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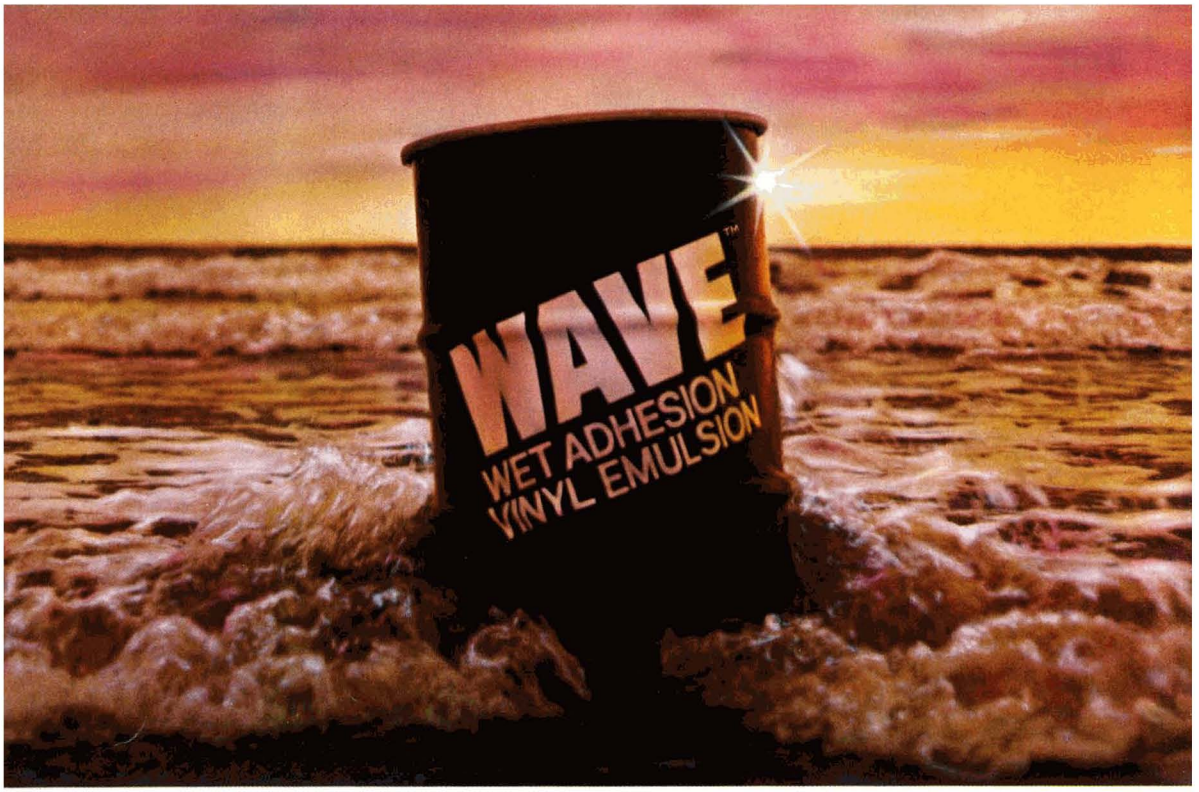
JANUARY 1979

jct JOURNAL OF COATINGS TECHNOLOGY

TOTAL INSTRUMENTATION IN COLOR MANUFACTURE



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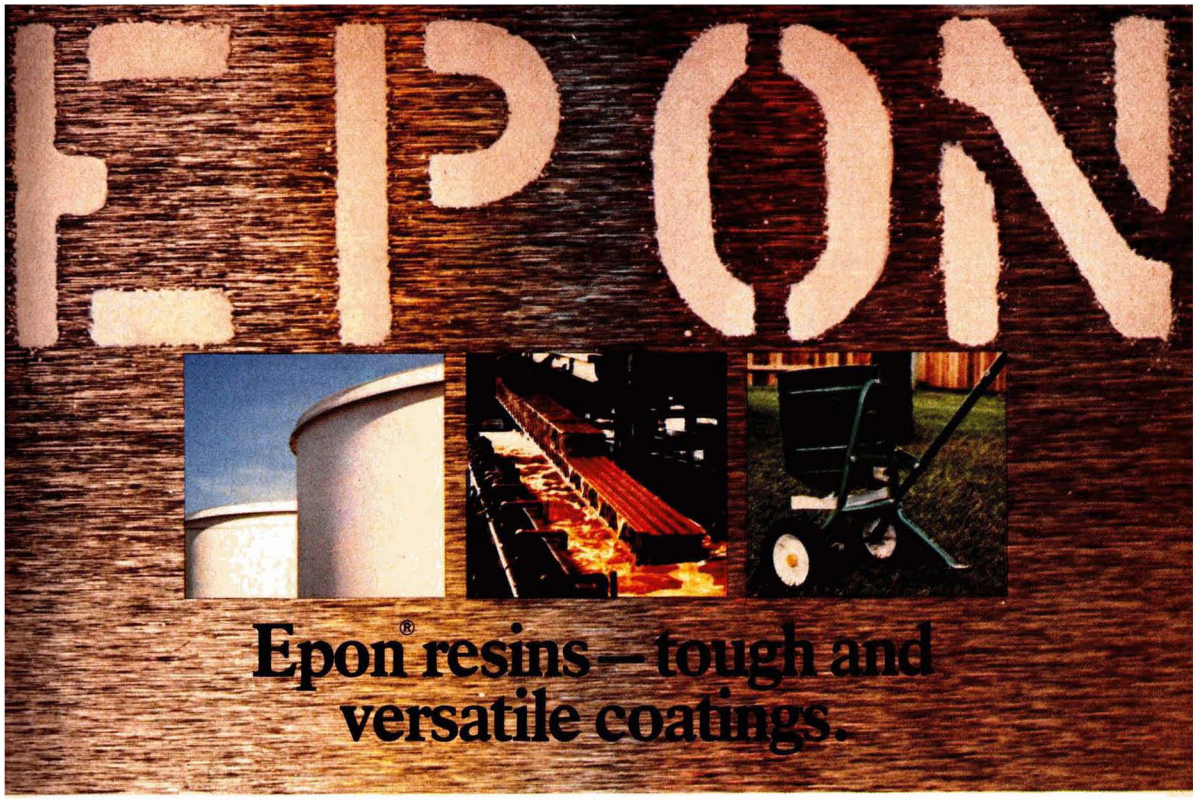

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JANUARY 1979

JOURNAL OF COATINGS TECHNOLOGY

Volume 51 Number 648

Features

Federation Activities

Departments

THE JOURNAL OF COATINGS CHNOLOGY (ISSN 0361-8773) is pub- hed monthly by the Federation of cieties for Coatings Technology at esent & Mulberry Streets, Harrisburg, 17104. Editorial and executive offices located at 1315 Walnut St., Philadel- ia, Pa. 19107. Phone: (215) 545-1507. Second class postage paid at Philadel- ia, Pa. and at additional mailing of- es.

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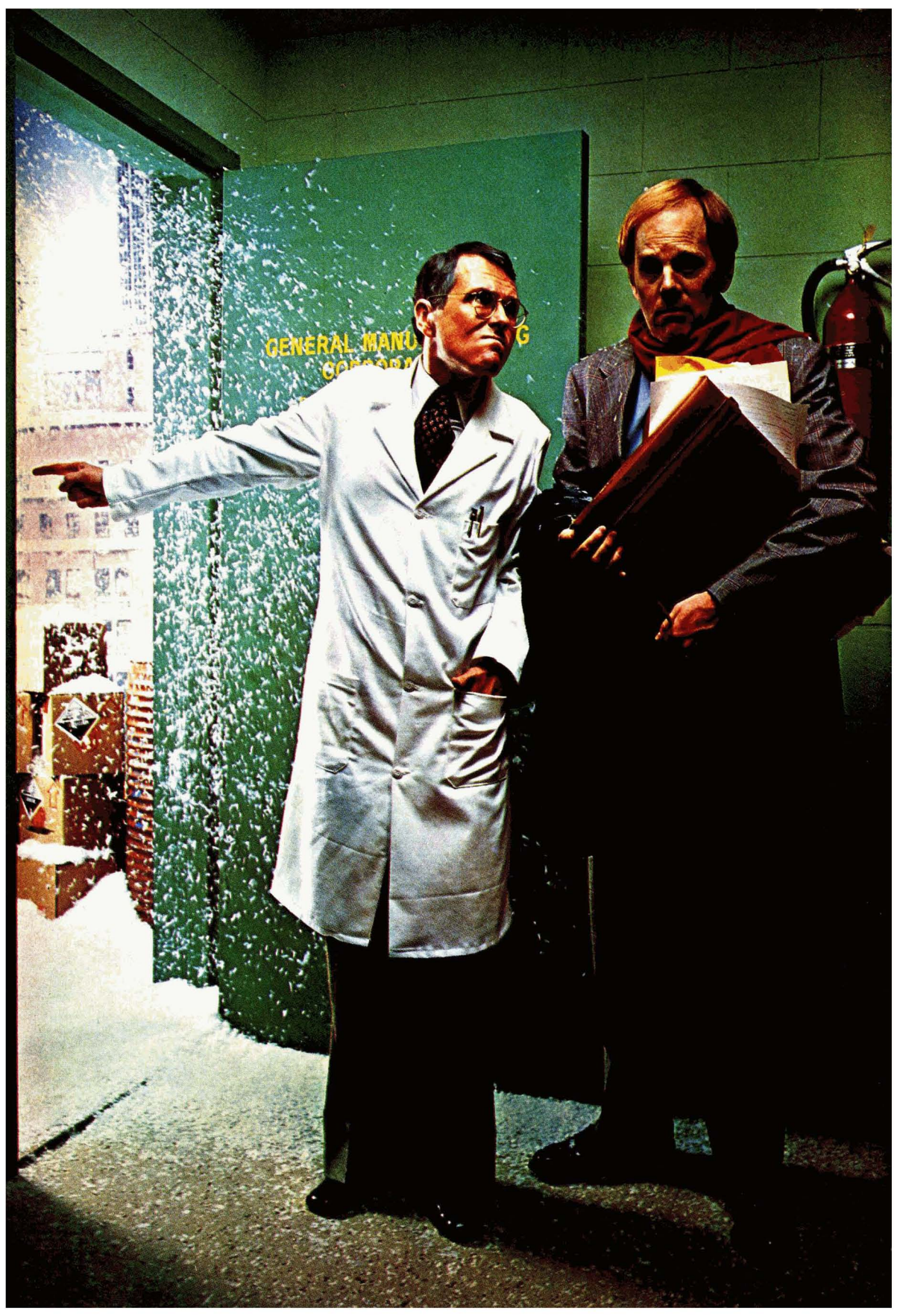
GENERAL MANU

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	U.S. and Canada	Europe (Air Mail)	Other Countries
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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.

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

Comment

Making the Most of An Industry Resource

Technical project work by Constituent Society members has been diminishing in recent years, a trend reflected in the dwindling number of Society papers presented at Federation Annual Meetings.

True, some Societies do have active Technical Committees that meet regularly and pursue ongoing programs. Overall, however, work on technical projects has been on the decline, and a frequently heard lament is the difficulty in finding meaningful projects to attract member interest.

In addressing itself to this problem, the Federation Technical Advisory Committee has embarked on development of suggested projects for Society Technical Committee activity. These projects will focus on areas of interest which it is felt will have maximum appeal for member participation and, at the same time, generate practical work on topics of current concern.

To pursue discussions on the suggested projects, as well as Society technical efforts currently underway, the Federation will host a meeting of all Society Technical Committee Chairmen with the Technical Advisory Committee on March 30 in Atlanta. It is hoped that from these discussions will evolve a number of project undertakings that will effectively utilize member expertise to make a meaningful contribution to the industry.

