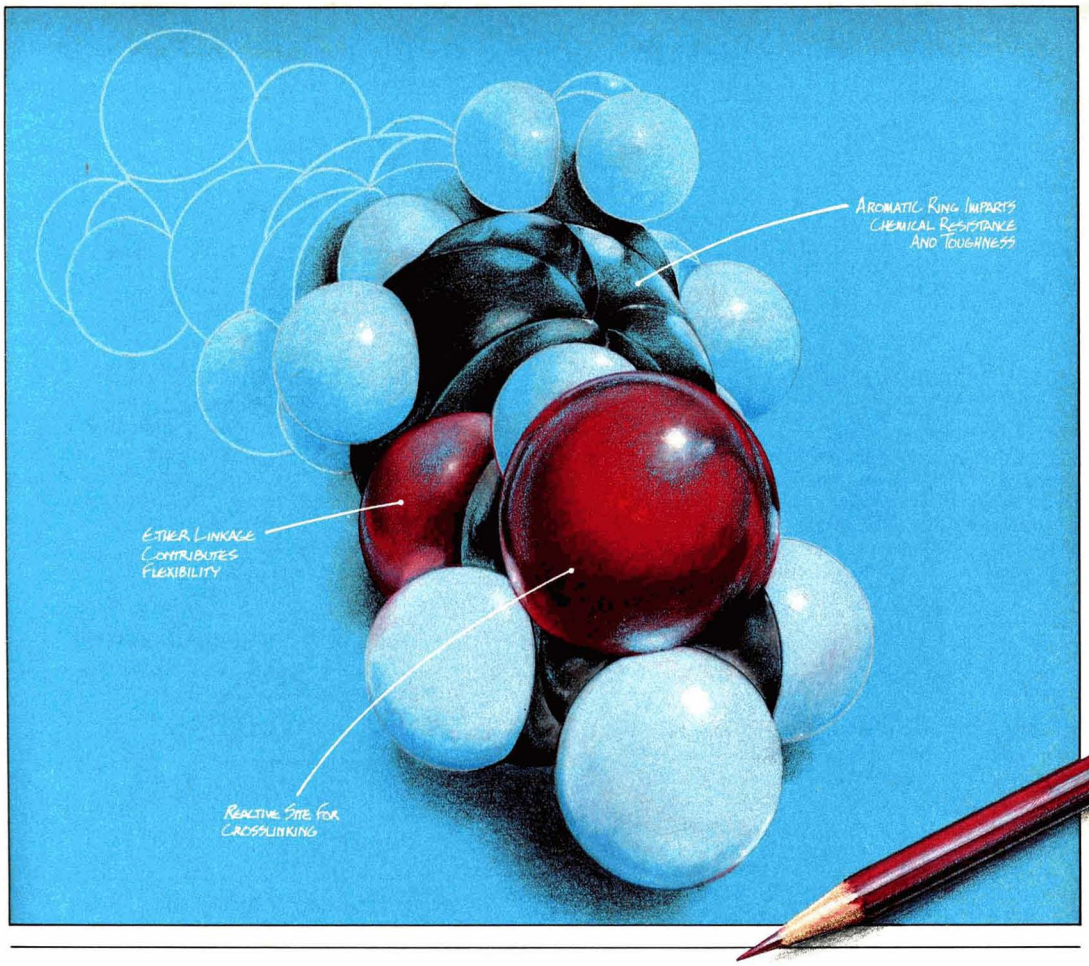

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OPEN FORUM

Computer Formulation Of Colors for Letterpress

M.A. Genshaw, B.F. Phillips, and K.A. Ruggiero
Miles Laboratories, Incorporated*

The purpose of this work was to improve color matching between reagent strips and color charts. Reagent strips are chemically reactive papers which produce a color change on exposure to an appropriate chemical. In order to make a semiquantitative visual (quantitative instrumental measurements may also be done) determination, it is necessary to use a color chart to relate the color of the reagent strip to the concentration of the chemical sensed. In the past, ink formulations have been optimized by the visual, trial and error method. Although the computer colorant formulation method has been standard in the paint and textile industry for many years, its application to printing has been only recent. This manuscript describes our efforts in formulating inks for printing color charts by letterpress.

An initial calibration experiment was conducted to determine the ink thickness required to duplicate printed labels of the color charts. Standard rollouts have been prepared for mixtures of each of 10 colored inks in a white ink base. This data permits the computation of ink mixtures which should match the color of reagent strips.

The calculation methods used are those developed by Allen and involve the use of matrix algebra to compute the color of a mixture of inks. The method of optimization developed by Allen is used to optimize the formulation with an interpolation method recommended by Brockes. The results demonstrate that the method can provide close color matches with a minimum of metamerism.

The standard deviation in color difference units was: 0.4 between samples taken from a single rollout; 1.1 between rollouts; and 0.4 between replicated mixes of the same formulation.

Introduction

COLOR CHARTS FOR REAGENT STRIPS: A major product for our corporation is a series of reactive papers mounted on a plastic base. These reactive papers (reagent strips) are sensitive to a number of different analytes such as pH, albumin, glucose, and hemoglobin. The semiquantitative determination of the analyte concentration is performed by comparing the color of the reagent strip to a color chart. Instrumental measurement of the reflectance permits quantitative determinations to be made. For visual use there are several problems introduced by the need to compare the color of the reagent strip to a printed color chart. These include the need to match colors produced by organic dyes in a wet, fibrous matrix to colors printed with lightfast pigments. The reagent strip may be used under various lighting conditions as found in the home and clinical laboratory. Thus, good spectral matches are necessary to minimize metamerism (changes in the color match when the spectral properties of the lighting are changed). In the past the ink mixtures have been formulated visually. For many years the paint and textile industries have applied computer colorant formulation methods. The application of this technology to printing has been slower to develop and was considered a difficult problem.[1] Here, we present our work on applying computer colorant formulation to letterpress.

QUANTITATIVE MEASUREMENT OF COLOR: The possibility of quantitatively measuring color is not intuitively obvious. Most of us have been taught that all colors can be produced by the combination of three primary colors. Actually, it is necessary to use three polychromatic primaries rather than monochromatic primaries. These primary colors can be defined as a set of spectral weighting functions which are defined for the energy distribution of a particular light source. The weighting functions are a red primary (x), a green primary (y), and a blue primary (z). The primaries have considerable spectral overlap and the red primary, x, contains a substantial contribution in the blue spectral region. These tristimulus weighting functions are used in conjunction with reflectance spectra to calculate numbers which represent the color of a sample. The weighting functions are multiplied by the reflectance spectrum and by the energy distribution of the light source. The resulting functions are integrated over the entire visual spectral region to provide values for each primary color. These integrated values are called tristimulus values, X, Y, and Z, and can be calculated as follows:

$$X = 100*S(1)$$
$$Y = 100*S(2)$$
$$Z = 100*S(3)$$

where S(1), S(2), and S(3) are the first, second, and third elements, respectively, of the vector formed by W*R1/W4 or W*R2/W4 and

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Presented at the "Color and Imaging" Conference of the Inter-Society Color Council and Graphic Arts Technical Foundation, Williamsburg, VA, on February 12–15, 1984.

W = 3×16 matrix (tristimulus factors) (400nm-700nm) for any illuminant
R1 = 16×1 matrix for Reflectance of the color standard
R2 = 16×1 matrix for Reflectance of the calculated formulation
W4 = 3×1 matrix for tristimulus factors @ 100% Reflectance for any illuminant
W*R1/W4 = 3×1 matrix for tristimulus values of the color standard
W*R2/W4 = 3×1 matrix for tristimulus values of the theoretical formulation.

A number of methods of transforming tristimulus data to differences in visually perceived color have been proposed. We use the approach currently recommended by the CIE which is the CIELAB formula.[2] The color difference (ΔE) for a particular light source is calculated as follows:

$$\Delta E = [(L^*-L^*R)^2 + (a^*-a^*R)^2 + (b^*-b^*R)^2]^{1/2} \quad (1)$$

where $L^* = 116*[(Y/YO)^{1/3}] - 16$

$a^* = 500*[(X/XO)^{1/3}-(Y/YO)^{1/3}]$

$b^* = 200*[(Y/YO)^{1/3}-(X/XO)^{1/3}]$

where XO, YO, and ZO = tristimulus values for the perfect white (R = 100% at all wavelengths) and L*R, a*R, and b*R are the L*, a*, b* values for the reference sample.

The tristimulus values or the color coordinate values (L*, a*, b*) provide a numerical representation of the color of the surface. Two surfaces with identical tristimulus values will have identical colors even if the reflectance spectra are different. In practice perfect spectral matches are rarely achieved in color formulation.

Methods and Materials

INKS: Ten inks (Acme Ink Co., Chicago, IL) were used in this study. Standard mixtures of each ink in the white base ink have been prepared. Concentrations of 1, 4, 10, 30, and 100% of the colored inks have been used. The formulations are prepared by weighing the inks on an analytical balance and then mixing them.

ROLLOUT PREPARATION: All rollouts were prepared with the Quickpeek Color Proofing Kit (Thwing-Albert Instrument Co.). The amount of ink used is measured by filling a hole in a metal plate with ink and then pushing the ink out onto the surface of the metal plate by means of a matching rod. The ink is then spread uniformly on the plate with the roller. Except for the initial experiments, each rollout is prepared with two large holes plus one small hole full of ink.

Rollouts were prepared in triplicate on either 60 lb. Kromekote (Champion Paper Co.) or 60 lb. Lusterkote (Warren Paper Co.) paper.

ROLLOUT MEASUREMENT: All measurements have been taken with the integrating sphere version of a Macbeth Series 1500 Color Measurement System. The small area view mode is used with ultraviolet excluded and the specular component included.

FORMULATION CALCULATIONS: Several methods of calculation could be used in calculating ink formulations to match the reagent strips. Perhaps the most obvious is to attempt to match the reflectance spectrum of the reagent strip. However, unless a perfect reflectance match is produced, and this is rarely the case, the reflectance match is not a color match. The best reflectance match is usually not the best color match obtainable from a particular combination of pigments. The reason for this failure to produce a color match is that the calculation weights all spectral regions equally. The eye is much more sensitive to reflectance changes in certain spectral regions where a small change in reflectance may result in a greater change in color than a relatively large reflectance change in a region of low sensitivity. Thus, the method of calculating the best reflectance has not proven satisfactory for computer colorant formulation.

A second method would be to produce a match of the K/S spectrum of the reagent strip. The K/S spectrum is analogous to an absorbance spectrum. This method can readily be accomplished mathematically. However, the eye responds to light and thus is most sensitive to the spectral regions where the pad reflectance is high and K/S is low rather than the low reflectance regions where K/S is large. A K/S optimization will emphasize the fit in the spectral regions of large K/S (low reflectance); the converse of the need.

A color fit is the desired result. The computation of a color fit requires the solution of the series of nonlinear equations given in the previous section. Because of the nonlinearity between chromogen concentration and reflectance and between reflectance and color, this computation is difficult. If there was no simpler alternative, these nonlinear calculations could be made.