Society Technical Committee work represents an invaluable resource, and the upcoming meeting offers an opportunity to assess current and proposed programs in terms of how best to respond to member and industry needs. —TAK

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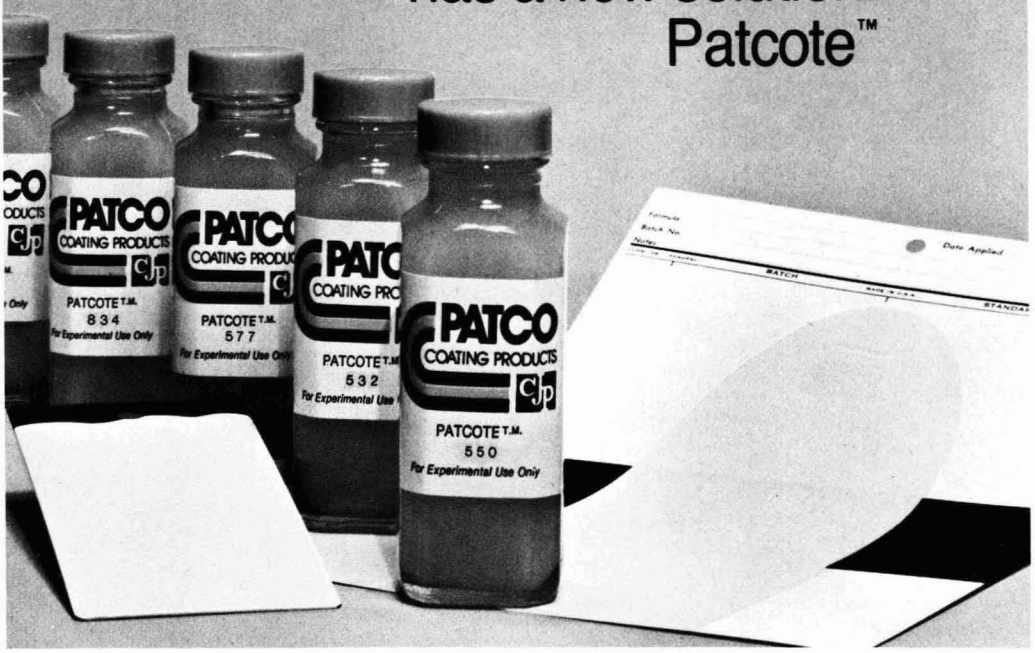

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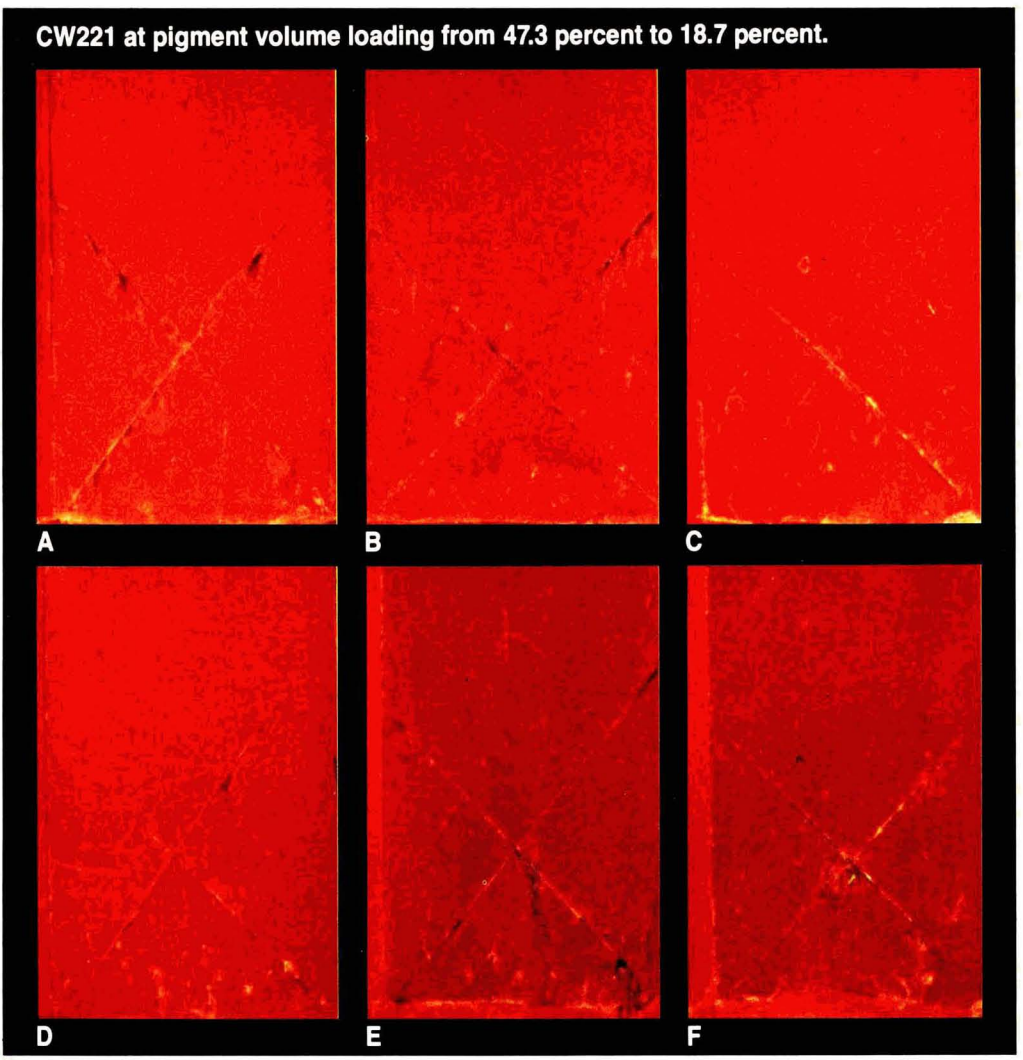

TOTAL INSTRUMENTATION IN COLOR MANUFACTURE—A.B.J. Rodrigues

Journal of Coatings Technology, 51, No. 648, 49 (Jan. 1979)

Recent advances in light-scattering theory, colorimetry, and instrumentation have made it possible to transform color matching from an art to a science. However, to achieve maximum benefit from this science, instrumentation should be used through the entire process of color manufacture, from conception of the color (styling), through pigment selection (formulation), and final manufacture (shading). At the same time (color being very subjective) even a complete instrumental system cannot ignore the human observer. Human observation and judgement are the key to success. Hence, a total instrumental color system must be designed to allow user interaction at every stage.

PEOPLE MAKE OR BREAK AN INSTRUMENTAL COLOR CONTROL SYSTEM—R.T. Marcus

Journal of Coatings Technology, 51, No. 648, 53 (Jan. 1979)

The excellent results modern color control systems are capable of producing are only achievable by having competent, well-trained production, technical, and quality control personnel associated with the system. Many times only those people directly operating the instruments and computer are given training. Unfortunately, formulators and other key people involved with the total pigmentation process often do not understand instrumental color control. Without their understanding, a good color system may produce disasterous results.

This paper describes the degree of knowledge and type of training required at different operational levels of involvement with color control. Commercially available sources of training are discussed.

REACTIONS OF U.V. CURABLE RESIN FORMULATIONS AND NEAT MULTIFUNCTIONAL ACRYLATES II. PHOTOINITIATED POLYMERIZATION OF NEAT 1,6 HEXANEDIOL DIACRYLATE—G.L. Collins and J.R. Costanza

Journal of Coatings Technology, 51, No. 648, 57 (Jan. 1979)

The course of the benzoin isobutyl ether photoinitiated polymerization of 1,6-hexanediol diacrylate was monitored by changes in the IR spectra. The reaction profile revealed that the polymerization was inhibited by dissolved oxygen. This inhibition could be eliminated by the addition N,N-dimethyl aminobenzaldehyde and eosin-Y. The mechanism of this suppression of inhibition is discussed. With these additives, propagation appears to be quite rapid even at a level of 0.5% benzoin isobutyl ether. Residual unsaturation is lowered from 10-15% in neat hexanediol diacrylate to 3% by diluting the diacrylate monomer with butoxyethyl acrylate.

INTERNAL STRAIN IN SOLVENT-CAST COATINGS—S.G. Croll

Journal of Coatings Technology, 51, No. 648, 64 (Jan. 1979)

After mercury amalgamation of their tinplate substrates, the shrinkage of physically drying coatings was measured and identified with their internal strain. This strain arose from the solvent lost between the solidification point of the coating and its final "dry" state. The measurements showed no variation of internal strain with coating thickness or initial solution concentration.

A model is presented which explains the results quite successfully. It is based on the assumption that the solidification point can be identified with the solvent concentration which depresses the glass transition of the polymer to the ambient temperature.

SOME FACTORS AFFECTING CURE OF UV CURING INKS AND VARNISHES—G. Plews and R. Phillips

Journal of Coatings Technology, 51, No. 648, 69 (Jan. 1979)

The influences of pigmentation, photoinitiator type, curing atmosphere, radiation intensity, and film thickness, on the UV curing of inks and varnishes, were studied using infrared spectroscopy. The UV absorption spectra of the components, and theories of photoinitiation and oxygen inhibition, were used to interpret the results. Competition between photoinitiator and pigment for radiation was shown to influence both the degree of cure and the uniformity of cure in thicker films. Oxygen inhibition was greatly influenced by the choice of photoinitiator. The benefits of using focused radiation were found to disappear when an inert atmosphere was used.

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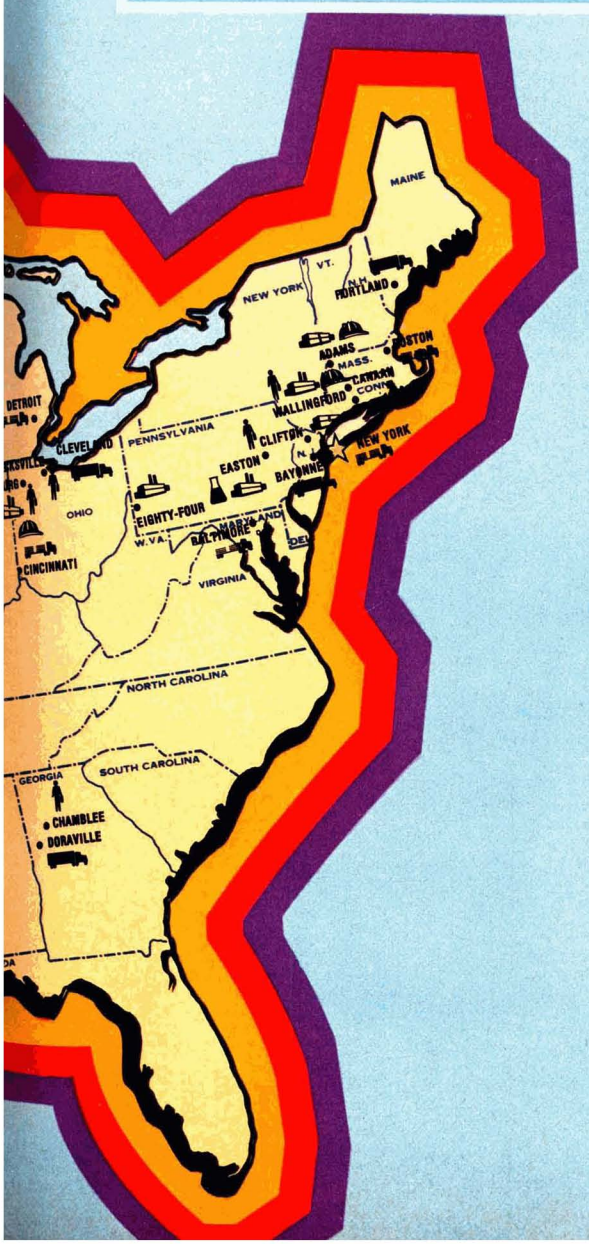

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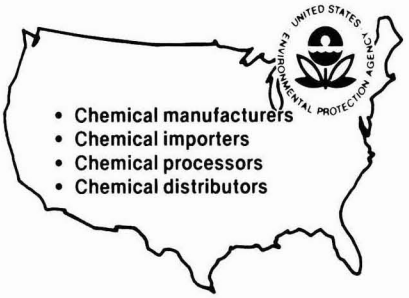

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NUMBER 78 JANUARY 1979

FEDERATION NEWSLETTER

FEDERATION NOW GOVERNED BY TWO GROUPS: BOARD OF DIRECTORS AND EXECUTIVE COMMITTEE

The reorganization of the Federation, which had been discussed for more than two years, became effective at the 1978 Annual Meeting. The Federation is now governed by:

Board of Directors: Composed of the three officers; three Past-Presidents; four members-at-large; and twenty-six Society Representatives.

Executive Committee: Composed of the three officers; the immediate Past-President; and three Society Representatives.

The Board will meet twice a year; the Executive Committee four times.

HIGHLIGHTS FROM FIRST MEETING OF NEW EXECUTIVE COMMITTEE

The first meeting of the Federation's new Executive Committee was held on November 4, in Chicago. Major actions of the committee were:

- That the Federation again hold a Friday Luncheon at the next Annual Meeting (St. Louis, October 3-5, 1979)
- That the University of Southern Mississippi proposal for a "Correspondence Course on Surface Coatings" be accepted and that the Finance Committee be requested to include $22,000 in the 1979 budget for the preparation of this course.
- That the Board of Directors be requested to approve Chicago as the site of the 1984 Annual Meeting and Paint Show.
- That scholarship funds for the 1979-80 academic year be awarded as follows: University of Southern Mississippi--$6,000; North Dakota State University--$4,000; University of Detroit--$2,000; Kent State University--$2,000; and University of Missouri-Rolla--$1,000.
- That $19,650 in appropriations to Federation committees be approved for 1979.

All actions of the Executive Committee are subject to approval/disapproval by the Board of Directors.

FEDERATION TO HOST MEETING OF SOCIETY THIRD-RANKING OFFICERS ON MAY 17

The Federation will sponsor a meeting of third-ranking officers of all 26 Societies, with Federation officers and staff, on May 17 in New Orleans. The Federation will reimburse the transportation expense of all who attend. This annual orientation meeting for Society officers has been a success since its initiation in 1977. The open session, with plenty of across-the-table discussion, provides the officers

with a closer look at Federation/Society matters and sheds light on their future presidential responsibilities.

The Federation Board will meet on the 18th; the Executive Committee on the 19th.

ACTIVITIES OF TECHNICAL, EDUCATIONAL, ENVIRONMENTAL, AND MANUFACTURING COMMITTEES

Here's an update on the current plans and activities of these four important Federation committees:

The Technical Advisory Committee (Chairman Colin Penny, of the Baltimore Society) met December 12 in Philadelphia to develop project recommendations for Society technical activity, and to pursue discussions on how to assist Society Technical Committees' efforts. A meeting with all Society Technical Committee Chairmen has been scheduled for March 30 in Atlanta. The Federation will reimburse the transportation expense for all who attend.

The Environmental Control Committee (Chairman S. Leonard Davidson, of the New York Society) met December 5 in Chicago. This group is addressing its efforts to disseminating current information on matters of government regulatory actions as they apply to the field of environmental control impacting on the coatings industry. To this end, an "Environmental Control Newsletter" will be published periodically (initially to be mailed to all Federation members). The first edition is scheduled for publication in mid-January and it will focus on the current situation as regards TOSCA and an update on solid waste disposal. The committee solicits member input on local impending regulatory activity to include in the Newsletter.

The Educational Steering Committee (Chairman John A. Gordon, Jr., of the St. Louis Society) will meet in Louisville on March 21 to discuss current and future educational programs. One of the major agenda topics will be the proposed correspondence course at the University of Southern Mississippi.

The Manufacturing Steering Committee (Chairman Don Fritz, of the Philadelphia Society) has scheduled a meeting on January 12 in Philadelphia to map activities for the coming year. Current programs will be reviewed and new areas of involvement will be discussed.

PAINT RESEARCH INSTITUTE TO SPONSOR MAY 1-2 SYMPOSIUM ON "ANALYTICAL METHODS FOR PRODUCT COMPLIANCE WITH REGULATIONS"

The Federation's Paint Research Institute will sponsor a symposium on "Analytical Methods for Product Compliance With Regulations" on May 1-2, 1979, at Battelle Laboratories, Columbus, Ohio.

Purpose of the symposium will be: (1) To inform suppliers, formulators, and users of methods available for the analysis of materials that are regulated or are likely to be regulated; (2) To assess the validity of mandated limits and sampling practices; and (3) To enable coatings chemists to select the most appropriate method for a given compliance problem, with consideration of the acceptability of the method to a referee.

The Program Committee is chaired by Dr. Ray Myers, Research Director of PRI. Working with him are: William Golton, of the duPont Co.; Richard Holsworth, of Glidden Coatings & Resins Div.; Percy Pierce, of PPG Industries, Inc.; John Vandeberg, of DeSoto, Inc.; and Dr. John Weaver, industry consultant.

ACTIVITIES OF FEDERATION'S CONSTITUENT SOCIETIES

BALTIMORE--Will sponsor a "Mid-Atlantic Coatings Exhibit" on March 16, at the Hilton Hotel in Pikesville, Md. Exhibit will feature 35 booths manned mostly by local reps of raw material and equipment suppliers.....Technical Committee will present a mini symposium on "Formulating Within the Law" on May 17.

CHICAGO--Coatings course at Elmhurst College has enrollment of 117.....Management Development Seminar scheduled for April 26.....Technical Committee working on: Acid-Base Interactions; Analysis of Coatings; and Accelerated Method of Screening Mildewcides.

DALLAS--Society and local PCA have offered Dallas Community Colleges the services of coatings industry personnel in development of a new program, "Chemical and Quality Control in the Paint and Coatings Industry."

CLEVELAND--November meeting was "Bosses Night" and many members were accompanied by their supervisors.

DETROIT--Society, local PCA, and Polymer Institute of University of Detroit are offering a 12-week course in "Modern Resin Technology." Began on January 8. Certificate will be issued upon successful completion.

GOLDEN GATE--Has instituted a Matching Funds Program for contributions to Paint Research Institute - similar to idea initiated by Cleveland Society in 1977. For every dollar companies and/or individuals contribute to PRI, Society will match, up to $500.....Local PCA presented Society with $500 in support of its educational program.....47 are enrolled in Coatings Courses.

LOS ANGELES--1979 Membership Directory is a very impressive publication - and - effective with this year, it contains advertising.

NEW YORK--Joint Educational Committee of Society and local PCA will sponsor "Fundamentals of Coatings Technology II" at New York City Community College, beginning February 7. Course consists of 13 two-hour sessions. Students receive three college extension units of credit upon successful completion.....Three retired members: Lou Eromenok (NL Industries); John Congleton (National Research & Development Labs); and Morton Treade (Reichard-Coulston) were elected Honorary Members.....New Technical Subcommittees may be formed to study: Soluble-non-Soluble Coalescents for Emulsions, Air-Drying Gloss Water Vehicles, Cross-Linking of Emulsions, High Solids House Paints, Low Cure Technology, Waste Disposal Recovery for Plant Re-Use.

PACIFIC NORTHWEST--The British Columbia Section is assembling a "Hazardous Chemicals Data" booklet, for use by shop floor operatives. The handy reference publication would include such items as chemical description, appearance, uses, physical appearance, and fire and health hazard data for a variety of chemicals used in coatings manufacture.

PHILADELPHIA--Joint Educational Committee of Society and local PCA are offering two courses: (1) ACS Course in Coatings Technolgy by Dr. S. Hochberg, of the duPont Co. Eight 2-hour sessions given immediately before Society regular and Technical Committee meetings. $150; (2) Color Matching - Theory and Applications by P.J. Sotorrio, of DeSoto, Inc. Five 2-hour sessions. $50.....Recent speakers at Technical Committee meetings discussed "Can Coatings," "Selling Technology Abroad," and "Temporary Coatings."

COMING EVENTS

Feb. 6-Mar. 2....University of Missouri-Rolla. Refresher Short Course for Painting
& Nov. 5-9 Contractors, Maintenance Engineers, etc. Rolla, Mo.

Feb. 28-Mar.2....Western Coatings Societies' Symposium and Show. Fairmont Hotel, San Francisco.

Mar. 5-9 .....University of Missouri-Rolla. Introductory Short Course on Composition of Paints.
& Sept. 10-14

Mar. 14-17.....Southern Society. Annual Meeting. Dutch Inn, Buena Vista, Fla.

Mar. 20-21.....Chicago Society. SYMCO '79.

Mar. 20-21.....Cleveland Society. 22nd Annual Symposium. "Advances in Coatings Technology." Baldwin-Wallace College, Cleveland.

Mar. 26-30 .....University of Missouri-Rolla. Basic Quality Control and Painting Inspector's Short Course.
& Sept. 17-21

Apr. 2-6.....University of Missouri-Rolla. Introductory Short Course on Tinting, Shading, and Matching Paints and Coatings.

Apr. 5-7.....Southwestern Paint Convention of Dallas and Houston Societies. Shamrock Hilton Hotel, Houston.

Apr. 9-10.....Washington Paint Technical Group. Symposium. "Uncle Sam Wants Your Paint - $100 Million Opportunity." Marriott Twin Bridges, D.C.

Apr. 23-27 .....University of Missouri-Rolla. Advanced Chemical Coatings Workshop.
& Oct. 22-26

May 1-2.....Paint Research Institute. Symposium. "Analytical Methods Used to Monitor Product Compliance With Regs." Battelle Labs., Columbus.

May 3-5.....Pacific Northwest Society. Symposium. Bayshore Inn, Vancouver, B.C.

May 3.....Detroit Society. Annual FOCUS Seminar. "Recent Advances in Automotive Coatings." Michigan Inn, Detroit.

May 17.....Society Third-ranking Officers Meeting.)
May 18.....Federation Board of Directors Meeting.) Hilton Hotel, New Orleans.
May 19.....Federation Executive Committee Meeting.)

May 21-25.....Kent State University. "Dispersion of Pigments & Resins in Fluid Media." Kent, Ohio.

May 22.....Pittsburgh Society. Symposium on "Corrosion Protection." Duquesne University, Pittsburgh.

June .....Golden Gate Society. Manufacturing Seminar. "Mixing Time '79."

June 4-29.....North Dakota State University. Courses in "The Coating Sciences." Basic Coatings Course, June 4-15. Strategy of Planning, Executing and Coordinating R&D Projects - and - Advanced Coatings Course, June 18-29. Fargo, N.D.

June 11-15.....Kent State University. "Coatings and Polymers Characterization."

June 25-29.....Kent State University. "Applied Rheology for Industrial Chemists."

Oct. 3-5.....57th Annual Meeting and 44th Paint Industries' Show of Federation. Convention Center, St. Louis.

Oct. 15-19.....University of Missouri-Rolla. Introduction to Paint Formulation.

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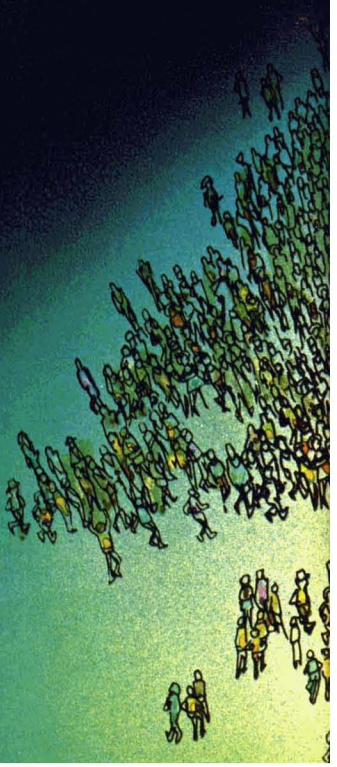


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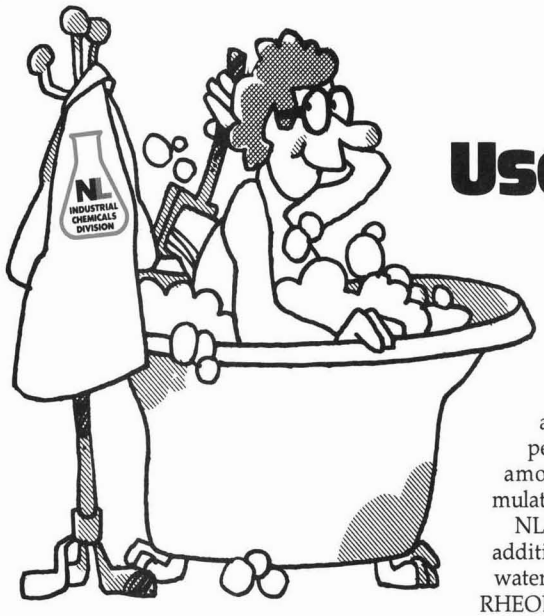

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FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Fall 1978 Council Meeting

Forty-four members of the Federation Council attended the Fall Council Meeting of the Federation of Societies for Coatings Technology on October 31, 1978 at the Conrad Hilton Hotel in Chicago, Ill.

The following were present:

Officers

President ..... John J. Oates
President-Elect ..... James A. McCormick
Treasurer ..... Harry Poth

Society Representatives

Baltimore ..... Alex Chasan
Birmingham ..... George Tennant
Chicago ..... Tom Daly
C-D-I-C ..... Herbert L. Fenburr
Cleveland ..... Thomas Keene
Dallas ..... Carlos E. Dorris
Detroit ..... Harry Majcher
Golden Gate ..... A. Gordon Rook
Houston ..... Willy C.P. Busch
Kansas City ..... Terryl F. Johnson
Los Angeles ..... William H. Ellis
Louisville ..... Joseph A. Bauer
Mexico ..... Tony Pina Arce
Montreal ..... Horace Philipp
New England ..... Charles Aronson
New York ..... S. Leonard Davidson
Northwestern ..... Lowell Wood
Pac. N'West ..... John A.J. Filchak
Philadelphia ..... J. Richard Kiefer, Jr.
Piedmont ..... James Bohlen
Pittsburgh ..... Gerry Ward
Rocky Mt. ..... J.D. Mullen
St. Louis ..... Howard Jerome
Southern ..... J.T. Robertson
Toronto ..... A. Clarke Boyce
Western N.Y. ..... Eugene LeVea

Other Members

Newell P. Beckwith
William Dunn
Neil S. Estrada
Donald J. Fritz
Milton A. Glaser
Philip Heiberger
Elder C. Larson
J.C. Leslie
Michael W. Malaga
Robert W. Matlack
Raymond R. Myers
Carroll M. Scholle
Howard G. Sholl
Joseph W. Tomecko
Willard W. Vasterling

Guests

Dr. Mart F. Kooistra, President of the Federation of Associations of Technicians in the Paint, Varnish, Lacquer and Printing Ink Industries of Continental Europe (FATIPEC); John Dahl (Pittsburgh); Mrs. Ruth Johnston-Feller (Pittsburgh); Deryk Pawsey (Pacific Northwest); Gerald West (Los Angeles); and Victor M. Willis (Chicago).

Staff

Frank J. Borrelle
Thomas A. Kocis

Executive Vice-President Frank J. Borrelle called the roll of members and reported a quorum present. The report of the Spring 1978 Council Meeting was approved as published in the July 1978 JOURNAL OF COATINGS TECHNOLOGY.