Allen [3-6] proposed a computation method which is primarily a fit of the K/S spectrum and thus is a solution of linear equations. However, his approach weights the K/S data by the derivative of the relation between reflectance and K/S. This approach emphasizes the spectral regions where the reflectance is most sensitive to changes in K/S and thus the regions where the color change with K/S is likely to be greatest. This then provides a solution which is both a good reflectance fit and color match. Since this method is primarily a calculation of a K/S match, it does not provide a perfect color match. However, the result indicates which inks are the best choice for producing the final color match.

Calculations have been made using the methods given by Kuehni[5] with some

Figure 1—Color coordinate and color difference versus amount of ink

modifications. The equations have been programmed in BASIC on a Hewlett-Packard HP85 calculator with a matrix ROM option and 32k of RAM memory.

The Allen method is used for determining the initial solution. This method calculates the concentration of three inks from the formula.

$$V = (MEDT)^{-1} MED(F-G) \qquad (2)$$

All of the variables are matrices or vectors. V is the concentration of each of the colored inks. M is the matrix of the color matching functions (x, y, and z). E is the energy distribution of the light source. D is a diagonal matrix of the derivative of the additive function of the standard. T is the specific K/S for each of the colored inks. F is the K/S for the standard and G is the K/S for the substrate (the white ink). For convenience, the product ME is given by Kuehni[5] so this product matrix was used in the calculation.

The equation, in matrix notation, appears quite simple. The actual mathematical operations are very lengthy. For a calculator with a matrix ROM, solving the equation for V is just as simple as the equations indicate. It is just a matter of performing the appropriate operations and requires very few program steps.

This method requires a single value for K/S at each wavelength. This happens to be unsatisfactory for color chart calculations because K/S is not a linear function of concentration. Thus, for the final optimizations we used a method of interpolating the K/S values between concentrations as suggested by Brockes[7] and Stanziola.[8,9]

The calculation procedure is to obtain reflectance spectra of the reagent strip with the Macbeth instrument or a specialized reflectance instrument.[10] All of the experimental data for the rollouts has been taken with the Macbeth instrument. The K/S factors for each ink at the 10% concentration level are used for the calculation of the specific K/S factors for the initial calculations. All combinations of the 10 colored inks taken three at a time are entered in the matrix equation given above and the concentrations providing a color match are calculated. The program analyzes the data to discard formulations requiring significant negative concentrations, concentrations greater than 100% for any component, or formulations with large rms errors in reflectance. The magnitude of these rejection limits is adjustable. Only formulations passing the criteria are printed out. The ink combinations with the lowest rms reflectance errors are then selected by the operator for further optimization. The rms reflectance error is calculated as the square root of the average of the squares of the differences between the reflectance of the reagent strip and the computed formulation.

For the optimization stage another method given by Allen[3,5,6] has been used. The concentration adjustment matrix is calculated from

$$\text{conc. adj.} = (MEDT)^{-1}t \qquad (3)$$

where the t matrix is the matrix calculated from the differences in the tristimulus values for the standard (reagent strip) and the calculated formulation and the other variables are those defined previously. The tristimulus value is the sum over the 16 wavelengths of the product of the reflectance and the color matching function as previously described.

We have modified this routine by simultaneously using an interpolation routine to provide a better estimate of the specific K/S for the inks. This routine calculates the specific K/S value for each ink by linear interpolation between the K/S values of the standard mixtures at the concentrations adjacent to the current value of the ink concentration. This method compensates for the nonlinearity of the dependence of K/S on ink concentrations but does not correct for any interaction between the inks. Experimentally the optimization routine has been observed to fail in some cases with an oscillation of the concentrations from iteration to iteration or a divergence of the concentrations occurring. These failures seem to be related to formulations containing two inks with similar spectral properties and formulations containing a colorant with a very nonlinear relation between the absorption coefficient and concentration as will be shown later.

When rollouts are prepared and measured, the color is not exactly the desired color although more than 90% of initial formulations are reported to be within six color difference units of the desired color (reference 5, page 50). This failure to obtain a perfect match on the first try is due to the lack of consideration of interactions between the inks and the imperfect compensation for the nonlinear dependence of K/S on concentration. The formulation is then adjusted by calculating the ink formulation which matches the experimental rollout reflectance spectrum. The ratio of the calculated to the actual concentrations is then used to adjust the formula for the next trial.

The experimental approach toward formulating a color block then involves the following steps: (1) Obtain a reflectance spectrum for the reacted reagent strip; (2) Run the routine to screen the inks for the most appropriate combinations; (3) Select several formulations with the lowest rms error for further optimization with the Allen method; (4) Select the formulation with the lowest metamerism (lowest color difference for all illuminants); (5) Prepare the formulation and make and measure the rollouts; (6) Calculate the correction to the formulation required to provide a perfect color match and repeat steps (5) and (6).

Results and Discussion

SELECTION OF THE INK THICKNESS: Several printed labels were obtained

Figure 2—Dependence of K/S on concentration for red ink

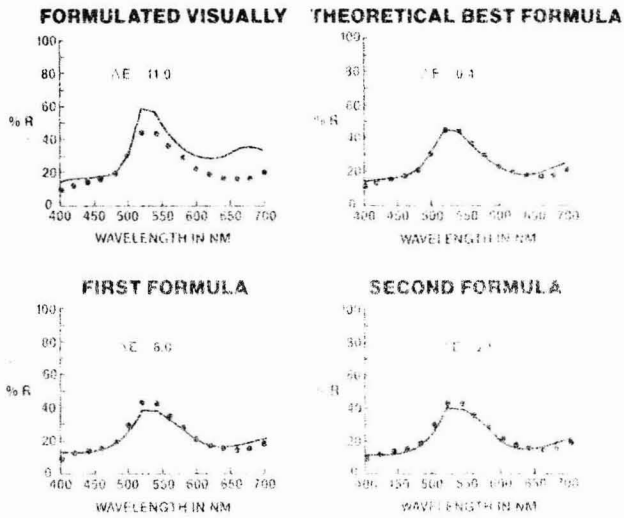

Figure 3—Comparison of visually and computer formulated rollouts with the reagent strip spectrum

along with a container of the ink formulation actually used in printing the moderate level color block for an occult blood reagent. Rollouts were prepared in triplicate with various amounts of ink. A plot of the color coordinates and color differences versus ink thickness is shown in *Figure* 1. The optimum ink thickness was that produced by two large holes plus one small hole full of ink. This amount of ink was then used in all subsequent work.

STANDARD ROLLOUTS: Reflectance of the standard formulations of all of the inks were obtained for 0 (the white base ink), 1, 4, 10, 30, and 100% of each of the inks.

Each of the inks was distinctly different from all of the other inks. The plots of K/S versus concentration are distinctly nonlinear. One ink was particularly nonlinear as shown in *Figure* 2. The plot for 560 nm exhibits a maximum with a decrease of K/S for concentrations greater than 10%. A similar result is evident in the data published by Davidson for iron oxide red.[11] The interpolation method is essential to calculate the specific K/S value for this ink at 560 nm.

TESTS OF COLOR FORMULATION:

Occult Blood—Calculation of the formulation required to match the rollouts gave ink concentrations between 91 and 107% of the concentrations actually used for printing the labels. The rms color difference (rms color difference average for illuminants C, D65, A, and F) between the rollouts and the color predicted for the formula was 1.9 color difference units. This is a very good prediction since anything 2-4 color difference units is considered typical for an initial match.[5]

Blood Glucose—Data for the visually formulated rollout and the theoretically calculated best fit are shown in *Figure* 3. One may note that the overall shapes are similar but also that the computer calculated ink combination provides a better shaped fit in the high wavelength region and does not have the maximum at 680 nm as does the visually formulated rollout. The color difference of eleven units is also rather large.

A formulation to match the color of a 70 mg/dL reagent strip was computed and prepared. The first effort (*Figure* 3) produced rollouts 6.0 color difference units from the target color. The reformulation provided a color difference of 2.5 units which was better but still not as good as desired. The shape of this

Figure 4—Comparison of color coordinates for a reagent strip and experimental rollouts

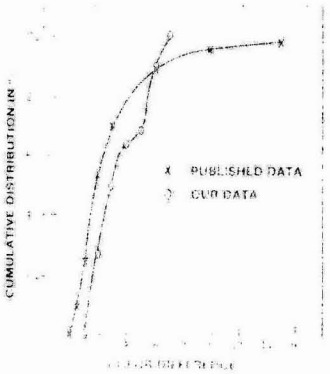

Figure 5—Cumulative distribution for initial formulations

spectrum is a good approximation to the reagent strip spectrum and to the spectrum of the calculated best fit.

Urine Glucose—The production of an experimental color chart by this method is illustrated in *Figure* 4. The reagent strip colors at the various analyte concentrations are indicated by X. The O's and dots show the experimental rollouts for the first and second iterations, respectively.

Accuracy of Initial Formulations—Although only 22 colors have been formulated thus far, the results have been quite encouraging. In *Figure* 5 the total percentage of initial formulations with less than a certain color difference is plotted as a function of the color difference for our results and those of K. Hoffman (as cited by Kuehni). Although an analytical comparison is risky due to the small number of samples in our work and the use of different color difference formulae, the method described here does clearly produce respectable initial formulations.

The standard deviation in color difference units was 0.4 between samples taken from a single rollout, 1.1 between rollouts, and 0.4 between replicated mixes of the same formulation.

Conclusions

The data presented here shows that the use of computer colorant formulation works well for the preparation of rollouts for matching reagent strip colors.

Acknowledgment

We acknowledge the cooperation of C. Hillman and B. Wilson of Mossberg & Company, Inc. of South Bend, Indiana in doing this work.

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5/83

Society Meetings

BALTIMORE ..... MAY

"Solvent Reclamation and Recycling"

The following officers were elected for the 1984-85 year: President Robert Hopkins, of SCM Pigments; President-Elect – Frank Gerhardt, of Bruning Paint Co.; Secretary Harry Poth, of Bruning Paint Co.; Treasurer Ted Grumbine, Jr., of Lenmar, Inc.; Society Representative James A. McCormick, of Inland Leidy.

Society President Joe Giusto announced that Hampton Paint Co. was the recipient of "National Prime Contractor of the Year" by the U.S. Small Business Administration. Congratulations were extended to Society member, Colin Penny, President of the firm.

The Manufacturing Committee's presentation, entitled "SOLVENT RECLAMATION AND RECYCLING," was addressed by several speakers.

Michael Schmutzer, of Disti, Inc.; Robert White, of Delaware Container Corp.; and Jim Mislak, of Lenmar, Inc., spoke on the pros and cons of various types of solvent recovery and disposal. Members of the panel stated that the most economical method is the reclamation of solvents in-house by distillation.

FRANK GERHARDT, *Secretary*

BIRMINGHAM ..... APR.