Reports of Officers And Staff

PRESIDENT OATES

With the assistance of a competent and dedicated Federation staff, I have proceeded, since my last report in May, to discharge my duties as Federation President. Among the activities I have been involved in are the following:

(1) Meeting with members of the Host Committee in the planning of our 1978 Annual Meeting;

(2) Meetings in Europe with officers of FATIPEC, OCCA, and the Birmingham Club;
(3) Attendance at the Annual Convention of the Canadian Paint Manufacturers Association;
(4) Meeting with officers of the Winnipeg section of the Northwestern Society;
(5) Meeting with the Joint Paint Industry Coordinating Committee; and
(6) Representing the Federation at the recent Annual Convention of the Mexican Association of Paint Manufacturers.

I would like to point out what I consider to be the major accomplishments realized (or about to be realized) in 1978:

- Completion of the revision of the Federation By-Laws, accomplishing, in fact, the re-organization of the Federation's governing structure;
- The funding and publishing of the Federation Paint/Coatings Dictionary;
- The establishment, on a routine annual basis, of the national meeting of all incoming officers of local Societies;
- The agreement by the Birmingham Club to arrange for continuity of representation and participation at future Council (or Board) meetings of the Federation.

It should be emphasized that any significant accomplishments realized in this past year developed out of ideas initiated and work pursued during the course of previous administrations. Any pride I feel stems from my having participated, over a number of years, in work aimed at serving a worthy industry in company with friendly, competent, and dedicated colleagues.

To these many people—members and officers of local Societies, Federation Committee chairmen, members of the Board and Council, and Federation officers and staff—I extend my deepest thanks. I am confident the Federation will be well-served by their continuing efforts.

JOHN J. OATES,
President

PRESIDENT-ELECT McCORMICK

Since the 1978 Spring Council meeting in Kansas City, the office of the President-Elect has participated in meetings with Host, Liaison, and Executive Committees. In September, the Joint Paint Industry Coordinating Committee met, producing several interesting internal committee actions which should produce results benefiting all members and participants of JPICC. We will also have attended the Canadian Paint Manufacturers Association meeting in Winnepeg, Canada.

During the last year John Oates, Frank Borrelle, and I have created a dialogue, attempting to bring the Federation to its members. A new format was developed for use during officer visitations to encourage member/officer dialogue. This parlance essentially developed into rather large Society executive committee meetings. The results have offered us several suggestions and exposed some oversights. Many of the suggestions offered have already been implemented and most of the oversights corrected. We feel this sort of dialogue is both valuable and necessary to the healthy existence of the Federation.

The responsibility of appointing Federation Committee chairpersons for the forthcoming year and the official Federation Representatives to other organizations has been properly discharged.

Our efforts to inspire and encourage member participation in Federation activities will continue. As it is said, value is received in direct proportion to the efforts expended.

JAMES A. MCCORMICK,
President-Elect

TREASURER POTH

I am pleased to report that the Federation is in excellent financial health. We are on budget and should show a surplus of income over expenses by year's end.

Since my last report in May, I have attended in behalf of the Federation the NSF Workshop and PRI Board of Trustees Meeting held at Kent State University in June; a meeting of the Executive Committee and the Host Committee in Chicago in August; the Dallas Society Meeting in September; and the New York Society Meeting in October.

In my travels, I have found a strong nucleus of members involved in initiating meaningful programs, but lacking support from the general Society membership. I have tried to emphasize the value of becoming involved and participating in Society and Federation activities. I have also attended to all of the financial duties connected with the office of Treasurer of the Federation and Treasurer of PRI.

I sincerely regret that this will be my last report to Council as an officer of the Federation. Recent events in my company, creating new responsibilities, have interrupted my succession through the chairs.

I wish to thank all of you for your confidence in electing me to this great honor, and also for the cooperation and hospitality you have shown me. Special thanks to the Federation office and staff for their excellent assistance. I shall never forget.

HARRY POTH,
Treasurer

The Council extended its thanks to Treasurer Poth for his outstanding service and dedication to the Federation during his term of office.

EXECUTIVE VICE-PRESIDENT BORRELLE

The February 1978 JCT Comment Page "crystal-balled" that 1978 would be a banner year. Indeed it will be as many of the expectations are now accomplishments. At year's end, the Federation can look back with pride to the achievements of 1978.

PUBLICATIONS

Paint/Coatings Dictionary: This long-awaited and much heralded reference volume will be on display at the Annual Meeting. Congratulations and thanks are extended to Stanley LeSota and the untiring members of his Philadelphia Society Committee (David J. Engler, Ruth Johnston-Feller, J. Richard Kiefer, Jr., Seymour Mark, John Landis, Michael McGroarty, Lothar Sander, Francis J. Willard). They established an unbelievable record of dedicated perseverance—13 lucky years with their noses to the Dictionary grindstone.

JCT: Production and advertising matters are satisfactory and in line with the income and expense budgets. Thanks are extended to the Publications Committee (Tom Miranda, Chairman) and the Editorial Review Board for their good cooperation during the year.

JCT Circulation is: member subscribers—6,381; non-member subscribers—2,592, for a total of 8,973. Figures reported last year were 6295 and 2635.

Year Book: The Society Representatives, at the May 1978 Council Meeting, recommended to the Executive Committee that the *Year Book* be published in two parts in order that information re key Federation and Society personnel be available early in the administrative year. They suggested that Part 1 consist of the By-Laws; Federation officers, Board, and committee chairmen; and Society officers and committee chairmen. Part 2 would include the Society membership rosters.

I have proposed a plan to the Executive Committee which should fulfill the request of the Society Representatives and keep the *Year Book* intact. Staff will prepare a "handbook" which will include most of the information requested in Part 1. Such a "handbook" is already underway and will be released within three weeks after the Annual Meeting.

Newsletter: Six editions were published so far in 1978. More than 2,000 copies are being distributed to Societies in bulk quantities. Some Societies mail them with their next regular meeting notice; some make them available at the next meeting. Because of timing, the bulk distribution is not the most effective means of communication. Staff is looking at the possibility of direct-mailing the Newsletter to all members.

Infrared Spectroscopy: The Chicago Society has completed its revision of this valuable book. The expanded edition will comprise 750 pages of spectra and 150 pages of text. The Society plans to turn over the publication manuscript to the Federation office before the end of the year.

Pictorial Standards: This publication of coatings defects on exterior exposure, by the Philadelphia Society, is also nearing completion.

Federation Series: The next unit, #27, will also be on Corrosion. It will be published early in 1979.

Memberships

The names of 6,424 members were published in the 1978 Year Book — 152 more than in 1977. A new and improved membership application form was mailed to the Societies in August.

Color-matching Aptitude Test

Three hundred sets of the 1978 edition of the CAT were made ready for sale in May and 50 have already been sold.

Annual Meeting and Paint Show

The 1978 Paint Industries' Show will be the largest in Federation history:

Paid Exhibitors	127	
Comp. Exhibitors	1	
Booths Paid	282	(29,600 square feet)
Booths Comp.	1	

For the third consecutive year, space was sold out early.

The program theme — "Search for Coatings Opportunities" — has brought forth several excellent papers and we commend the Program Committee (Fred Schwab, Chairman) for a job well done. We also are grateful to Tom and Wyn Nevins and Rick and Claudia Hille for their help and cooperation as co-leaders of the Host Committee.

The 1979 exhibit brochure has been completed and will be given to all exhibitors in Chicago.

Officers/Staff Travel

The Society visits schedule for 1978-79 has been mailed to the Societies. The visitation policy set by the Executive Committee is as follows: to most Society monthly meetings on an alternate year basis; to each of the annual (or biennial) special Society meetings; and to Sections of the Northwestern, Pacific Northwest, and Southern Societies every two or three years.

Societies visited by staff during 1977-78 were: Baltimore, Birmingham, Detroit, Houston, Louisville, New England, Northwestern, Pacific Northwest, Philadelphia, Pittsburgh, Southern, and Western New York. Also the Southwestern Paint Convention and the joint St. Louis-Kansas City meeting. At most of these, the Federation's slide program was shown.

Society Officers' Meeting

The second annual orientation meeting for Society officers was held in May and was very successful. Second and third-ranking officers participated. In May 1979 and future years, it will be for third-ranking officers only.

Attendance at FATIPEC Congress

M/M John Oates and M/M Frank Borrelle had the pleasure of representing the Federation at the FATIPEC Congress in Budapest, June 4-9. It was quite an enlightening experience. One of the highlights was the meeting of the "Coordinating Committee"—composed of the officers of FATIPEC, OCCA, SLF, and the Federation. A report on the Congress and minutes of the committee meeting were prepared and submitted to the Executive Committee. I also wrote a story about the Congress and it was published, with photos, in the August JCT.

We also had the privilege of attending the annual general meeting of the OCCA in London, after which we journeyed north for meetings with the Birmingham Club. The four of us are living testimony that Birmingham hospitality is superb. It is even better than that! The grand finale was a magnificent dinner, given in our honor. Reports on these meetings were also submitted to the Executive Committee.

Field Director

Tom Kocis has issued his own report so no details will be given here. He has administered the activities of the Educational and Manufacturing Committees and prepared two editions of the Manufacturing Newsletter. Tom has worked hand-in-hand with Stan LeSota, Chairman of the Directory Committee, and is responsible for all printing arrangements.

JPICC

Since 1972, the Federation has been a member of the Joint Paint Industry Coordinating Committee (JPICC), which is composed of the officers and top staff of the: Federation; National Paint and Coatings Association; National Decorating Products Association; and the Painting and Decorating Contractors of America. JPICC meets twice yearly and each group presents an update of its activities since the last meeting. At the most recent meeting, the four staff heads were appointed to a committee to study the feasibility of establishing local JPICC groups in two or three key cities.

Society Activities

For some time, I have wanted to prepare a compilation of all activities of our Constituent Societies. More is going on than one realizes. A request from the *American Paint Journal*

Convention Daily for a similar Federation-authored article was a good reason to undertake such a task. The 1977-78 compilation was completed and will appear in one of the issues of the *Daily* to be released at the Annual Meeting. An updated version will appear in the December JCT.

Reorganization

From all indications, the proposals to reorganize the Federation will be passed at the Council Meeting. I feel it is a good move - especially giving the Societies the responsibility of involvement in decision-making processes on the Board of Directors and Executive Committee.

On behalf of staff, I extend sincere thanks to President John Oates, the other officers, Board and Council Members, and committee chairmen for their cooperation and service to the Federation throughout the year. It was a pleasure for us to have worked with them.

I also express my thanks to the staff for their steady cooperation and professional work.

Frank J. Borrelle,
Executive Vice-President

DIRECTOR OF FIELD SERVICES KOCIS

Major involvement over the last few months has been in providing staff support for the production of the "Paint/Coatings Dictionary." To be published in mid-October, the 632-page Dictionary contains more than 5500 coatings-related terms, a thesaurus, and a bibliography of over 600 references, and culminates a 13-year effort by the dedicated members of the Definitions Committee.

Copies will be on display at the Federation booth at the Paint Show in Chicago, and orders will be taken there. As the result of advance publicity, approximately 300 copies have been ordered to date. Additional promotional efforts are being undertaken to publicize the Dictionary to all segments of the coatings and interfacing industries.

Meanwhile, work continues on the "Pictorial Standards for Coatings Defects," with publication expected in time to display copies at the Paint Show.

Committee Liaison

Educational: Society Educational Committee Chairmen were hosted by the Federation at meetings in Kansas City on September 15 and 16. The full group discussed items of interest at the national level on the first day, then broke into groups for discussion of regional matters on the second day.

Principal topics of discussion were: proposed correspondence course, for which support was reaffirmed; cultivation of student interest at the high school level in the coatings industry; continuation of the Federation scholarship program at North Dakota State University, University of Southern Mississippi, University of Detroit, Kent State University, and University of Missouri — Rolla; pursuit of work-study programs for students; and development of Society educational projects.

Reports on Society educational activities were submitted and will be published in a forthcoming issue of Journal of Coatings Technology. Also, updated information was provided on courses, symposia, and seminars available in the various Society areas, and this will be reflected in the revised "Guide to Coatings Courses," which will be published shortly.

Manufacturing and Technical Advisory: Both these committees are being reorganized for 1978-79, and the Chairmen of each have initiated preliminary planning for activities for the coming year. Staff support has been provided as required for these efforts.

Program: Close contact has been maintained with the Program Committee for the 1978 Annual Meeting in Chicago to accommodate follow-up correspondence with participants, as well as to make arrangements for on-site needs.

The scheduling for the 1979 Annual Meeting (October 3, 4, and 5, in St. Louis) dictated that the Program Committee for that event begin its planning early. Accordingly, the committee met September 25 and chose as the theme topic for next year's Annual Meeting, "Progress Through Innovation." A news release has been distributed to the trade press announcing the meeting and calling for papers which address the theme.

PRI Liaison

In addition to attending the PRI Trustees meeting of June 22 and 23, efforts continue in assisting in preparation and distribution of literature and slides for use in the "PRI Night" presentation at Society meetings.

Society Visits

In the role of Field Director I visited the Cleveland Society, as well as accompanying Treasurer Harry Poth and Executive Vice-President Frank Borrelle on their official visitation to the New York Society.

Meetings were held with the Executive Committees at each Society to discuss Federation activities and how the staff might assist local efforts. Major concern expressed has been in the area of programming, and several suggestions for assistance in this effort are being evaluated for possible implementation.

Thomas A. Kocis,
Director of Field Services

Paint Research Institute

We all know that the paint industry is undergoing unprecedented changes. And although the PRI is but a microcosm within the paint world, it is equally influenced by the changing needs and objectives. The present Board of Trustees, well aware of this transitional industrial climate, began the task of adapting the PRI to meet the needs of our industry. Although all avenues were considered, we made every effort to accomplish this without changing our essential character, objectives, or mode of operation.

Had 1977-1978 been a more "normal" time, we would have been immensely successful. We are more effective in coupling academe and industry in both planning and programming. We are sharing our problems and concerns with our membership. We are restructuring most of our programs into an interdisciplinary format. We are successfully sponsoring the Roon Awards Competition. We have held successful symposia and PRI nights. And most recently we planned and participated in a Workshop on Science of Organic Coatings. The latter was a momentous achievement because the program was sponsored jointly by the National Science Foundation, the Paint Research Institute of the Federation of Societies for Coatings

Technology, the National Paint and Coatings Association, the Organic Coatings and Plastics Division of the American Chemical Society and the Protective Coatings Division of the Chemical Institute of Canada. This is the first time that trade, professional, scientific organizations associated with the coatings industry have joined hands with the government in sponsoring an event for furthering science and technology and for improving interactions between industry, the universities, and government.

Already the consequences of this meeting are influencing the future direction of the PRI.

As the retiring PRI President, this is my final report. My May 1978 report to Council substantially states our present position. We have essentially made all the changes proposed and are now in a holding position. At this writing it appears that this holding position cannot be maintained. In the next few months, your new administration (PRI Trustees and Federation Directors) will have to consider several proposals and make significant decisions as to scope, structure, direction and level of funding to prepare the PRI for the 1980's. At this time anything said is premature or immature. For the same reasons, I am unable at this time to anticipate our next year's program or budget.

I do wish to thank the many people, too numerous to name, who were so helpful to the 1977 and 1978 Trustees — the Federation officers, the Federation Directors and Council, the PRI Trustees, active and honorary, the PRI Research Director, the Federation staff and the many Federation members who took the time and effort to voice their concerns and to offer suggestions. We listened to all. Without the massive help of the above, nothing would have been accomplished. Because of this, I can look forward to a significant growth of the PRI in size and in status. Serving the PRI and the Federation was a fulfilling and memorable experience.

PHILIP HEIBERGER,
President

Dr. Heiberger and Dr. Raymond R. Myers, Research Director of PRI, advised the Council that they and Roy Brown, of NPCA, had visited the National Science Foundation on October 4 — at the invitation of NSF. Purpose of the visit was to discuss a planning grant directed toward establishing the feasibility of expanding the present Paint Research Institute into a "bricks and mortar" central research institute at some university. This institute would serve two functions: (1) Facilitator of basic research in fields related to coatings and (2) Coupler between the research community and the coatings industry. The intent of NSF is to establish an institute that would become supported 100% by the private sector in five years.

The proposal for the planning grant has been prepared by Dr. Myers and will be presented for approval to the PRI Board of Trustees and the Federation Executive Committee. Further meetings will be held with NSF in November.

They indicated that the Department of Commerce has also shown some interest in supporting a central research institute.

Contributions to PRI were presented to Dr. Heiberger by the Houston, Kansas City, New York, and Piedmont Societies.

The Council extended its thanks and appreciation to Dr. Heiberger, retiring President of PRI, for his outstanding efforts and contributions to PRI during his two-year term.

Society Representatives Report

The Society Council Representatives met the previous evening and Chairman Eugene LeVea presented the following requests to the Board of Directors:

(1) That the proposed new By-Laws — regarding the composition of the Nominating Committee (Article V, Paragraph A. (1) — be changed so that two members of the committee shall be Society Representative members of the Board of Directors.

(2) That the By-Laws Committee prepare a model set of By-Laws for Constituent Societies that will include giving Associate Members voting rights and the opportunity to hold office.

(3) That under the proposed new organization, time be set aside at Board of Directors meetings for a discussion of Society matters, under the agenda heading, "Society Business."

By-Laws

The proposals to amend the Constitution and By-Laws of the Federation (as published in the February JCT, pages 21-34) were approved for first reading (with editorial changes) at the Spring Council Meeting of May 19, 1978.

The proposals, as revised, were published with the report of the Spring meeting on pages 38-51 of the July 1978 JCT, and were direct-mailed to members of Council and all Constituent Society officers.

Constitution and By-Laws

By-Laws Committee Chairman, Howard Jerome, presented the proposals for second and final reading, and requested a motion from the Society Representatives. Upon motion by Mr. LeVea, seconded by Mr. Chasan, the proposed new Constitution and By-Laws were approved unanimously and became effective immediately.

Thereupon, the meeting of the Federation Council was adjourned and President Oates convened the meeting of the brand new Board of Directors for 1977-78, as follows:

Officers: Messrs. Oates, McCormick, and Poth.

Past-Presidents: Messrs. Estrada, Sholl, and Vasterling.

At-Large Members: Messrs. Fritz and Larson.

Society Representatives: Messrs. Chasan, Tennant, Daly, Fenburr, Keene, Dorris, Majcher, Rook, Busch, Johnson, Ellis, Bauer, Pina, Philipp, Aronson, Davidson, Wood, Filchak, Kiefer, Bohlen, Ward, Mullen, Jerome, Robertson, Boyce, and LeVea.

Standing Rules

Mr. Jerome then presented the proposed new Standing Rules (July JCT, pages 52-60) to the Board of Directors for approval. As requested at the Spring Council Meeting (see "New Business," July JCT, page 37) he offered a new Article SR VII on "Open Meetings" as follows:

ARTICLE SR VII
OPEN MEETINGS

"A. Policy

"(1) Meetings of the Board of Directors are open to all members of the Federation as observers.

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

"(3) Invitations may be extended to specific members of the Federation should the President feel their presence would be necessary to the deliberations of the Board."

(Mr. Jerome noted that the present SR VII on "Committees" would be renumbered as SR VIII.)

Upon motion by Mr. Kiefer, seconded by Mr. Bohlen, the proposed new Standing Rules, as amended, were approved unanimously, and also became effective immediately.

Nominations And Elections

Because of an unexpected development regarding nominations, it is necessary to preface the election proceedings at the Council Meeting with the following report from the Nominating Committee which was included in the meeting package.

Report of Nominating Committee

It has become necessary for the Nominating Committee to amend the report which it presented at the Spring Council Meeting (July JCT, page 33). Harry Poth has informed the Executive and Nominating Committees that, because of increased business responsibilities, he is withdrawing his name as the nominee for President-Elect of the Federation for 1978-1979.

The By-Laws provide that the Nominating Committee present its report at the Spring Council Meeting which in effect terminates the activities of the committee. There is no provision for the committee to re-assemble in the By-Laws. However, the By-Laws do provide (Article XIV, Parliamentary Procedure) that where no parliamentary procedure is provided specifically in the By-Laws, then the question should be resolved pursuant to the latest revised edition of Robert's Rules of Order. The pertinent section of Robert's Rules of Order states in effect:

"A Nominating Committee is automatically discharged when its report is formally presented to the assembly, although if one of the nominees withdraws before the election, the committee is revived and must meet immediately to agree upon another nomination."

Accordingly, the Nominating Committee did meet by telephone, with all members participating, and places the name of Elder C. Larson, of the Houston Society, in nomination for the office of President-Elect of the Federation for 1978-1979.

The remainder of the report presented by the Nominating Committee at the Spring Council Meeting remains in effect.

NEIL ESTRADA, *Chairman*

Nominations

Mr. Estrada then presented the slate of candidates for officers, Board of Directors, and Executive Committee, as follows:

BOARD OF DIRECTORS

[*The new Board of Directors is composed of: three officers, 26 Society Representatives, the immediate Past-President; two other Past-Presidents; and four members-at-large.*]

- For President-Elect: Elder C. Larson, of the Houston Society.
- For Treasurer: William H. Ellis, of the Los Angeles Society.
- For Past-President Member: Neil S. Estrada, of the Golden Gate Society.
- For Board of Directors (members-at-large): four nominees for two 2-year terms—John C. Ballard, of the Louisville Society; John J. Kenney, of the Southern Society; Thomas J. Miranda, of the Chicago Society; and Kurt F. Weitz, of the Toronto Society.

The remaining four members (two Past-Presidents and two members-at-large) will be as provided in By-Laws Article XIII, Temporary Provisions, Paragraphs B and C.

EXECUTIVE COMMITTEE

[*The new Executive Committee is composed of: three officers; three Society Representatives; and the immediate Past-President.*]

- For Executive Committee (Society Representative Member): two nominees for one 3-year term—Howard Jerome, of the St. Louis Society; and A. Gordon Rook, of the Golden Gate Society.

The remaining two members (Society Representatives) will be as provided in By-Laws Article XIII, Temporary Provisions, Paragraph A.

Voting

Messrs. Larson and Ellis were elected President-Elect and Treasurer, respectively.

Mr. Estrada was elected as a Past-President member of the Board of Directors.

A secret ballot was conducted for the two 2-year terms on the Board of Directors and Messrs. Ballard and Miranda were elected.

A secret ballot was conducted for the one 3-year term on the Executive Committee and Mr. Jerome was elected.

New Business

Mr. Philipp and Mr. Boyce, of the Montreal and Toronto Societies, respectively, advised the Council that at the current rate of exchange, the $15.00 annual dues fee is costing each of their members about $17.25 in Canadian funds.

Conversely, they pointed out that every Canadian dollar contributed to the Paint Research Institute is worth about 15% less in American funds.

They wondered, therefore, if the Federation and/or PRI could establish a bank account in Canada to serve as a depository for both dues income and PRI contributions. Both could be used to defray the cost of any PRI research grants at Canadian institutions.

Mr. Kiefer moved that the Executive Committee be requested to look into this matter. Seconded by Mr. Wood and so ordered.

In Memoriam

We record, with deep regret, the passing of the following members of the Federation during the last year:

Baltimore

BLINOFF, VSEVOLOD — Retired
SHUGAR, JULIUS — Retired

Birmingham

TAYLOR, CYRIL J.A. — Retired

Chicago

OLSON, NORRIS E. — DeSoto, Inc.
PINE, MILTON K. — Retired

C.D.I.C.

ALLMAN, CLARK — Maumee Color Co.

Cleveland

HELMRICH, CHARLES W. — Seegott & Associates
EBERMAN, EDWIN C. — Retired

Dallas

METCALF, ELBERT L. — Retired
YOUNG, CLELL C. — Retired

Detroit

LA POINTE, ALEX — Ford Motor Co.

Golden Gate

BALLINGER, WALTER B. — Glidden Coatings & Resins Div.

Houston

DELAY, ROY E. — Crozier-Nelson Chemical Co.

Kansas City

MANN, NORBERT — Pratt & Lambert Co.
WALLACE, ROBERT G., JR. — Retired

Los Angeles

JOHNSON, K.C. — Retired
PALMER, HAL — Zynolyte Products Co.

Louisville

MENEFEE, WILLIAM D. — Hy-Klas Paint Co.
WHEATLEY, FRANCIS P. — Blatz Paint Co.

New England

DOLNICK, ARTHUR A. — Stahl Finishes Co., Inc.
TRUESDALE, ROBERT — Truesdale Co.

New York

FITZSIMMONS, H.F. — du Pont Co.
GERSON, MELVIN M. — Daniels Products Co.
KOPFER, MANNY — Retired
SLOAN, LOUIS — Retired

Northwestern

EASTMAN, RAYMOND — Retired
MINARIK, WILLIAM L. — H.B. Fuller Co.
WILSON, GUY — Retired

Philadelphia

ALLYN, GEROULD — Retired
ELSER, WILLIAM C. — Unichem Coatings Co.
MACFARLAND, WILLIAM H. — Richardson Paint Co.
SHEETS, VIRGIL — Retired
STOVER, ALBERT H. — Retired
WILLIAMS, JOHN, JR. — Retired

Pittsburgh

ISACCO, ANTHONY J. — Puritan Paint & Oil Co.
WEISS, ALBERT J. — Society President (1962)

St. Louis

HARLAND, WALTER J. — Retired
SCHULTE, CATHERINE — Schulte Paint & Lacquer Co.

Southern

BURKS, CHARLES L., SR. — Retired
ROTHERBERG, HOWARD R., SR. — Retired

Toronto

PANKO, STEVE J. — Bayer (Canada) Ltd.

Western New York

ROWE, ROBERT G. — Retired

CARROLL M. SCHOLLE
Chairman, Memorial Committee

Committee Reports

A.F. VOSS/AMERICAN PAINT JOURNAL AWARDS

Six Society papers were submitted in 1978. The winners were:

REFERENCE AND REVIEW — First Prize ($150) — "An Infrared Spectroscopy Atlas for the Coatings Industry" — Chicago Society.