"Saturated Polyester Developments"

Distinguished Service Awards were presented to Bob Howse, Sid Harris, and Grahame Fowkes.

Contributions of Mr. Howse include his years of service as a member of the Executive, Technical, Program, Publicity, and Membership Committees, as well as Society Secretary. He acted as Society President in 1951 and 1966.

President of the Society in 1964, Mr. Harris served as Secretary in 1971. He was also a member of the Executive Committee.

Mr. Fowkes served on the Program and Publicity Committees from 1974-83. His contributions to the Society include serving as Secretary from 1978-83.

Barry Langdon, of Dynamit Nobel, presented a paper by Dr. Schmitthenner, entitled, "SATURATED POLYESTER DEVELOPMENTS FOR THE INDUSTRIAL PAINT INDUSTRY."

Mr. Langdon detailed the areas of application of saturated polyester primers, including automotive, particularly as the base coat in metallic systems, can coating, and industrial. He divided the functions into three areas: corrosion and weather resistance, hiding and bend adhesion, and hiding and formability.

DON H. CLEMENT, *Secretary*

CLEVELAND ..... MAY

Past-Presidents' Night

Eighteen Past-Presidents in attendance were recognized for their contributions to the Society: Carl Knauss, Jack S. Malaga, Paul J. Houck, Charles K. Beck, Helen Skowronska, Fred G. Schwab, Thomas H. Keene, Donald H. Fordyce, Victor G. Sandorf, Kenneth C. Waldo, Jr., W.J. Bair, R.S. Taub, Fred H. Hollenberg, George Selden, Michael W. Malaga, Sam Huey, G.H. Mutersbaugh, and Edward Schulte.

The Education Committee presented $100 awards to Edna Chmielarski (grade 8) and Becky Gwidos (grade 7) for their participation in the 1984 Greater Cleveland Science Fair.

Officers elected to serve during the 1984-85 year are: President – Robert D. Thomas, of PPG Industries, Inc.; President-Elect Scott E. Rickert, of Case Western Reserve University; Secretary – Madelyn Harding, of Sherwin-Williams Co.; Treasurer George Sajner, of Man-Gil Chemical Paint Group; and Assistant Treasurer – Richard Eley, of Glidden Coatings & Resins Div., SCM Corp.

The Dr. Frank Selden Award was presented to Charles K. Beck, of Premier Industrial Corp., in recognition of his outstanding service to the Society.

A Special Merit Award was presented to Tex Reed, of Sheffield Bronze Paint Co., for his handling of the duties of Publicity Chairman and his participation in Society activities.

SCOTT E. RICKERT, *Secretary*

GOLDEN GATE ..... APR.

"Dispersion of Titanium Dioxide"

Vagn Pedersen, of Tioxide Chemicals, Inc., spoke on "DISPERSION OF TITANIUM DIOXIDE."

Among the topics discussed by Mr. Pedersen were millbase formulation by flow point curve technique, dispersion in different mills, proper high speed dispersion mill geometry and millbase stabilization. He also described flocculation and its measurement by various mills, its effect on opacity and the effect of UV exposure on dispersed and flocculated systems. Mr. Pedersen emphasized the importance of optimizing the dispersion process.

SANDRA J. LUND, *Secretary*

HOUSTON ..... MAY

"Computer Control for the Modern Paint Plant"

Elected to office for the year 1984-85 were: President – Richard D. Batchelor, of Valspar Corp.; Vice-President – Arthur R. McDermott, of Nalco Chemical Co.; Secretary – Rudolf F. Buri, of Champion Coatings, Inc.; and Treasurer David H. Satzger, of The O'Brien Corp. Willy C.P. Busch will continue to serve in the position of Society Representative.

Following the election, the Nuodex Corp. Gavel was presented to incoming president, Richard Batchelor.

John Pennington, Chairman of the Southwestern Paint Convention, reported that the convention, held in conjunction with the Dallas Society, was successful and the quality of the technical program was excellent.

James T. DeGroff, of Applied Color Systems, Inc., spoke on "COMPUTER CONTROL FOR THE MODERN PAINT PLANT."

Mr. DeGroff described his company's efforts to merge the functions of the paint plant laboratory, office, and production facilities with computers. He pointed out that the first successful efforts involved color processing, but that these computer programs required little data manipulation.

According to Mr. DeGroff, few paint plants have integrated computer systems. He explained that by networking, it is possible to create scientific data in the lab and to integrate this data with the business computer for office and plant considerations.

ARTHUR R. MCDERMOTT, *Secretary*

NEW ENGLAND SOCIETY'S Educational Committee sponsored a student paper competition recently. Awards were presented at the March meeting of the Society. First Prize ($300) was given to Robert Mallory for "Comparison of the Fluidized Bed and Electrostatic Fluidized Bed Powder Coating Process"; Second Prize ($150) was for Donna Graves' "Conductive Paints for EMI Shielding—A Promising Market for Coatings." Both are students at the University of Lowell (Mass.).

Shown (left to right) are: Keith Mulkern, Educational Committee Chairman; Dr. Rudolph Deanin, University of Lowell; Maureen Lein, Society Secretary; Donna Graves; and Paul Mueller, Society President.

PIEDMONT ..... MAY

"Inerting for Safety in Coatings Plants"

The topic, "INERTING FOR SAFETY IN COATINGS PLANTS," was presented by Kevin Donahue, of Neutronics, Inc.

Using slides to illustrate, Mr. Donahue presented statistics regarding the reasons for, and results of, flash fire occurrence. He proposed a solution in terms of process control technology.

According to Mr. Donahue, the main hazard in paints and coatings plants revolves around flammable liquids, handling, and storage. When combustible liquids are mixed or dispensed, flammable vapors may be released. These are a source of fuel, resulting in a potential source of ignition.

While there are several accepted techniques for controlling static electricity, "inerting" is one of the safest and most reliable for flash fire and explosion prevention, he said. The process described by Mr. Donahue is one in which oxygen content in a vessel or other contained system is decreased to a level at which combustion cannot take place. In the "automatic inert gas control system," oxygen measurement is combined with inert gas controls system which reduces the potential for human error. It can be made a part of the manufacturing process because it can be integrated into other process control functions, he continued.

Mr. Donahue stated that several companies have made significant contributions to the development and design of the system. The essential components are inert gas supply, oxygen analyzer, a sampler, and an inert gas feed valve. Mr. Donahue stressed the importance of sampling techniques in getting the accuracy of the vessel atmosphere. Representative percentages of oxygen concentration for maintaining the balance with inert gas were shown.

Mr. Donahue then discussed environmental constraints in positioning the system, as well as maintenance importance. Regardless of the operating cost, the analyzer based system is the most efficient use of inert gas, he concluded. Production requirements of this system need careful study to determine design as well as expandability.

SARA ROBINSON, *Secretary*

PITTSBURGH ..... MAY

"Titanium Dioxide"

Officers elected to serve for the 1984-85 year are: President– Clifford Schoff, of PPG Industries, Inc.; President-Elect Joseph Mascia, of Campbell Chemical Co.; Secretary– Anthony J. Isacco, Jr., of Puritan Paint & Oil Co.; Treasurer Raymond Stewart, of PPG Industries, Inc.; and Society Representative Ed Vandevort, of PPG Industries, Inc.

The Education Committee reported that schools in the Pittsburgh area have been contacted regarding the Society's newly organized speaker service.

Richard Ensminger, of NL Industries, Inc., spoke on "TITANIUM DIOXIDE – WHY SO MANY GRADES?"

To introduce his presentation, Mr. Ensminger explained that there are many grades of TiO_2 aimed at the coatings market, and he attributed this to an increase in the market share of TiO_2 sold. He said that the differences in the types of TiO_2 are with surface treatment.

He described the two processes involved with producing TiO_2: with the sulfate process, titanium ore is treated with sulfuric acid; with the chloride process, the ore is treated with chlorine. Even though the processes of production differ markedly, pigments from both processes are widely used today.

Mr. Ensminger continued by stating that the inorganic treatment of the TiO_2 with alumina and silica is what controls how the pigment will ultimately perform. There can be a wide range of combinations of aluminum and silica, he said. In addition, the order of addition, and the pH and temperature of the solution can affect the surface treatment and change the ultimate pigment's reactivity.

In the treatment process, as described by Mr. Ensminger, the TiO_2 is first slurried in a raw form in water, so that it will accept the various reagents used on it. Aluminum sulfate and sodium silicate are the two reagents he mentioned. Since by-products can be formed from these reagents, the pigment has to be washed to some degree to remove these impurities. Following this, the drying of the pigment takes place, he explained.

Mr. Ensminger said that in various tests conducted in his company's labs, an attempt is made to vary the pretreatment, so that the type of coatings that is being applied to the TiO_2 particle can be controlled. The result is either a hard or a sponge-like coating, and this difference can affect the particle's performance, he said. He discussed some organic treatments of TiO_2 pigments which are used to help disperse the TiO_2 more easily.

Mr. Ensminger concluded, however, that there are no remarkable new improvements being announced by the TiO_2 producers at this time.

Q. Are the untreated grades of TiO_2 being offered today completely 100% untreated, with no contaminants?

A. The purest grade of TiO_2 on the market today is 99.9% pure, and it is aimed solely for the ceramic market where that type of purity is required. 98.5% is the finest grade I know of being used in the coatings field today.

JOSEPH L. MASCIA, *Secretary*

Elections

BALTIMORE

Active

KUMINS, CHAS A.—Consulting Services, Easton, MD.

Associate

ELLWOOD, DAVID A.—Union Carbide Corp., Moorestown, NJ.
GALLI, CLARENCE—Hercules Incorporated, Wilmington, DE.
HARRIS, CHIP—Dow Corning Corp., Parsippany, NJ.
KOWALSKI, EDWARD B.—SCM Pigments, Hedgesville, WV.

DETROIT

Active

BALATAN, SERGIO E.—Inmont Corporation, Detroit, MI.
BARBER, HARRY—Durako Paint & Color Corp., Detroit.
DERBIN, GEORGE M.—Seibert Oxidermo, Inc., Romulus, MI.
DZIEKEN, DENNIS J.—Inmont Corporation, Southfield, MI.
EVENER, VAN S.—Seibert Oxidermo, Inc., Detroit.
GARY, JOSEPH—Titan Finishes Corp., Detroit.
HENRY, ROBERT L.—Valspar Corp., Warren, MI.
KELLY, PHILIP—Titan Finishes Corp., Detroit.
KORDOSH, JOHN—Inmont Corporation, Detroit.
MAYNOR, DURAND—Inmont Corporation, Detroit.
MORRIS, NANCY J.—Dow Chemical USA, Midland, MI.
PATEL, RAMAN—Standard Detroit Paint Co., Detroit.
PATON, ROBERT W.—Advanced Coatings & Chemical Co., Hillsdale, MI.
PETERS, DAVID C.—Toledo Paint & Chemical Co., Toledo, OH.
SCHMONDIUK, JOSEPH—Titan Finishes Corp., Detroit.
SHAEKALIS, MARY—Glasurit America, Inc., Sterling Heights, MI.
SHELTON, DARRELL E.—Titan Finishes Corp., Detroit.