TECHNICAL — First Prize ($150) — "Comparison of Methods to Determine Water Content of Emulsion Paints" — Golden Gate Society.

PRACTICAL — First Prize ($150) — "Caustic Cleaning Apparatus for Use in Small Paint Plants" — Toronto Society.

In addition to the above papers, the following presentations received HONORABLE MENTION:

"Study of Organic Titanates as Adhesion Promoters in Acrylic Systems" — Cleveland Society.

"Factors Influencing Dry Properties of a Water-Soluble Alkyd" — Kansas City Society.

"Use of Air Pads as Pallet Trucks in Moving Materials in a Paint Plant" — Toronto Society.

UMBERTO ANCONA,
Chairman

CORROSION

The Corrosion Committee activity has centered around the work in progress at the Steel Structures Painting Council. This effort has been directed by John Keane and is described herein.

PROJECT PACE

Project PACE (Performance of Alternate Coatings in the Environment) is designed to evaluate the durability of new types of coatings raw materials and surface preparation methods for structural steel. These new paint systems have been intensely developed by the industry to avoid possible adverse environmental effects, polluting solvents, suspect heavy metal pigments, other toxic ingredients and dry sandblasting. The program is developed to provide information on alternate coating systems designed to protect steel economically from corrosion while still complying with present and expected legislation and rules governing pollution, conservation, toxicity and safety.

Some unique features of this SSPC study are:

(1) Extensive controls, repeated periodically and correlated with 25 years of SSPC exposures.
(2) Only promising products accepted for evaluation.
(3) Results expressed in generic terms, when possible, for maximum applicability.
(4) Proprietaries identified only if outstanding and only with manufacturer's approval.
(5) Open-ended — Promising products and methods are welcome.

The PACE project is sponsored by a group of outstanding organizations in industry and government including: The Federation of Societies for Coatings Technology, American Iron and Steel Institute, American Institute of Steel Construction, Pennsylvania Department of Transportation, Federal Highway Administration, Steel Plate Fabricators Association, and the U.S. Environmental Protection Agency.

SURFACE PREPARATION PROFILE

Both users and producers of steel have long recognized that coating performance can be influenced not only by the degree of surface cleanliness but also by the profile of the clean steel surface. A program was therefore undertaken which has already provided interim answers to many questions such as the following:

(1) What effect does profile have on performance of various generic coatings in typical environments?
(2) What are the relative effects of cleanliness, oiliness, pre-rusting, coating and environment?
(3) What methods and equipment can be used most effectively for measuring profile or blast cleaned structural steel?
(4) What are the effects of abrasive size, degree of cleaning, and other blast cleaning parameters in creating surface profile?
(5) What can be learned about the mechanism of profile formation and the resulting surface?

Work to date has established new concepts, such as exceedingly narrow limits on profile appear to be less important than coating thickness for most well-formulated coatings; methods developed or standardized for effectively measuring profile; and the effect of abrasive size, rate of cleaning angle, etc., on profile set forth.

The mechanisms of surface preparation and profile formation have been glimpsed and illustrated. These indicate the possibility of over-cleaning and developing "hackles" as well as under cleaning; non-metallic abrasives leave hundreds of residue particles on each square inch of surface, but still provide in many cases an even better surface for coatings than metallic abrasives do.

This work is being continued in order to verify and greatly extend these breakthroughs, by observation of outdoor exposure panels, studies of profile measurement, and expansion (under U.S. Navy sponsorship) to include severe marine environment.

TOPCOATING OF ZINC COATINGS

Although zinc-rich paints and other zinc coatings represent, in many ways, a uniquely effective class of protective coatings for steel, their continued use is limited by problems of topcoating. A statistically designed experiment has therefore been undertaken to test, with a reasonable number of specimens, the interaction between the various types of zinc primer, generic topcoat, tie-coat, pre-weathering, surface preparation, and exposure location. Empirical evaluations have been carried out in accelerated salt fog cabinets, marine environment, industrial location and typical coke plant site. Problems in application and in early incompatibilities have been reported and the causes of topcoating failure are being explored. Current work includes regular inspections, examination with scanning electron microscope, electrochemical tests, and correlation with related SSPC evaluation on the Golden Gate Bridge and other structures. By making zinc rich coatings more reliable and effective, this type of study tends to enhance the reliability and performance of structural steel.

NEW SURFACE PREPARATION METHODS

A survey of new surface preparation methods is being made in order to identify promising or creative new methods for cleaning surface of steel preparatory to painting. This survey has included visits to cleaning operations and shipyards in the U.S., Canada, Great Britain, and Denmark, as well as a computerized literature search and interchange of information with both innovators and users. Three SSPC meetings of

leading surface preparation specialists have focused on this problem, and additional suggestions are still welcome. (Sponsorship by U.S. Maritime Adm.)

Low-Solvent Coatings

There is widespread uncertainty in both industry and government regarding future regulations affecting the use of any organic solvents in coating formulation for structural steel. There is an almost equal uncertainty regarding the determination and the potential of the huge coatings and supplier industries to develop high solids coatings, water-base paints, and other products to meet these needs. For this reason SSPC has undertaken an intensive survey of both the prospective regulations and research outlook for meeting such regulations. As with all of its projects, the SSPC openly welcomes any information bearing on this industry-wide problem, particularly as it is likely to affect the painting of bridges and other highway steel.

Coatings Evaluations

The SSPC continues to observe and correlate the performance of both new and established coating systems in a range of environments throughout the country. These include panel tests in mild industrial environments (e.g., Neville Island, Pittsburgh, Pa.); marine environment, (Kure Beach, N.C., Bermuda, San Francisco Bay area, etc.); in severe industrial environments, (coke plant, chemical plants); urban (Mellon Institute); and accelerated test environments (SSPC salt fog cabinets, humidity cabinets, Kesternik cabinet, Weather-Ometers, etc.).

In addition the SSPC continues to monitor a series of field tests being carried out on such structures as the Golden Gate Bridge, Ambridge Water Tank, and Delaware Memorial Bridge, the Chesapeake Bay Bridge, the George Washington Bridge, the Robert Moses Bridge, and the Bessemer and Lake Erie Bridge.

These exposures constitute a data bank uniquely effective in evaluating new or proposed coatings, since each exposure represents a known SSPC surface preparation, standard thickness and application, exposure in known environments, and periodic rating according to SSPC standard methods by a balanced group of SSPC inspectors. It has been proposed that these exposure ratings become the basis for a computerized compilation of coating experience on large numbers of structures.

Other Research Studies

Other studies being continued include a project on optimizing paint film thickness and an exploration of a special paint application method which gives preferential protection to exposed edges on structures.

Dean M. Berger
Chairman

DEFINITIONS

Finally, the *Paint/Coatings Dictionary* will be available for sale by mid-October and will be on exhibit at the Federation booth at the Paint Industries' Show. It has 632 pages, with about 5500 entries, a thesaurus, and a bibliography of more than 600 references.

Now that we have completed the dictionary, it is not too early to start planning a succeeding edition, which we envision as a more encyclopedic, illustrated volume, where illustrations, tables, and structural formulae can be put in wide margins to complement the definition.

We are now recruiting members from the various Societies for this longer range endeavor and are looking for dedicated workers.

Stanley LeSota
Chairman

EDUCATION

A meeting of the Steering Committee of the Education Committee was held in St. Louis in March. As a result of this meeting, a meeting of the entire committee was scheduled for September 15 and 16, in Kansas City.

At the Kansas City meeting it was decided that individual Societies would continue the work on slide-tape presentations already in progress although there was some question about the frequency of use of those already completed and in circulation.

Each Society was urged to complete a survey of educational opportunities available in their local area and to get the information to the Federation Office as soon as possible. This is to bring our current listing up to date. Area chairmen are following up on this and results should be available soon.

The subject of a correspondence course was brought up again and the decision of USM to withdraw their proposal was explained. There was a strong feeling that something like a correspondence course was definitely needed. No other organizations have expressed willingness to develop and administer such a course and the ACS lecture course does not seem to be readily adaptable to meet this need. It was decided that USM should be approached again and, if there is any interest on their part, it should be arranged for people from USM to meet with the FSCT Board of Directors at the 1978 Annual Meeting to decide, once and for all, if this project will be carried on or dropped.

Universities with coatings courses have been asked to submit requests for scholarship money for the 1979-1980 year. Requests have come from:

North Dakota State University	$ 4,000
University of Southern Mississippi	6,000
University of Detroit	2,000
Kent State University	2,000
University of Missouri-Rolla	1,000
	$15,000

The University of Southern Mississippi and Kent State University report increasing interest and enrollment in coatings oriented courses. The other three seem to be about stabilized with the University of Missouri-Rolla just beginning to rebuild their coatings course.

The situation at all the schools with coatings courses is that there are not enough students enrolling in the courses to provide graduates to fill the jobs that are available. The Education Committee is urging individual Societies to become active in promoting interest in Coatings Science at the high school and junior high school level. Several Societies have programs of this nature at the present time and others should be active in this work. With but few exceptions there are more jobs available than people to fill them. The prospects for the future are that more technically trained persons will be needed in the coatings industry to meet the demands of changing technology and increasing government regulations.

Another topic of discussion was the hiring of students in coatings courses for summer work. This can give industry a chance to observe the students in real work situations without having a long-term commitment to hire them after they grad-

uate. Furthermore, it gives the students a taste of the industrial world so they can decide if they want to continue. Successful associations give companies a chance to bring the same students back for several years to provide vacation replacements and the students are helped by the experience and the money they earn.

The next meeting of the Steering Committee of the Education Committee will be held in Louisville in March.

Each regional chairman will arrange a meeting of the regional members during the year. Each Society will arrange to pay expenses for their representative.

JOHN A. GORDON, JR.,
Chairman

LIAISON

Since the Council Meeting in Kansas City in May, the activities of the Liaison Committee have centered about the FATIPEC meeting in Budapest, Hungary on June 9, 1978 and on the liaison functions at the Annual Meeting, in Chicago.

Representing the Federation at the FATIPEC meeting were President John Oates, Executive Vice-President Frank Borrelle, and Liaison Committee members Newell Beckwith, Fred Daniel, and Howard Gerhart. Other U.S. attendees were Fred Ball, W.B. Bartelt, J.H. Braun, B. Burachinsky, R. Christenson, W. Georgov, J. Hortensius, G. Hudson, L.P. Larson, P.E. Pierce, D.C. Prieve, J. Rooney, D. White, Z. Wicks, and D.T. Wu.

Five papers were presented by Federation people - Gerhart, Hortensius, Pierce, Wicks, and Wu. A special meeting ("Coordinating Committee") of the representatives of FSCT, FATIPEC, OCCA, and SLF was held on June 9, where several matters of common interest were discussed. It was suggested that such a "Coordinating Committee" of the various international organizations might be a valuable permanent organization for all the groups involved and that the formation of a "Secretariat" be considered.

Five overseas papers will be presented at this Annual Meeting. They are:

"APS - A New Coatings System" — K. Brugger and H. Lauterbach, CIBA-GEIGY, Basel, Switzerland

"New Concepts in the Formulation of Gloss Latex Paints" — John Bax, Scott-Bader Co., Ltd., Northamptonshire, England. Presented on behalf of OCCA.

"Information - Vital Paint Raw Material" — D. Dasgupta, Paint Research Association, Middlesex, England.

"Part of Diffusion in the Electrochemical Passivation of a Painted Metal" — Dr. Marcel Piens, Laboratoire de la Profession, Limelette, Belgium. Presented on behalf of FATIPEC.

"Role of Scandinavian Institute's Research in Seeking New Coatings Opportunities" — Charles Hansen, Scandinavian Paint & Printing Ink Research, Copenhagen, Denmark. Presented on behalf of SLF.

A meeting of the "Coordinating Committee" of the various national groups will be held at noon on November 2. A reception for overseas visitors will be held on the same day.

M.A. GLASER,
Chairman

MMA AWARDS

The 1978 winners of the Materials Marketing Associates Awards ($350 each) — for notable achievements by Constituent Societies — were the Baltimore Society (for its activities in providing correlative testing services) and the Los Angeles Society (for its liaison efforts on behalf of the coatings industry at hearings of various regulatory agencies in California).

DONALD J. FRITZ,
Chairman

MEMBERSHIP

Ten years ago at the Annual Meeting in New York, the 5000th Active member was inducted into the Federation; the latest available membership figures based on the 1978 *Year Book* show only 4600, a drop of 8%. Over that same span of time, the number of Associate members has risen from 787 to 1526 — an increase of 200%! As a result there has been an increase of only 10% in the *total* number of members. This change in composition is likely the reason behind a recent Federation questionnaire showing Associate members in half of the Societies serving on boards and voting on Society business and holding office in a third as well.

Since it is the duty of this Committee — "to encourage and assist the Constituent Societies in undertaking continuing and constructive programs" — it is recommended that Society Membership Chairmen receive copies of the Educational Committee's "Guide to Coatings Courses, Symposia and Seminars". This publication can be a useful tool for them to follow up non-Federation registrants of local programs as possible applicants for their Societies.