Associate

GRAY, ROBERT—Epworth Manufacturing Co., Inc., South Haven, MI.
LAURIE, JAMES A.—Union Chemical Div., St. Clair Shores, MI.
WINTERS, ARMIN A.—Nuodex Inc., Chicago, IL.

HOUSTON

Active

RADEBAUGH, BRUCE A.—Champion Coatings, Inc., Houston, TX.

Associate

STRONG, KENT—Angus Chemical, Houston, TX.

Retired

JOHN DEBOER—Houston, TX.

LOS ANGELES

Active

ANGENENT, CONRAD H.—Whittaker Corp., Colton, CA.
BOYLES, L.J.—Engravers Ink Co., Brea, CA.
BRUNER, ROBERT J.—Purex Industries, Carson, CA.
COMBS, WAYNE E.—Pratt & Lambert, Inc., Orange, CA.
DE LA FUENTE, EDUARDO—Guardsman Chemicals, Southgate, CA.
ESCOVITZ, MYRON—Sinclair Paint Co., Los Angeles, CA.
GAIUS, LUZVIMINDA A.—Charlton Associates, El Toro, CA.
HOHL, RONALD J.—Pratt & Lambert, Inc., Orange.
LAIRD, EDWIN C.—Chemical Resource Corp., Whittier, CA.
MCNAUGHTON, MICHAEL—Pacific Dispersions Co., Inc., Cudahy, CA.
MIRA, ROLINDA S.—Day-Glo Color Corp., South El Monte, CA.
MITRA, ARUP R.—Trail Chemical Corp., El Monte, CA.
NOLL, CARL—Whittaker Corp., Colton.
PACE, PARKER—Behr Process Corp., Santa Ana, CA.
PARIGIAN, MICHAEL—Pacific Dispersions Co., Inc., Cudahy.
RAY, FRANK A.—Buena Park, CA.
RITTER, JIM A.—Charlton Associates, Mission Viejo, CA.
SHAH, BHUPENDRA M.—Koppers Co., Inc., Commerce, CA.
WILLIAMS, MORRIS E.—Northrop Electronics, Playa Del Rey, CA.

Associate

CZERWINSKI, JOSEPH—Buckman Laboratories, Santa Ana, CA.

NEW YORK

Active

GOVINDARAJU, JAGANNATH—Eutectic Corporation, Flushing, NY.
HERRERAS, ARMAND—The Problem Solvers, Staten Island, NY.

PHILADELPHIA

Active

HARVEY, WILLIAM A. III—M.A. Bruder & Sons Inc., Philadelphia, PA.
MCNAMEE, WILLIAM H.—Inolex Chemical Co., Philadelphia.

Associate

D'ANDREA, VINCENT J.—E.M. Sullivan Associates, Inc., Springfield, PA.
MCNIFF, JOSEPH P.—McWhorter, Inc., Cherry Hill, NJ.
NOWAKOWSKI, THOMAS E.—United Color Tech. Inc., Newtown, PA.
REYNOLDS, JOHN J. III—Callahan Chemical Co., Palmyra, NJ.

FSCT Membership Anniversaries

25-Year Members

Los Angeles

Carl A. Blaze, Retired
Kenneth N. Edwards, Kenneth N. Edwards Enterprises.
Robert W. Emlich, John K. Bice Co., Inc.
Martin J. Fischer, Certified Coatings Products Co.
Roy Fredericks, Retired.
Robert W. Jepson, United Technologies-Inmont.
Cyrus G. Leeper, Cyron Coatings.
Richard Oppenheim, Spraylat Corporation.
R.F. Stancl, DeSoto, Inc.
John L. Zywocienski, Sinclair Paint Company.

Philadelphia

Curtis H. Clement, Jr.—Clement "Coverall" Co.
C. Gabrill—American Inks & Coatings Corp.
An-Hwa Liu—M.A. Bruder & Sons Inc.
Walter Trbovic—Color Set Corp.
Joseph A. Vasta—E.I. du Pont de Nemours & Co., Inc.

PITTSBURGH

Active

MARCI, RICHARD—Royston Laboratories, Blawnox, PA.
SMITH, RONALD E.—PPG Industries, Inc., Allison Park, PA.
TERSILLO, MICHAEL—PPG Industries, Inc., Allison Park.

Associate

GRUBBS, DONALD C.—Neville Chemical Co., Pittsburgh, PA.
REICHARD, MARK E.—Maroon Chemical Inc., Lakewood, OH.
RUST, RICHARD S.—Neville Chemical Co., Pittsburgh.
WOLF, LINDA LEE—Wolf Container & Chem. Co., Sewickley, PA.

SOUTHERN

Active

CORCORAN, DAVID J.—Global Alliance Labs, Ft. Lauderdale, FL.
GRISSOM, EDWIN—Masonite Corp., Laurel, MS.
LANE, THOMAS A.—Micor Coatings Inc., St. Petersburg, FL.
LEGGETT, RICHARD L.—Masonite Corp., Laurel.
ROSEN, MURRAY—Micor Coatings Inc., St. Petersburg.

Associate

HILLMAN, PATRICK E.—PPG Industries, Inc., Charlotte, NC.

ST. LOUIS

Active

BRAUN, KEVIN Rockford Coatings Corp., Imperial, MO.
GRUBBS, CHARLES L. U.S. Paint Div., St. Louis, MO.
LOTT, JOSEPH C. Clayton Corp., St. Louis.

Associate

NIEHAUS, JOHN J. Reichhold Chemicals Inc., St. Louis, MO.
WOROBIEC, MIKE BASF Wyandotte Corporation, St. Louis, MO.

TORONTO

Active

BRERETON, A.D. Fineline Auto Products, London, Ont., Can.
CORLESS, JOANNE Sterling Ltd., St. Catharines, Ont., Can.
EPPENBERGER, MAX R. Color Your World, Inc., Orangeville, Ont., Can.
HAMMA, RALPH G.P. Dutch Coating System, Scarborough, Ont., Can.
HERNANDO, EDUARDO P. Tremco (Canada) Ltd., Mississauga, Ont., Can.
HOUSE, ANDREW J. duPont Canada Inc., Ajax, Ont., Can.
LOYVET, ANDRE Reichhold Limited, Weston, Ont., Can.
PETTING, KEVIN E. Lepage's Limited, Bramalea, Ont., Can.
PEREPAS, JOSEPH M. Tremco (Canada) Ltd., Toronto, Ont., Can.
RICKARD, CHRIS Bate Chemical Co., Ltd., Don Mills, Ont., Can.
SHAH, ROHIT Zochem Ltd., Brampton, Ont., Can.
ZYMIAK, BARBARA Sico Paints Inc., Rexdale, Ont., Can.

Associate

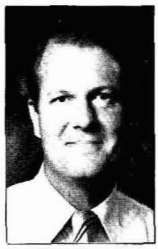
BASSETT, JERRY Hercules Canada Ltd., Mississauga, Ont., Can.
BRIDGES, BRUCE R. Hall-Chem International, Concord, Ont., Can.
BYRD, HARRY ESSO Chemical Canada, Toronto, Ont., Can.
CARTER, GLENN Debro Inc., Brampton, Ont., Can.
DRAGASEVICH, JOHN GAF (Canada) Ltd., Mississauga.
GAUDET, RAYMOND G. Celanese Canada Inc., Mississauga.
LAING, MICHAEL L. Industrial Colours and Chemicals, Brampton.
MCMARTIN, BILL Continental Can Co. of Canada Ltd., Toronto.
PATERSON, R.G. A.S. Paterson Co., Ltd., Willowdale, Ont., Can.
READ, D.W. American Can Canada, Rexdale, Ont., Can.
RODRIGUES, PAUL Union Carbide Corp., Downsview, Ont., Can.
STOCK, J. Hercules Canada Ltd., Mississauga.

People


J.C. Leslie


C. Maroudas


G. Swanson


K.K. Hesler

The Federation of Societies for Coatings Technology is pleased to announce that **J.C. Leslie** was elected to Federation Honorary Membership by the Board of Directors at its Spring Meeting, held May 18 in Louisville.

Mr. Leslie, who retired from the industry as Vice-President of Tnemec Co., Inc., in Kansas City, is a Past-President of the Federation (1974-75) and the Kansas City Society, as well as the Kansas City Paint and Coatings Association. He served for four years as the Society's Representative to the Federation Board, and chaired the FSCT Corrosion Committee from 1968-72.

Mr. Leslie began his career in the paint industry in 1940, working for Farmland Industries and Cook Paint & Varnish Co. before joining Tnemec Co., Inc. in 1957.

Kenneth R. Martinez has joined Paramount Paint & Lacquer Co., a division of Surface Protection Industries, Inc., Los Angeles, CA, as Vice-President of Sales. Also joining Paramount is **Robert T. Maves** as Sales Representative for Los Angeles and Orange County. Both Mr. Martinez and Mr. Maves will be based at the East Los Angeles headquarters.

Finnaren & Haley, Inc. has appointed **Carl O. Johnson, Jr.** to Vice-President of Trade Sales and Division Manager.

At the May meeting of the Los Angeles Society, **Albert M. Aronow** and **Clyde L. Smith** were voted to Society Honorary Membership.

Mr. Aronow, retired from Sinclair Paint in 1983, was Society President in 1964-65, and was a major spokesperson for the industry at the Environmental Task Force public hearings. Mr. Smith, who retired this year as Chairman of the Grow Chemical Group, was Society President in 1946-47 and President of the Southern California PCA in 1965-66. He became a 50-year Member of the Society in 1983.

Also honored by the Society was Past-President **Donald I. Jordan,** of Cargill, Inc., who was presented with the Outstanding Service Award for his many years of involvement in Society committees and activities.

Dr. Christos Maroudas has been appointed Technical Manager for R&D of Vernichem Varnishes Co., of Greece. Dr. Maroudas, an Affiliate Member, was recently a consultant headquartered in Piraeus, Greece.

Glen Swanson has been appointed Vice President of H.B. Fuller Co., St. Paul, MN. Mr. Swanson has served as Division Manager of the Industrial Coatings Div. since 1980. He is on the Board of Directors of the Powder Coatings Institute and is a member of the Northwestern Society.

Dr. Robert A. Burns has been named Senior Vice-President of Sales and Marketing for ECC America, Inc., Atlanta, GA. Dr. Burns will be responsible for the worldwide sales and marketing of ECC America and its subsidiaries, Anglo-American Clays Corp. and Southern Clay Products.

Judy Hittman has joined National Paint & Coatings Association as Promotions Manager within the Public Relations Div. She replaces **Bonnie Benhayon**, who has joined one of NPCA's member companies, in overseeing the Picture It Painted campaign.