After the return of the 1978 membership lists by the respective Societies and where losses appeared to have occurred, personal letters were sent to them for further action, listing names of local companies (obtained from the latest *Paint Red Book)* which have no members in the Federation. These are but two more sources remaining to be developed in addition to the ones given in the Spring 1978 Report. As has been said — "There can be no gain without (pain) effort".

It is further recommended that the geographical segregation of nonmember registrants to the Annual Meeting be made a permanent feature as an aid to local Society Membership Chairmen. Also, Constituent Society membership figures should be included with delegate packages for Spring Council and Annual Meetings as their importance cannot be underestimated. The annual compilation of the Society Membership figures by the Federation staff has been invaluable in the analysis of the status of the various classes of members and should be continued.

A revised membership application form has been sent to all Societies. The interchange of ideas, i.e., good communication, by local membership chairmen, to aid their programs should be coordinated by the Field Director in the form of a periodic Membership Committee newsletter.

The Chairman wishes to thank the Committee and Federation staff for their past cooperation and contributions.

HORACE S. PHILIPP,
Chairman

METRIC SYSTEMS

This period saw the completion of the Metric Preparedness Survey. The results have been published as a "Metric Corner" article in JCT. The summer period is usually a time of low activity and this one was no exception. No committee meetings were held. Contributions to "Metric Corner" have been continued. Liaison with NPCA's Metric Task Force was continued by receiving their literature and by attending their

meeting. Also continued was liaison with CPMA and with the Canadian Metric Commission, the undersigned being a member of Sector Committee 3:08 of the latter.

The very slow progress in arriving at an industry-wide standard for the physical dimensions — as opposed to capacities — of metric paint cans is a matter of grave concern to the chairman. It is to be hoped that recent moves by NPCA's Metric Task Force will help to speed up this long overdue decision.

E.L. HUMBURGER,
Chairman

PROGRAM

On December 8, 1977, the Program Steering Committee met to begin plans for the 1978 Annual Meeting Program. "Coatings: The Search For Opportunities" was the theme selected.

In an editorial comment in the January 1978 JCT, Tom Kocis aptly expressed the committee's intent to present a program having a positive outlook:

> "Along with their brethren in other industries, coatings manufacturers have in recent years faced a variety of challenges that have sometimes seemed almost insurmountable. The list of adversities is almost a litany: growing governmental regulations; energy shortages; spiraling costs; product liability claims; and on, and on. Individually and collectively they have impacted heavily on the business community, leaving all too often a negative outlook for the future.
>
> "So, it's refreshing to hear that . . . the theme for the 1978 Federation Annual Meeting in Chicago will be: 'Coatings: The Search for Opportunities.'
>
> "This accentuating of the positive should attract a goodly number of presentations on the potential for coatings that will add new dimensions to their traditional roles, and should make for an upbeat program.
>
> "At Chicago, the word will be 'not problems, but opportunities.' "

Now, the plans have been completed and our committee believes that an outstanding program is on tap. Attendees should have no problem in finding topics of interest among the 50 planned presentations.

I am most grateful for the help of the Program Steering Committee members, Harvey Beeferman, Gordon Bierwagen, Moe Coffino, Hugh Lowrey, and Tom Miranda. Each member contributed greatly in assembling this program.

Also, my sincere thanks to Frank Borrelle, Tom Kocis, and the Federation staff for their valuable assistance. Their prompt and efficient handling of mailings, speaker contacts, program arrangements, etc., made the job of Program Steering Committee Chairman an easily-managed task. I trust that other committee chairmen also avail themselves of the professional back-up help the Federation office is equipped to provide.

Finally, my personal thanks to President John Oates for giving me this opportunity to work with a great group of people. It has been a most pleasant and rewarding experience.

FRED G. SCHWAB,
Chairman

PROGRAM AWARDS

The 1978 awards, for the best presentation of a Society paper, were won by:

FIRST PRIZE ($100) — Steven D. Johnson (Cook Paint & Varnish Co.), of Kansas City Society.

SECOND PRIZE ($50) — Alun G. Morris (L.V. Lomas Chemical Co. Ltd.), of Toronto Society.

LOWELL CUMMINGS,
Chairman

PUBLICATIONS

We have been able to maintain an adequate supply of papers. This has been achieved by personal contact, surveying appropriate symposia and meetings for quality papers, and encouraging submission of papers from foreign authors.

We have supported the Program Committee in obtaining papers and speeches for the Convention.

The membership of the Publications Committee and Editorial Review Board will be reviewed and appropriate changes made.

Your Chairman participated in the Symposium on the Science of Organic Coatings — held at Kent State University.

Book reviews are continuing and State-Of-The-Art Survey Papers have been added.

THOMAS J. MIRANDA,
Chairman

ROON AWARDS

A total of six papers was submitted for the 1978 competition.

Prior to June first, we had every reason to expect at least a fair showing of good quality papers. Three last-minute cancellations caused a definite deterioration of the competition quality and in the end, there was a question as to how many prizes should be awarded. However, the committee elected to award a full complement of prizes. It was further concluded that a tie score for third and fourth prizes was best resolved by awarding two third place prizes and splitting the prize money for third and fourth places equally between the two papers.

The new rules for this year allowed the entry of a prize-winning paper from the paint industry that would not have been eligible under last year's rules. The committee recommends that efforts continue so that the rules and the competition remain responsive to the needs of the coatings industry.

The winners selected from the papers submitted were:

FIRST PRIZE ($750) — "Cathode Reactions and Metal Dissolution in Cationic Electrodeposition" — Dennis G. Anderson, Edward J. Murphy, and John Tucci III, of DeSoto, Inc., Des Plaines, Ill.

SECOND PRIZE ($500) — "Effect of Humidity and Other Ambient Conditions on Evaporation of Ternary Aqueous Solvent Blends" — Albert L. Rocklin, of Shell Development Co., Houston, Tex.

THIRD PRIZES (tie-$250 each) — "Rheological Properties of Styrene/Acrylic Polymers" — H.P. Schreiber and G. Thibault, of Ecole Polytechnique, Montreal, Quebec; and

"Single-Grade Rutile TiO_2 Concept for Interior Latex Trade Sales Systems" — Calvin C. Tatman, of Glidden Chemical/Metallurgical Div., SCM Corp., Baltimore, Md.

(All of the above papers were published in the November 1978 JCT – Ed.)

BILL SHACKELFORD,
Chairman

SPECIFICATIONS

The Specification Committee has been in existence for 13 years (its inception was at the 1965 Annual Meeting, under Chairman Neil Estrada) and has made noteworthy contributions during the ensuing years toward the development of sound specifications for the Federal Government, certain State Governments, and local specification writing bodies, such as the Painting and Decorating Contractors of America.

However, since most of the specification development and writing activity through the years has originated in the three sections of the Pacific Northwest Society and the Golden Gate Society, one must question the need for and viability of a National Committee. For some reason, specification development has never manifested itself as a basic need in other areas of the Federation. There has been response to specific requests for input, but there has never been initiation and completion of a specification development project except on the West Coast. This indicates that, for the most part, development of specifications has little appeal and almost no priority for the paint industry. Perhaps a part of the problem is the passive attitude incorporated in the duties of the Specification Committee outlined on page 75 of the 1978 *Year Book*.

For example, it is increasingly obvious that attempting to maintain liaison with Governmental Specification writing bodies and acting as an industry clearinghouse for distributing proposed specifications has become almost nonproductive for the Federation. Long-existing Government entities which used to be cooperative are under new management and are increasingly adopting the same adversary role as the more recently created environmental, safety, and other regulatory agencies.

Paradoxically, even though the climate for cooperation with many major Governmental specification writing activities has chilled, there exists a major thrust from the Office of Federal Procurement Policy for "off the shelf" procurement of common-use items manufactured to industry standards. However, the major problem with the common-use item "paint" is that there is no industry-wide standard for *quality!* Everyone connected with the paint industry knows the quality and price variabilities of the products offered in the marketplace and the difficulties encountered in determining the "best buy" for a particular end use.

Considering all of the factors, such as the inability of meaningful industry input into the specification development effort by Governmental bodies, the proliferation of regulatory groups, and the need for an industry consensus of quality before someone else defines it, I suggest that the Federation Specification Committee duties be oriented away from the passive role of a clearinghouse to a more active role in the development of industry quality standards. This role should interface with the newly established ASTM D1-Subcommittee-41.

I know this proposal will not "ring bells" immediately with the majority of the paint industry because of deep-seated feelings and proprietary concerns of what is best! Notwithstanding this, I think it is time for the industry to pool its collective "know bests" and begin to establish standards for paint product quality in the same manner as the plywood and plastic pipe industries have done.

During the next year the Specification Committee proposes to explore in a positive manner the feasibility and practicality of developing industry-wide standards or indices for coatings properties, such as: spreading rate, hiding power, gloss, washability, and scrubability, and application ability. Each index would be determined by established and universally known test procedures. Because of the number of industry quality levels and end uses, it is anticipated that a given manufacturer will have products with varying indices for individual parameters, and will need some means of expressing the overall quality level in one index. This problem will be considered by the committee.

JOHN A.J. FILCHAK,
Chairman

TECHNICAL ADVISORY

In some years past, there have been instances when the Federation's Program Committee has had to cope with an embarrassment of riches in terms of an almost excessive number of Society papers for the time available at the Annual Meeting. In more recent years, the danger of this embarrassment has been replaced by fear that there will hardly be enough papers for a respectable showing.

Somehow, the Societies do come through, as they have this year, with six papers from five Societies, the Toronto Society setting the pace with two. Following are the Societies that will be represented, and the titles of their papers:

Chicago: "An Infrared Spectroscopy Atlas For The Coatings Industry."

Cleveland: "Study of Organic Titanates as Adhesion Promoters in Acrylic Systems."

Golden Gate: "Comparison of Methods to Determine Water Content in Emulsion Paints."

Kansas City: "Factors Influencing Drying Properties of a Water-Soluble Alkyd."

Toronto: (1) — "Caustic Cleaning Apparatus For Use in Paint Plants;" and (2) — "Use of Air Pads as Pallet Trucks in Moving Materials in a Paint Plant."

The extent to which this group of papers appeals to the spectrum of interests from theoretical to practical is most gratifying. The Chicago Society certainly deserves special recognition for another opus that, like its first publication on infrared spectroscopy, involved an immense amount of work by a devoted band of collaborators. The new Infrared Atlas, with its scholarly treatment of the theory of qualitative and quantitative analysis by infrared spectroscopy; its review of modern instrumentation, its 1350 spectra, and its comprehensive list of literature references, is bound to achieve the worldwide recognition that it deserves, and that was accorded to its first publication. The reputation of this work will reflect credit on the Chicago Society and the Federation, as well as the authors.

Having commented in several previous reports on the growing difficulty of obtaining volunteer cooperators for Society technical projects—a phenomenon certainly not limited to the Federation among professionally-oriented societies these days—further remarks in this vein would be redundant. I believe that the wisdom and generosity of the Federation Board in approving allocation of funds for the national meetings of Society Technical Committee Chairmen in 1976 and 1977 had a demonstrably good effect in improving morale, suggesting good ideas for committee recruitment and direction, and, ultimately, in promoting the sense of commitment which has yielded these papers, and which we hope will yield many more.

After my service from 1974 through 1978, chairmanship of the Technical Advisory Committee is being handed on to Colin D. Penny, of the Baltimore Society. I have first-hand knowledge of Mr. Penny's fine record of service in the educational and technical activities of the Federation, and I believe that the Federation is fortunate in his willingness to accept this assignment.

SID LAUREN,
Chairman

TECHNICAL INFORMATION SYSTEMS

1978 Federation Annual Meeting Program

The Technical Information Systems Committee (TISCO) has arranged a two-hour program on Information Management.

Foreign Language JCT Contents

Last spring the committee suggested that each issue of the JCT carry the usual Table of Contents in English, plus Tables of Contents in French, German, and Spanish, and then appealed to Society Council Representatives for help in locating volunteer translators. In response to this request, seven Federation members volunteered their services as translators. The decision of how and when best to implement this translations project has been left up to the Federation Staff.

JCT Keyword Subject Index

Once again committee members are actively engaged in the selection and compilation of keywords for the 1978 JCT Keyword Subject Index, scheduled to appear in the December 1978 JCT issue. This index will follow the same format as the 1977 Index prepared by the committee.

Technical Articles in Other Periodicals (TAOP)

Committee members continue to scan leading technical coatings periodicals for articles suitable for inclusion in the JCT column/page TAOP. For those unacquainted with the column, it is a compilation of contents of leading technical coatings periodicals, chiefly European.

"Paint /Coatings Dictionary" Proof

At the request of the Definitions Committee Chairman, assistance in reading page proof for the *Paint/Coatings Dictionary* was provided.

Helen Skowronska,
Chairman

TRIGG AWARDS

The winners of the 1978 awards for the most interesting reports of regular Society meetings are:

First Prize ($100) — Donald I. Jordan, of Cargill, Inc., Secretary of the Los Angeles Society.