James E. Grannen was named President and Chief Operating Officer of Buckman Laboratories, Inc., Memphis, TN. **Robert H. Buckman** will continue as Chairman of the Board of Directors and Chief Executive Officer. **Dr. C.K. Cloninger,** formerly General Manager of Buckman Laboratorios Ltda, Campinas, Brazil, was elected Vice-President—Strategic Planning.

DeSoto, Inc., Chicago, IL, honored **Kazys Sekmakas**—Staff Scientist; **Raj Shah**– Research Associate; **Kenneth Hesler**—Research Associate and **John Lofstrom**—Research Chemist, with the DeSoto Researcher of the Year Award.

Kazys Sekmakas and Raj Shah were chosen for their research efforts in polymer synthesis. Kenneth Hesler and John Lofstrom were awarded for their work in the use of experimental design with statistics to produce protective coatings. Mr. Sekmakas and Mr. Hesler are members of the Chicago Society.

Ken G.W. Smith, of DuPont Canada, Inc., was re-elected Chief Executive Officer of the Canadian Paint and Coatings Association, 1984-85. In an organizational change, his title of President will become Chairman of the Board. The Chief Staff Officer, **Richard Murry**, will become President. **A.D. Roos,** of the Glidden Co. Ltd., was re-elected as the second executive officer with the title, Vice-Chairman of the Board. Mr. Murry announced that **Michael E. Cloghhesy** has joined the staff of CPCA as Director of Technical Services.

Bonnie Bender, Trade Paints Color Marketing Manager for the Coatings & Resins Group of PPG Industries, Inc., Pittsburgh, PA, has retired after 12 years of service. Ms. Bender was responsible for color counseling and forecasting decorating trends.

Glidden Coatings & Resins, Division of SCM Corp., Cleveland, OH, has appointed **Peter McConnell** as Marketing Manager of international business. Mr. McConnell is responsible for export sales and licensing activities overseas. He succeeds **Howard Shelley** who retired after 35 years with the company.

John W. Nee, Executive Vice-President of Briner Paint Manufacturing Co., Corpus Christi, TX, recently retired. Mr. Nee is a member of the Houston Society.

Michael Goldberg has been named Plant Manager of the McCloskey Varnish Co., Philadelphia, PA.

McCloskey Varnish Co., Industrial Div., has named **William H. Ferry** as Technical Sales Representative. Prior to joining McCloskey, Mr. Ferry was Technical Representative for Sherwin-Williams Co.

James D. Waters has been named a Sales/Service Engineer for metal coatings, Coatings Div., Ferro Corp. He will be responsible for the sales and technical service of metal coatings in the Northeastern district.

Joining the Coatings Div. as the Architectural Market Manager for VEDOC® powder coatings is **James V. Parish.** Mr. Parish is a member of the Cleveland Society.

The D & L Paint Company, Liberty, IN announced the appointments of **Ray Podlewski** and **Tim McDonough** to Vice-Presidents. Mr. Podlewski, now Executive Vice-President, will be responsible for research and development. Mr. McDonough will be responsible for manufacturing. Mr. Podlewski is a member of the C-D-I-C Society.

Pratt & Lambert, Inc., Buffalo, NY, has promoted **Alvin J. Waite** to Senior Research Scientist in its Paint Division Laboratory. Mr. Waite previously was Group Leader Latex section. He will continue to direct the activities of that group and additionally will be responsible for long-range research planning for the Paint Division Laboratories. He is a member of the Western New York Society.

Boehle Chemicals, Inc., Southfield, MI has appointed **Nicholas J. Cherasaro, Jr.** as Sales Representative in Michigan and northwestern Ohio.

Dr. Leonard M. Baker was appointed Director of Corporate Technology for Union Carbide Corp., Danbury, CT. Dr. Baker will succeed **Dr. Samuel W. Tinsley,** who will retire at the end of 1984.

Kerr-McGee Corp., Oklahoma City, OK, has announced the following appointments. **C.A. Blake** has been named Regional Sales Manager for the Pigments Division of the central/western region, headquartered in W. Chicago, IL. **Melvin L. Penn,** a member of the Southern Society, has been named Sales Manager for the Southern region, based in Tucker, GA. **John R. Dawson,** formerly regional Sales Manager, is now Director of Technology Licensing and is located in Oklahoma City, OK. Mr. Dawson is a member of the Southern Society.

Seibert Oxidermo, Detroit, MI, has promoted **Stephen C. Hurst** to Administrative Vice-President and has appointed **George M. Derbin** to Technical Director. Mr. Derbin, formerly of Moline Paint Mfg. Co., is a member of the Chicago Society.

Douglas W. Huemme has been named Executive in charge of Whittaker Corp.'s Chemicals Group, Los Angeles, CA. He succeeds **Gregory T. Parkos,** who has been named Executive Vice-President. Mr. Huemme is a member of the Los Angeles Society.

Shell Chemical Co., Houston, TX, has appointed **Victor F. Figurelli** as Manager quality improvement, a newly created position in its polymers and catalysts division.

Thomas F. McCall has been named Director of Chemical Research and Development Worldwide for The Goodyear Tire & Rubber Co., Akron, OH. Mr. McCall succeeds **Dennis E. Dick** who was promoted to Vice-President of General Products Research & Development Worldwide.

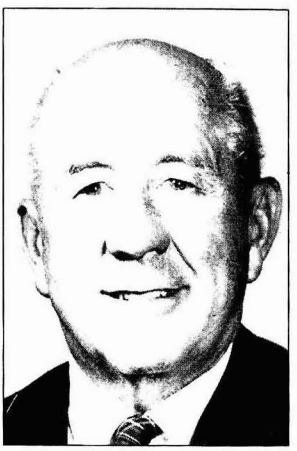
Obituary

Glenn L. Knott, Jr., 61, died on May 20.

Mr. Knott represented Mooney Chemicals, Inc., for 21 years and was a retired member of the Western New York Society.

Dr. J.S. (Shorty) Long, Researcher/Educator, Dies at 91

Dr. James Scott (Shorty) Long, leading coatings scientist and avid educator, died in Clearwater, FL, June 3, at the age of 91 years.



Dr. Long received the Ch.E. and M.S. Degrees at Lehigh University in 1914 and 1915, respectively. He did some graduate work at Columbia University and earned his Ph.D. Degree at Johns Hopkins University in 1922.

Dr. Long rose through the teaching ranks in the Chemistry Department at Lehigh, being successively Assistant, Instructor, Assistant Professor, Associate Professor, and Professor of Chemistry. Practically from graduation he served as chemist and consultant for the Chester Enameling Co. in the manufacture of patent leather and carried on extensive researches leading to the production of patent leather with a minimum tendency to crack.

In 1927, he organized a cooperative research agreement between Lehigh University and Archer-Daniels-Midland Co., William O. Goodrich Co., the Raybestos-Manhattan Co., the New Jersey Zinc Co., the Armstrong Cork Co., and Columbus Union Oil Cloth Co. These companies contributed to a common research fund of which Dr. Long served as the Research Director. Under his direction work was carried out attempting to extend the frontiers of knowledge of oil chemistry and its allied fields of usefulness through the acquisition of the fundamental principles and data on drying oils and the changes they undergo. The work resulted in a number of patents taken out by the companies concerned and in 20 primary scientific papers.

In 1934, Dr. Long left Lehigh to join Devoe & Raynolds Co., Inc., Louisville, KY, as Chemical Director. At Devoe, he, and the men under his direction, were responsible for the development of: (1) the two-coat system; (2) the Dowtherm solvent process for manufacture of vehicles; (3) the one-coat house paint; and (4) epoxy resins. In 1955, Dr. Long retired from Devoe to assume duties at the University of Louisville where he had been a special lecturer for 20 years and where he had been appointed "Distinguished Professor" in 1954.

In 1949, Dr. Long represented the Federation, and presented papers at the Rothesay meeting of the Oil and Colour Chemists' Association and at the meeting in Switzerland of the Federation of Technicians in the Paint, Varnish, and Printing Ink Industries of Continental Europe (FATIPEC). In 1953, he was the recipient of the Federation's George Baugh Heckel Award. The next year, he was selected to give the Annual Joseph J. Mattiello Memorial Lecture at the Federation's Annual Meeting.

When the Federation's Paint Research Institute was founded in 1956, Dr. Long was appointed Executive Director, serving in that capacity until he was succeeded by Dr. Raymond Myers in 1962. In the early seventies, Drs. Long and Myers collaborated for the publication of a multi-volume "Treatise on Coatings."

Among the many honors bestowed upon Dr. Long are the following: Voted one of the ten top scientists in the field of paint, varnish, and plastics by the Chicago Section of the American Chemical Society (1947); Elected Fellow of the American Society of Chemists (1950); Elected Fellow of the Royal Society of Arts (England) (1952); Received Gold Medal of the Ohio Chapter, American Institute of Chemists (1954); Awarded Honorary Doctor of Science Degree by Lehigh University (1957); Awarded Honorary Doctor of Science Degree by North Dakota State University (1963); and was an Honorary Member of the Federation, and the Louisville, Philadelphia, and Southern Societies.

Dr. Long, who had been in failing health in recent years, was honored in 1977 by the University of Southern Mississippi, when the university named a symposium for him and many friends and associates from across the country gathered for a dinner in his honor. At that time a plaque was presented to Dr. Long by the Polymer Science Department. An endowment fund was set up at the school for the J. S. Long Chair of Polymer Science.

Dr. Long, who was born August 11, 1892, in York, Pa., did consulting work as recently as 1978.

His last major participation in a coatings meeting was to deliver the keynote address at the 1975 Annual Meeting of the Southern Society for Coatings Technology.

Dr. Long is survived by his wife, Grace Foster Long; a daughter, Jane Jaggers of Louisville; a stepson, George Lewis of Dunedin, Fla.; and a brother, Henry F., of Dunedin and Watertown, Conn.

In lieu of flowers, the family prefers donations be made to a charity scholarship fund of the Rotary Club of Clearwater.

The home address is 2267 Habersham Dr., Clearwater, Fla. 33516.

CALL FOR PAPERS

Eighth Annual Meeting, The Adhesion Society,
Savannah, GA
February 24-27, 1985

Topics to be covered and the respective session chairmen are:

Test Methods for Fibers, Fiber Surfaces and Adhesion of Fibers
Dr. Lynn Penn
Midwest Research Institute
425 Volker Boulevard
Kansas City, MO 64110 (816) 753-7600

Rheology, Morphology and Adhesion
Dr. Donald Hunston
National Bureau of Standards
Polymer Division
Washington, D.C. 20234 (202) 921-3344

Chemistry at Surfaces
Professor Thomas McCarthy
Department of Polymer Science & Engineering
University of Massachusetts
Amherst, MA 01003 (413) 545-0433

The Role of Adhesion in Biocompatibility
Professor James Anderson
Department of Macromolecular Science
Case Western Reserve University
Cleveland, OH 44106 (216) 444-1012

General Session
Professor James Wightman
Virginia Polytechnic Inst. & State University
Department of Chemistry
Blacksburg, VA 24061 (703) 961-5854

A Poster Session is also planned. Inquiries and papers suitable for inclusion should be brought to the attention of the appropriate session chairman or Meeting chairman Douglas Rahrig, B.F. Goodrich R&D Center, 9921 Brecksville Rd., Brecksville, OH 44141, (216) 447-5531. Deadline for abstracts of papers is November 1, 1984. Funds for foreign and/or academic speakers, and for supplementing graduate students' attendance are also available.

Symposium on Color and Appearance Instrumentation Is Scheduled for Pittsburgh, in April 1985

A symposium on instrumentation for measuring color and appearance in the coatings industry will be held April 17 18, 1985 at the Sheraton Hotel at Station Square, Pittsburgh, PA. The two-day event will be sponsored jointly by the Federation of Societies for Coatings Technology, the Manufacturers Council on Color and Appearance, and the Inter-Society Color Council.

The symposium will immediately follow the Inter-Society Color Council's Annual Meeting, also being held at the Sheraton, April 14 16. Theme for both events will be "Color: The End User," and a special "bridge" session on April 16 will serve to tie in the back-to-back events.

The symposium program will be divided between "hands-on" workshop sessions and general oral presentations on instrumentation, sample preparation and presentation, and statistical control. Special emphasis will be devoted to coil coating and automotive applications. The format of the program is being designed to offer a "working meeting" environment, and registrants will be invited to bring samples with them.

General program sessions are under the direction of Jacqueline Welker, of PPG Industries, Inc., who chairs the Federation's Inter-Society Color Council Committee. Arrangements for the workshops and instrument displays are being handled by Charles Leete, of the Manufacturers Council on Color and Appearance.

Complete details will be available shortly. Meanwhile, further information may be obtained by contacting the Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 832, Philadelphia, PA 19107.

NPCA to Sponsor Seminar On Production Planning

"Production Planning and Inventory Management," a seminar sponsored by the National Paint and Coatings Association, will be held in Atlanta, September 26 28.

Designed to give attendees a chance to review their own paint production and inventory processes, the seminar will also deal with ways to improve methods and offer alternatives to help achieve maximum customer service, minimum inventory investment and efficient, low-cost plant operations.

The seminar will be taught by Dr. Gene Groff, of Georgia State University, and is based on the manual "Production Planning and Inventory Management for the Paint Industry."

NPCA will make hotel reservations for registrants at the Peachtree Plaza, provided arrival time and date and departure date are supplied. Deadline for registration is September 4, and the seminar is limited to 15 participants. For additional information, contact Juliette Benedicto, NPCA, 1500 Rhode Island Ave., N.W. Washington, D.C. 20005.

A/V Program on 'Sandmill Operation' Added to FSCT Series

Addition of "Operation of a Vertical Sandmill" to its series of audio/visual training programs has been announced by the Federation of Societies for Coatings Technology.

Prepared by the Manufacturing Committee of the Kansas City Society for Coatings Technology, the program focuses on the basics of operating a vertical sandmill and was developed to assist in training plant personnel in the use of such equipment.

Discussed are premix and preparation of the mill base; preparation, start, and setting of the mill; and completion of the grind and washing the mill.

The program runs approximately 14 minutes, and includes a cassette tape, 73 slides, and accompanying script, packaged in a vinyl album. The tape contains an audible pulse on one side for manual operation and an inaudible tone on the other side for use with appropriate equipment to advance the slides automatically.

Price is $75 prepaid (postage and handling charges added for orders requiring billing).

Orders and inquiries should be directed to Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 832, Philadelphia, PA 19107 (215) 545-1507.

Literature

Epoxy Floor Covering

An epoxy which minimizes the time required to lay a floor covering is the topic of new literature. The epoxy topping is an accelerator which can be added to the screed mixture to speed up curing time and can be applied with a power trowel. Literature can be obtained from Mr. Harvey Liss, Vice-President, Plastics and Resins Inc., P.O. Box 177, 401 Kennedy Blvd., Somerdale, NJ 08083.

Counting Scale

Introduced in literature is a new parts counting scale with computer output capabilities. Model DSC-II, with 25 lb capacity, displays the total number of parts on the scale in large digital numbers, and sends a signal to the computer to adjust inventory, compute price of order, or other computations. The scale can be connected to a printer for hard copy printout of weight, piece count, date, etc. For information, contact Circuits and Systems Inc., Foot of Second St., East Rockaway, NY 11518.

Polyurethane Coating

A new polyurethane coating has recently been introduced in literature. The polyurethane coating is resistant to weathering, smog, abrasion and impact. For further information on Chemglaze® A-Line Coatings, contact Lord Corporation, Chemical Products Group, Erie, PA 16514.

Corrosion Inhibitor

A new, full-color, six-page brochure explains the chemical theory and process variables affecting hydrogen blistering in the vapor recovery sections of fluid catalytic cracking units. The brochure outlines the steps in an effective corrosion prevention plan. For a copy of Bulletin RC-906, contact Welchem Inc., Dept. ADV-JCT, 5450 Northwest Central Dr., Houston, TX 77092.

Flatting Agent

Information is available on a new grade of fine particle silica for use in clear and pigmented lacquers, as well as aerosol lacquers, lacquer flatting bases, and topcoats for vinyl and other coated fabrics. For a sample and more information, contact SCM Pigments, 2700 Hollins Ferry Rd., Baltimore, MD 21230.

Electronic Level Transmitters

A line of displacement type liquid level controls which meets requirements of the Scientific Apparatus Manufacturers Association (SAMA), Standard PMC33.1-1978, Class 2 abc. for RFI interference, is discussed in new literature. For more information on Modulevel "EZ" electronic level transmitters in RFI environments, contact Magnetrol International, Inc., 5300 Belmont Rd., Downers Grove, IL 60515.

Viscometer

A 28-page booklet offers advice on viscometer use and maintenance and suggests ways in which particular equipment can be used to solve specific measuring problems. Also discussed in the booklet are principles of rheology and factors which affect rheological behavior and advance mathematical procedures. For a copy of "More Solutions to Sticky Problems," contact Brookfield Engineering Laboratories, Inc., Dept. NR 44, 240 Cushing St., Stoughton, MA 02072.

Sample Concentrator

Information is now available on a new sample concentrator which features splitless injection into 0.25 mm capillary columns under fully automatic operation. The sample concentrator is used for the analysis of trace organic components in air, liquid, slurry and solid sample matrices. For more information, contact James T. Kelley, Chemical Data Systems, Inc., Oxford, PA 19363.

Filters & Strainers

A unique size high capacity bag filter and basket strainer is the subject of a recently released technical bulletin. These units have an outside diameter of six inches, yet are designed to provide up to two square feet of filter or strainer area. For details, contact Rosedale Products Inc., 3730 Liberty, P.O. Box 1085, Ann Arbor, MI 48106.

Motorized Filter

Information is available on a motorized filter designed to protect a viscosity analyzer system from malfunctioning. It can be used in the petrochemical, power, petroleum, waste oil recovery, and chemical industries. For more information, contact AMF Inc., 400 Research Pkwy., Meriden, CT 06450.

Microscope Optics

A new 12-page guide to the selection of the correct objectives, condensers, and eyepieces for best performance in a variety of applications has recently been published. The brochure provides insights into diffraction-limited optics design and manufacture. Examples of specimen studies in medical and industrial research are documented in a series of full-color photographs. Technical brochure #41-9048 can be obtained from Scientific Instruments Div., Carl Zeiss, Inc., One Zeiss Dr., Thornwood, NY 10594.

Newsletter

The Spring 1984 edition of the newsletter "SunSpots" is now available. This newsletter is intended to communicate information concerning physical and environmental testing. Included in the Spring edition is a technical article on the intercomparison of radiant exposure among lamps and daylight. For further information, contact Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613.

Cadmium Pigments

An eight-page brochure is available which provides sample color chips, application information, and detailed chemical data for a new line of high-strength cadmium pure colors. Also included in the brochure is a chart showing the chemical analysis of each shade as well as data on oil absorption, pH, specific gravity, and specific resistance. For a copy of the brochure, contact SCM Pigments, SCM Corp., 2700 Hollins Ferry Rd., Baltimore, MD 21230.

Resins

Information is now available on two high-solids polyester resins for the manufacture of VOC-compliant, industrial finishes. Both resins contain a very narrow molecular weight range allowing for maximum package stability and batch-to-batch uniformity. For information, contact Phil Recitano, Kay-Fries, Inc., Chemical Div. of Dynamit Nobel of America Inc., 10 Link Dr., Rockleigh, NJ 07647.

Plastics Applications

A recently published brochure outlines a new process for coating plastic substrates with metal, carbide and ceramic surfaces that impart heat, chemical, wear, and abrasion resistance to a wide range of plastic materials.

An integral part of this process is a stainless steel/plastic composite thermal spray powder designed for use as a bond coat on plastic substrates. The coating adheres to the plastic surface without degrading the substrate, and provides a base for subsequent topcoating. For additional information and a copy of the brochure, contact Metco Inc., Dept. 172A, 1101 Prospect Ave., Westbury, NY 11590.

Polyester Resins

A four-color brochure has been published which describes the products and facilities of Scott Bader (USA) Inc., a manufacturer of polyester resins. To obtain a copy, write to Scott Bader (USA) Inc., 1145 Harbour Way South, Richmond, CA 94804.

Bench Scale

A new model bench scale featuring sensitivity to 0.0005 lbs or 0.0002 kgs is discussed in literature. Weights are displayed in large digital numbers. For more information, contact Mark Estes, Marketing Manager, Arlyn Scales, 199 Merrick Rd., Lynbrood, NY 11563.

Book Review

CHEMCYCLOPEDIA

Published by
American Chemical Society
Washington, DC
$40.00

Reviewed by
Paul R. Guevin, Jr.
AMF, Inc.
Stamford, CT

This 1984 annual edition is a personal guide to commercial chemicals. Following the first edition issued last year, the editors surveyed a large sample of the readers to determine how well their needs were served by this publication. They found that more than 90% of the readers select or specify chemicals and that only 15% of the readers were being reached by the average chemical firm's direct contact.

This book is similar to *Chemical Week's Buyers' Guide*. Information contained within are listed in 12 categories consistent with patterns of use, i.e., Organic Chemicals, Primary; Organic Chemicals, General; Fatty Chemicals; Process Chemicals; etc. They list the chemical name, name of supplier(s), give trade names or product codes, when available, grades and physical forms, special shipping or handling requirements (e.g., DOT four-digit UN numbers), and information on applications and end uses.

Preceding the listings in each category, a concise editorial overview of that particular chemical group is presented. It covers current and projected production levels and price forecasts, other factors affecting price and availability.

This volume is ideally suited for purchasing agents and others who perform a similar activity. It is well organized for the coatings industry as four of the 12 categories covered in this volume are Pigments and Dyes; Plastics and Resins; Oils, Fats and Waxes; and Surfactants. It is a reference that should be used frequently by those concerned with the various aspects of raw materials in the coatings industry. The $40 charge seems somewhat high, but it offers more technical information than most Buyers' Guides.

RAW MATERIALS DATA HANDBOOK
Volume 4: Pigments

Published by
National Printing Ink Research Institute
Bethlehem, PA
1983 (374 pages)
$100, members; $175, non-members

Reviewed by
M.J. McDowell
Du Pont Company
Philadelphia, PA

The National Printing Ink Institute at Lehigh University has issued Volume 4 in the following series: Volume 1 Organic Solvents (1974); Volume 2 Plasticizers (1975); Volume 3 Proprietary Solvents (1978); Volume 4 Pigments (1983).

Volume 4 is an excellent reference guide to regulatory data and technical performance properties of over 25 generic pigments. Volume 4 is very well organized. The pages are printed in seven different colors, e.g., a green section is devoted to Safety & Health Considerations, a pink section gives the Color & Chemical Constitution and a blue section gives the U.S.A. suppliers.

The data have been carefully compiled from published literature sources, from technical property sheets, material safety data sheets and supplementary information from responding manufacturers. The readers are cautioned by the "authors" to treat the data as a general guide and to conduct in-house testing and analysis in critical situations.

Several pages are devoted to summarizing data on the effect of Human Exposure to Pigments (chromates, lead, aluminum, talc, etc).

Readers should find that Volume 4 is particularly useful for colored pigments. However, they may find less data than they need on surface-treated rutiles, anatases, leafing and non-leafing aluminums, extenders etc., presumably because they are of less importance in printing inks.

MALEIC ANHYDRIDE

Edited by
B.C. Trivedi and B.M. Culbertson

Published by
Plenum Press
New York, NY
$89.50

Reviewed by
Joseph V. Koleske
Union Carbide Corp.
S. Charleston, WV

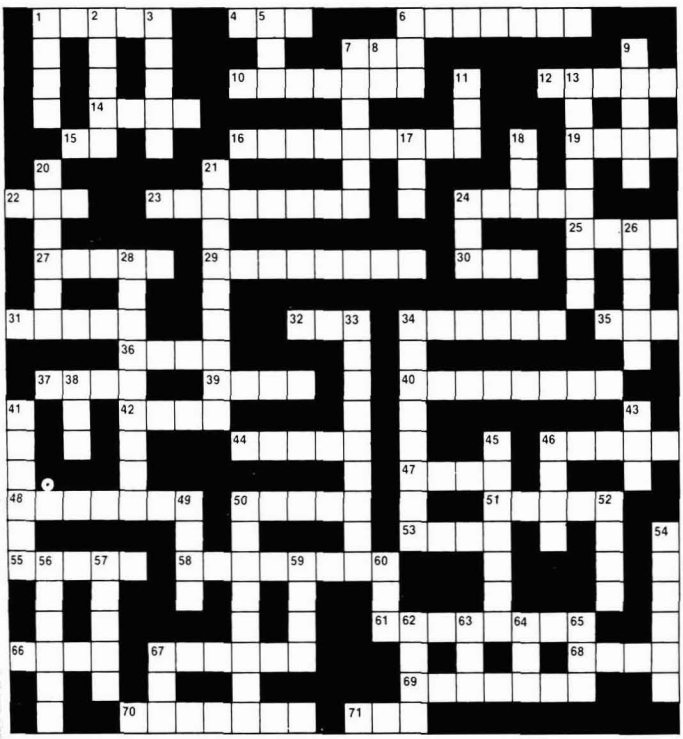
This is a well-written, comprehensive, technical source and reference book for those working with or planning to work with maleic anhydride. It will be useful to experts and to neophytes in maleic anhydride chemistry, as well as to people in production, research and development, and business.

Maleic anhydride is a commodity, dual functionality chemical that is used in various industries to make a variety of products. The largest volume product line is unsaturated polyesters which utilizes over one-half of the domestic production. The book describes maleic anhydride in detail, how it is produced, and the type reactions it undergoes, including its polymerization characteristics. The authors do not dwell on unsaturated polyester chemistry but rather delve into all of the reactions maleic anhydride will undergo. A particularly interesting twist is given by the "epilogue" to most chapters. These author comments provide useful summaries and insights into the utility and needs of maleic anhydride chemistry.

The Appendix section comprises about 20% of the book. It contains patent listings for seven categories of maleic anhydride chemistry. The listings in each category are further subdivided into production and various end uses. This tabulation will be a time saver and aid to the chemist who wishes to develop new product extensions or new end uses from existing products and technology.

In summary, this book contains what most chemists and production personnel want to know about maleic anhydride. In addition, it contains a detailed, easy-to-use index that will help one find the contained information. The authors have done an excellent job in developing this book.

CrossLinks



by Earl Hill

Earl Hill is a coatings chemist with an interest in mathematics and statistics, and lately, his home computer. He is a resident of Erie, PA.

This puzzle was prepared using a BASIC program and an Atari 800 computer. The words are selected mainly from the Federation of Societies for Coatings Technology's Paint/Coatings Dictionary *and Webster's* 9th New Collegiate Dictionary.

(Solution to appear in the September issue)

ACROSS

1. *Special pigments*
4. Classification scheme (Abr.)
6. Very useful for a paint
7. Container
10. Lacquer solvent
12. Handy plant item
14. ___ of reaction
15. Math term
16. Intrinsic property
19. What down and across are
22. Bad thing in kettles
23. Lab tool (Pl.)
24. Togetherness (Org. Chem.)
25. Substrate
27. Trouble preventive
29. Type of mer
30. Part of business lunch
31. Familiar laboratory term
32. *Flow additive (Abr.)*
34. Synthesis material
35. ___ roller
36. Material found in Shipping Department
37. *Useful oil*
39. Organic chemistry cornerstone
40. Fundamental factory process
42. AP&C Journal feature
44. Heavy oily acid
46. Essential for crosslinking
47. Black (Fr.)
48. Flax extract
50. Industry backbone
51. Type of conduction
53. Connecting interface
55. Has 'em all
58. Essential ingredient (Aqueous systems)
61. Vanderhoff favorite
66. Rotate
67. Wetting and dispersing agent
68. Author's home town
69. *Upper layer*
70. Familiar vendor
71. Source of trouble (Abr.)

DOWN

1. A No-No
2. Of coniferous origin
3. Gray
5. Precursor resin
6. From ___ to
7. Available in all ____
8. Stem prefix
9. Our heritage (found in Boston)
11. Useful bean
13. Favorable attribute of coatings
17. For when we're old and gray
18. Color
20. Precursor resin
21. Pioneer (polymers)
24. Computer talk
26. Round & round (Chemistry)
28. Drier
33. Milling invention
34. One of the basic three
38. Goes with 37 across
41. Pigment type
43. Math term (Abr.)
45. Goes on first (Pl.)
46. Mu oil
49. Indicator
50. Headache preventive
52. Type of rubbing test
54. Holds things together
56. Container
57. Organic chemistry term
59. Cafeteria delight (Fr.)
60. Alkaline compound (Abr.)
62. *One away (Org. Chem)*
63. Top of can
64. Prefix (Chemistry)
65. After deductions
67. Robert's rules (term)

Coming Events

FEDERATION MEETINGS

(Oct. 24-26)—62nd Annual Meeting and 49th Paint Industries' Show. Conrad Hilton Hotel, Chicago, IL. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

1985

(May 14-17)—Federation "Spring Week." Seminar on 14th and 15th; Society Officers on 16th; and Board of Directors on 17th. Hilton Hotel, Baltimore, MD. (FSCT, 1315 Walnut St., Philadelphia, PA. 19107).

(Oct. 7-9)—63rd Annual Meeting and 50th Paint Industries' Show. Convention Center, St. Louis, MO. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

1986

(May 13-16)—Federation "Spring Week." Seminar on 13th and 14th; Society Officers on 15th; and Board of Directors on 16th. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

(Nov. 5-7)—64th Annual Meeting and 51st Paint Industries' Show. World Congress Center, Atlanta, GA. (FSCT, 1315 Walnut St., Philadelphia, PA 19107).

SPECIAL SOCIETY MEETINGS

1985

(Feb. 26-Mar. 1)—Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim, CA.

(Mar. 26-28)—Southern Society. Annual Meeting. Atlanta Hilton Hotel, Atlanta, GA. (Salvatore G. Sanfilippo, Reichhold Chemicals, Inc., P.O. Box 1610, Tuscaloosa, AL 35403).

(Apr. 10-12)—Southwestern Paint Convention of Dallas and Houston Societies. Anatole Hotel, Dallas, TX. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Apr. 25-27)—Pacific Northwest Society for Coatings Technology Symposium. Empress Hotel, Victoria, B.C. (Ottwin Schmidt, Helzer Canada Ltd., 8531 Cullen Crescent, Richmond, B.C., V6Y 2W9 Canada).

1986

(Mar. 25-27)—Southern Society. Annual Meeting. Hilton Hotel, Savannah, GA. (Ronald R. Brown, Union Chemicals Div., P.O. Box 26845, Charlotte, NC 28213).

OTHER ORGANIZATIONS

(Aug. 20-24)—Short Course on "Advances in Emulsion Polymerization and Latex Technology." Davos, Switzerland. (Dr. Gary Poehlein, School of Chemical Engineering, Georgia Institute of Technology, Atlanta, GA 30332).

(Aug. 20-24)—Short Course on "Nitride and Carbide Coatings: Deposition Processes and Applications." Soderkoping, Sweden. (Continuing Education Institute—Europe, Rorstorpsvagen 5, S-612 00 Finspang, Sweden).

(Aug. 21-23)—"Managing Safety: Techniques That Work for the Safety Pro" Seminar sponsored by Du Pont Co. Buck Hill Falls, PA. (Du Pont Co., Applied Technology, Wilmington, DE 19898).

(Sept. 4-6)—"Autumn School in UV Curing Technology." Short Course. The Department of Colour Chemistry, The University of Leeds. (Dr. J.T. Guthrie, The Department of Colour Chemistry, The University of Leeds, Leeds LS2 9JT, England).

(Sept. 10-13)—"Radcure '84" Conference on Radiation Curing sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Downtown Marriott, Atlanta, GA. (Donna Theisen, AFP/SME Administrator, Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, MI 48128).

(Sept. 10-14)—"The Basic Composition of Coatings" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Sept. 13-15)—Oil and Colour Chemists Association Australia. 26th Convention. Mandurah, Western Australia. (Grant McManus, P.O. Box 490, Cloverdale, Western Australia 6015).

(Sept. 17-20)—Steel Structures Painting Council Annual Meeting and Symposium on "Maintenance Painting of Industrial Plants." William Penn Hotel, Pittsburgh, PA (Harold Hower, Symposium Coordinator, Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh, PA 15213).

(Sept. 17-21)—"Physical Testing of Paints & Coatings" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Sept. 22-25)—Canadian Paint and Coatings Association. Annual Convention. Westin Hotel, Winnipeg, Man., Canada. (CPCA, 515 St. Catherine St. W., Montreal, Que. H3B 1B4, Canada).

(Sept. 23-26)—American Oil Chemists' Society Short Course on Fatty Acids. Kings Island, OH. (AOCS, 508 S. Sixth St., Champaign, IL 61820).

(Sept. 23-28)—XVIIth Congress of FATIPEC (Federation of Associations of Technicians in the Paint, Varnish, Lacquer and Printing Ink Industries of Continental Europe). Lugano, Switzerland. (C. Bourgery, Secretary General, FATIPEC, Maison de la Chimie, 28 Rue St.-Dominque, 75 Paris (7), France).

(Sept. 26-28)—"Production Planning and Inventory Management." Seminar sponsored by the National Paint and Coatings Association, Atlanta, GA. (Juliette Benedicto, NPCA, 1500 Rhode Island Ave., N.W., Washington, DC 20005).

(Oct. 1-5)—Short Course on "Physics and Chemistry of Printing Inks," Lehigh University, Bethlehem, PA (Dr. M.S. El-Aasser, Dept. of Chemical Engineering, Sinclair Lab #7, Lehigh University, Bethlehem, PA 18015).

(Oct. 8-12)—"Advanced Industrial Paint Formulation" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Oct. 8-12)—Spray Painting Seminar. Binks Manufacturing Co., Atlanta, GA. (Binks Manufacturing Co., Training Div., 9201 W. Belmont Ave., Franklin Park, IL 60131).

(Oct. 21-26)—Interfinish '84. Jerusalem, Israel. (Interfinish '84 Secretariat, P.O. Box 29313, 61292 Tel Aviv, Israel).

(Oct. 22-24)—National Paint & Coatings Association 97th Annual Meeting. Palmer House, Chicago, IL. (Karen Bradley, NPCA, 1500 Rhode Island Ave., N.W., Washington, DC 20005).

(Oct. 23-24)—11th International Naval Stores Meeting. Fairmont Hotel, San Francisco, CA.

(Oct. 23-26)—Fall Technical Meeting of the National Coil Coaters Association. Hyatt Regency O'Hare Hotel, Chicago, IL. (NCCA, 1900 Arch St., Philadelphia, PA 19103).

(Nov. 7-8)—4th World Congress on "Coatings Systems for Bridges and Steel Structures." Breckenridge Concourse Hotel,

St. Louis, MO. (Cindy Sonewald, University of Missouri-Rolla, Dept. of Chemistry, Rolla, MO 65401).

(Nov. 13-14)—"Innovations in Finishing and Machining for the Wood Industry" Conference, sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Greensboro-High Point Marriott Hotel, Greensboro, NC. (Donna Theisen, AFP/SME Administrator, Society of Manufacturing Engineers, One SME Drive, P.O. Box 930, Dearborn, MI 48128).

(Nov. 14-15)—Seventh Resins & Pigments Exhibition. Crest Hotel de Boflelaan, Amsterdam, Holland. ("Polymers, Paints & Colour Journal," Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 16-17)—37th National Decorating Products Show. McCormick Place, Chicago, IL. (NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

(Nov. 26-27)—"Job Estimating Workshop for Painting Contractors" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Nov. 28-30)—FINSTRAT '84, Conference and Exposition on Finishing Strategies for the 80's. Marriott Hotel and Anaheim Convention Center, Anaheim, CA. (Association for Finishing Processes of SME, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Nov. 28-30)—"Maintenance Painting" Short Course. University of Missouri-Rolla, Rolla, MO. (Cindy Sonewald, Dept. of Chemistry, UMR, Rolla, MO 65401).

(Dec. 3-7)—Spray Painting Seminar. Binks Manufacturing Co., Franklin Park, IL. (Binks Manufacturing Co., Training Div., 9201 W. Belmont Ave., Franklin Park, IL 60131).

(Dec. 4-6)—Plant Engineering and Maintenance Show and Conference/West. Moscone Convention Center, San Francisco, CA. (Show Manager, Plant Engineering & Maintenance Shows, 999 Summer St., Stamford, CT 06905).

(Dec. 16-21)—1984 International Chemical Congress of Pacific Basin Societies. Honolulu, Hawaii. (PAC CHEM '84, Meetings and Divisional Activities, American Chemical Society, 1155 Sixteenth St., N.W., Washington, DC 20036).

1985

(Mar. 25-27)—"Electrochemical Techniques for Corrosion" Symposium to be held during CORROSION/85, sponsored by the National Association of Corrosion Engineers. Boston, MA. (Symposium Chairman, Robert Baboian, Texas Instruments, Inc., Mail Station 10-13, Attleboro, MA 02703).

(Mar. 25-29)—CORROSION/85. Annual Conference for the National Association of Corrosion Engineers, Boston, MA. (Meetings Manager, NACE Headquarters, P.O. Box 218340, Houston, TX 77218).

(Apr. 17-19)—PaintCon '85. O'Hare Expo Center, Chicago, IL. (Professional Exposition Management Co., Inc., Ste. 205, 2400 E. Devon Ave., Des Plaines, IL 60018).

(June 10-12)—International Conference on Biologically Influenced Corrosion, sponsored by the National Association of Corrosion Engineers, Washington, DC. (Meetings Manager, NACE Headquarters, P.O. Box 218340, Houston, TX 77218).

Advertisers Index

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'Humbug' from Hillman

For the past year, Howard Jerome has been feeding the company computer. What has been coming out is not known to me but the Jerome observations and his Laws of Programming should give us reason to question the results.

Laws of Computer Programming

(1) Any given program, when running, is obsolete.
(2) Any program will expand to fill any available memory.

If computers get too powerful, we can organize them into a committee, that will do them in.
If builders built buildings the way programmers wrote programs, then the first woodpecker that came along would destroy civilization.
Inside every large program is a small program struggling to get out.
If a test installation functions perfectly, all subsequent systems will malfunction.
Not until a program has been in production for at least six months will the most harmful error then be discovered.
And finally—
Machines work, people should think.

• • •

Frank Borrelle, who keeps his files in order by sending really important stuff to me, provided the following for safe keeping in the security of Humbug's files.

Scientists discover new word processing system

Scientists recently discovered another word-processing system, at the heart of which is a Personal Articulation Device, or PAD, which is a series of rectangles made from paper. (Paper is a super lightweight material invented by NASA technicians, to have something to put in their filing cabinets. Paper itself is derived from trees, the heretofore useless objects covering valuable mineral deposits in our national parks.)

The PAD operates in conjunction with a miniature data processor called the Portable ENCoder/ILustrator, or PENCIL. Attached to the human radium and ulna, the PENCIL may be activated by the human brain to produce words. Then again, it may be activated to do nothing at all as the human brain succumbs to such outside influences as wine, PacMan, and cable television.

The PAD and PENCIL system possesses many qualities not shared by conventional word-processing equipment. For example, it processes words only as fast as people can produce them. Sometimes, mirable dictu (to take a phrase out of the deep memory bank), it even chooses among words before processing them. This feature makes the apparatus next to useless for producing real estate contracts, cookbooks, and novels based on popular movies. Even in the hands of a skilled poet, the machinery may yield only a fistful of words per week.

The PAD and PENCIL system is also incapable of storing the billions of bytes or pieces of information stored in silicon chips by even the most primitive conventional computer. The new equipment does not use silicon chips, poker chips, or in fact any chip more sophisticated than the occasional potato chip.

Retrieving information from the new system poses great technical challenges to the user. Nevertheless, many executives are now investing in tax-sheltered PENCIL sharpeners and trading heavily in eraser futures in expectation of a growing demand for the PAD and PENCIL system.—*From the Printing Manager, Feb. '84 Natl Assn of Printers & Lithographers*

• • •

Our scientific mentor, Dr. Tom Miranda, has shared his collection of the philosophies of that eminent sage, Robert E. Ahlf, with us. I feel privileged to be able to offer some of them below:

- I invented a wheel chair that is propelled by pedals.
- If you take poverty away from poor folks, they won't have *anything.*
- That cheerful look on your face fools no one.
- The other day we were talking about cutting out dead wood and your name came up.
- It is better to have no opinion than to have none at all.
- Double your gas mileage. Change those two little gears in the back of your speedometer.
- I hate people who don't like their fellow man.
- A company is known by the men it keeps.
- No matter how fat a chicken gets, it never shows in its face.
- Never take away the client's teddy bear.

• • •

The husband was playing cards with the boys and was having so much fun that the time just slipped by. When he looked at his watch, it was 5:00 a.m.

He hated the thought of trying to explain to his wife how he had forgotten the time. He jumped up, rushed to the phone and called her. When she answered, he hollered at the top of his voice, "Sweetheart, don't pay the ransom! I've escaped and I'll be home in 30 minutes.

—The Lion

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361

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Manville

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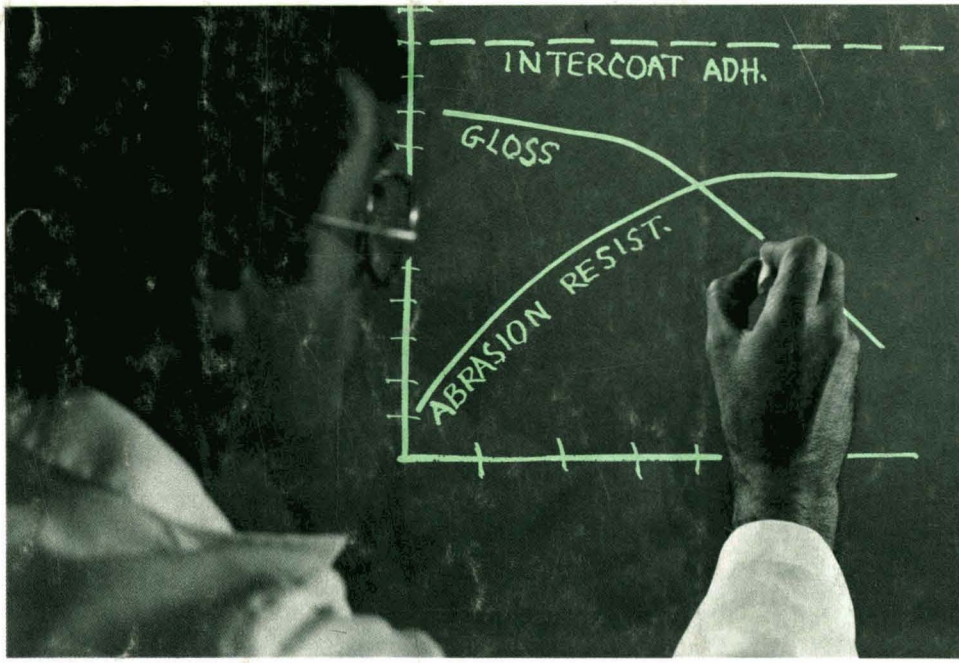

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