Second Prize ($50) — Ted Favata, of Triangle Paint Co., Secretary of the Golden Gate Society.

The committee also wishes to recognize the high-quality of meeting minutes of Saul Spindel and Sidney Rubin who shared the Secretary's job in New York and William Holmes, of Dallas, who placed third and fourth, respectively.

Gus W. Leep,
Chairman

DELEGATE TO NPCA AND GOVERNMENTAL AGENCIES (ENVIRONMENTAL CONTROL)

The following is a report of the activities of your Delegate to the NPCA and Government Agencies (Environmental Control) since January 1, 1978.

January 16 — Met with the officers and other interested parties of the Mexican Society to give them an update on Environmental Control legislation in the United States and to tell them of our method of working with governmental agencies.

March 17 — Attended an EPA-Burns & Roe seminar on the subject of Federal Environmental regulations regarding Water Pollution Control.

April 4 — At the request of the Public Affairs office of EPA Region II, I prepared and sent them a profile of the Federation and the extent of it's interest in Environmental Control matters.

April 5 — Represented the FSCT at a meeting of the NPCA Air Quality Task Force.

May 24 — Represented the FSCT at a meeting of the NPCA Water Quality Task Force.

June 8 — Represented the FSCT at a meeting of the NPCA Air Quality Task Force.

August 23-24 — Represented the FSCT at a meeting of the NPCA Water Quality Task Force.

September 13 — Represented the FSCT at a meeting of the NPCA Air Quality Task Force.

1978 Convention — Arranged for the Speaker from the EPA and am moderating the panel on Water Pollution Control.

Reports of the NPCA meetings mentioned above were submitted to the Journal of Coatings Technology for publication.

Gabriel Malkin,
Delegate

DELEGATE TO NATIONAL FIRE PROTECTION ASSOCIATION

Interested groups from the coatings industry have met with discussion on revisions to NFPA standards.

Currently, work is being done on the evaluation of an organic vapor detector for use on powered industrial trucks, which comes under NFPA Standard 505 covering type of truck and area of use. The effective use of an organic vapor detector would permit the use of EE rated industrial trucks in areas of a mixture of Class I, Division I and Division II, by turning off the truck ignition or power when 25% LEL solvent concentration was exceeded. This work is being continued but is still in the testing stages and, if the tests prove successful, final data will be submitted to NFPA for standards revision.

The Sectional Committee on Coatings Manufacture (No. 35) is currently defining the scope of proposed revisions for the next submission in 1981.

Interested people were successful in having revisions adopted in 1977 to Chapter 4 of Standard No. 30, which relates to the storage, transfer and use of flammable and combustible liquids. Of major importance to the retailing of flammable coatings was the removal of the stringent requirements on the retailing of organic coatings wherein the old standard permitted more storage in public areas than in storage areas. The new standard allows equal storage in both public areas and in storage areas. In addition, a great deal of information on sprinkler systems and storage have now been placed in the appendix as advisories rather than mandatory regulations.

These standards, as issued by NFPA, are not mandatory to all political levels and some local communities are operating with the 1973 standards which may not be as applicable to our industry and products.

Work is being done on defining the hazards of water reducible coatings which contain organic solvents and exhibit a flash point, but will not support combustion. Factory Mutual Research has conducted a series of tests under the sponsorship

of NPCA to aid in the classification of the fire hazards of paint coatings in 55-gal drums.

Currently, an ASTM Committee has been asked to develop a valid test for the hazards of mixtures containing flammable liquids along with nonflammable liquids. This could then become a quantitative measurement by which NFPA can classify coatings mixtures. Currently, flash points are used by DOT as a measure of flammable or explosive hazard, which may not be applicable to storage areas of water-borne coatings.

These studies are being undertaken so that more accurate knowledge can be obtained as to the hazards of water-borne coatings and, if significantly different from current standards, results may be submitted to NFPA for revision.

HOWARD J. HORTON,
Delegate

DELEGATE TO IUPAC

This Delegate attended the FATIPEC meeting in Budapest during the week of June 4-9, 1978 and had an opportunity to meet many of the participants in the "Supported Polymer Films" group of International Union of Pure and Applied Chemistry (IUPAC) (Macromolecular Division). The next meeting of the "Supported Polymer Films" group will be held on November 15 and 16, 1978 in Brussels.

The Analytical Section lead by Group Leader G. Christensen of Sadolin and Holmblad, has a very active program on amino resin analyses with extensive American and European participation. The following individuals and organizations in the U.S. and Canada are participating in the amino resin program:

A. Fiorelli, of Monsanto, Co. Springfield, Mass; Dr. S.M. Kambanis and Dr. J. Rybicky, Reichhold Chemical Ltd., Weston, Ont.; Dr. P.J. Secrest, Sherwin Williams, Chicago, Ill; Dr. D.J. Swanson, American Cyanamid Co., Stamford, Conn.; Dr. J.T. Vandeberg and Dr. L.C. Afremov, DeSoto, Inc., Chicago, Ill.; Dr. G.P. Cunningham and Dr. P.E. Pierce, PPG Industries, Inc., Allison Park, Pa.;

The work of this group has resulted in a review article [*Progress in Organic Coatings 5*, 255-276 (1977)] and development of four tentative methods.

(1) Solvent removal from amino resins.
(2) Analysis of urea and melamine resins by proton nuclear magnetic resonance spectroscopy.
(3) Analysis of alkoxy groups in amino resins by transetherification followed by gas chromatography.
(4) Analysis of alkoxy groups in amino resins by Zeisel cleavage followed by gas chromatography.

A cooperative exercise involving the analysis of a group of standard samples by ten different laboratories is underway to test the proposed methods.

The Adhesion Section lead by Dr. U. Zorll, of the German Paint Research Institute at Stuttgart, has a program on the measurement of adhesion. The participation in this group is mainly European. Topics of interest include:

(1) The influence of geometric and mechanical factors such as film thickness, size of loaded area, etc. on adhesion measurement.
(2) Quantitative difference of the results to be expected from different measurement methods.
(3) Influence of structural factors of the coating film such as polymer type, pigmentation type and concentration, etc. on adhesion.
(4) The relation of test method results to practice.

H. Raaschou Nielsen, of the Scandinavian Paint and Printing Ink Institute, Copenhagen, is leader of the information Retrieval Group. He is quite interested in promoting exchange of information with the Eastern European countries.

The solvent polymer interaction program is being organized and hopefully a tentative project program will appear at the November Meeting.

The properties of films and related bulk polymers program is also in an early stage of organization.

PERCY E. PIERCE,
Delegate

Society Reports

Annual reports from the Societies were presented at the Council Meeting, and complete copies were distributed to every member of the Council. Following are pertinent highlights for 1977-78.

Baltimore

Membership, Production, and Education Committees became more active . . . Subcommittee on Correlative Testing competed for an MMA award . . . Developed Baltimore Coatings Industry Scholarship Award with local PCA to be implemented in 1979 . . . Presently working on Society paper on solar reflective coatings for 1979 Annual Meeting.

Birmingham

Technical Committee produced first stage of the audio-visual presentation on "Setaflash Tester".

Chicago

By-laws amended to allow Associate members to vote on general Society business . . . Published Year Book . . . Education Committee sponsored Leadership Development Seminar, SYMCO '78 (on "Polymer Chemistry"), and Course in Coatings Technology . . . Technical Committee projects include: IR Spectroscopy Atlas (to be published in 1979); Acid-Base Interactions Between Pigment-Binder; Accelerated Method for Screening Mildewcides; Review of Federation Series booklet No. 17, "Acrylic Resins;" and Analysis of Coatings.

In addition, Society provided two $1,000 scholarships to NDSU and increased contribution to PRI to $1,000 . . . Hosted 1978 Annual Meeting.

Cleveland

Education Committee held 21st Technical Symposium on "Advances in Coatings Technology;" sponsored three credit-hour coatings course at Kent State University . . . Maintained liaison with Cleveland Technical Societies Council, co-sponsoring Northeastern Ohio Science Fair . . . Held coatings educational program at a meeting of the Cleveland Regional Council of Science Teachers . . . Purchased for Society the 1978 edition of Color-matching Aptitude Test Set.

Society continued its matching funds program for PRI, contributing $500 for a total of $1,295 for 1978 . . . Contributed $100 to Cleveland Engineering and Scientific Center . . . Purchased coatings reference texts for Cleveland Public Library.

Dallas

Co-hosted Southwestern Paint Convention in Dallas with Houston Society . . . Contributed $500 each to University of Southern Mississippi and PRI.

Detroit

Co-sponsored course in Surface Coatings Technology at University of Detroit along with Polymer Institute and Detroit PCA . . . Held FOCUS Seminar on "Coatings for Automotive Plastics".

Golden Gate

Graduated 22 students from Society-sponsored coatings technology course . . . Awarded three study grants for Society member travel to coatings conferences . . . Established coatings section in Redwood City (Calif.) Public Library . . . Technical Committee prepared paper for Annual Meeting, "Comparison of Methods to Determine Water Content of Emulsion Paints," in relation to CARB evaluations . . . Manufacturing Committee held Annual Seminar on "Input-Output '78" . . . Reactivated Specifications Committee which is presently preparing a paper for 1979 Annual Meeting . . . Preparing program for 1979 Western Coatings Societies Symposium, "Spectrum '79, A Bold Look Into the '80's."

Houston

Co-hosted Southwestern Paint Convention with Dallas Society . . . Environmental Subcommittee actively involved in Texas Air Control Regulations development.

Kansas City

Education Committee sponsored local Science Fair . . . Hosted 1978 Federation Spring Council Meeting.

Los Angeles

Continued 16 scholarships at a total of $8,000 . . . Established additional $1,000 scholarship . . . Contributed $500 to NDSU. . . . Manufacturing Committee held successful seminar on "Water-Borne Coatings in Respect to Manufacturing." Entered 1978 MMA Awards competition for CARB studies.

Louisville

Technical Committee project, "Study of Mildewcides in Exterior Paints," continues . . . Educational Committee co-sponsored two coatings courses with University of Louisville Speed Scientific School.

Mexico

Increased Society membership 20% during first year (59 to 71) . . . Co-sponsored successful annual meeting with Mexican Association of Paint Manufacturers in Acapulco with 500 attending. Technical Committee undertook translation into Spanish of CAT set instructions . . . Education Committee assisted in planning graduate level course on Organic Coatings at University of Mexico.

Montreal

Co-sponsored with Toronto Society the 11th Annual Joint Symposium, "Energy Today and Energy Tomorrow" . . . Donated $300 to Paint Research Institute . . . Education Committee continued its Introductory Course in Coatings Technology; in addition, several Society members were lecturers in paint technology courses at Ahuntsic College.

New England

Distributed questionnaire to Society membership in an attempt to re-direct activities towards future needs; discovered a solid interest in Society and presently preparing "action plan" . . . Technical Committee continuing work in "Freeze-Thaw" project and study on effects of surfactants on corrosion in water-borne coatings.

New York

Continued courses in Coatings Technology in conjunction with New York Paint Association . . . Started course in Science of Color. Continued financial support of PRI.

Northwestern

Marked 50th Anniversary in 1978 . . . Increased membership and attendance at monthly meetings . . . Held successful annual symposium on "Product Liability" . . . Technical Committee remained active preparing paper for presentation at 1979 Annual Meeting.

Pacific Northwest

Seattle Section held successful symposium — 312 people attended . . . Society membership increased to 217 . . . FSCT approved enlargement of Society boundaries, making it the largest Society in geographical area . . . In educational activities, all Sections (British Columbia, Vancouver, and Seattle) offered Coatings Technology Courses which were very successful . . . Production and Safety Committee remained active in reviewing specifications.

Philadelphia

Held joint meeting with local ink group . . . Presented speakers at monthly Technical Committee meetings; active projects include Data Analysis, Exposure Standards, and Flash Point Study . . . Dictionary Committee completed its 13-year effort with the publication of the "Paint/Coatings Dictionary" . . . Education Committee organized and conducted the American Chemical Society course . . . Environmental Concerns Committee held familiarization meetings with local governmental agencies.

Piedmont

Hosted Federation Board of Directors meeting in Greensboro, N.C. . . . Increased Society membership 7% . . . Donated $250 to Appalachian State University.

Pittsburgh

Celebrated 50th Anniversary during 1978 . . . Registered slight increase in Society membership and attendance at monthly meetings.

Rocky Mountain

Technical Committee progressed in writing a data base for submitting a CARB regulation to the Colorada Air Pollution Control Commission . . . Educational Committee is planning two seminars on Paint Formulation, Application, and Trouble Shooting . . . Approved By-laws change to adopt a single class of membership . . . Held joint meeting with Rocky Mountain Paint Association . . . Held seminar on Handling and Shipping of Hazardous Materials.

Southern

Held successful Society annual meeting in Atlanta, Ga. . . . Formed three-man committee to study lack of participation and attendance at monthly meetings — recommendations are presently being studied . . . Co-sponsored Fifth Annual Water-Borne and Higher Solids Coatings Symposium with USM . . . Contributed $8,500 to USM Polymer Science Scholarship Fund and $500 to PRI.

St. Louis

Held joint industry meeting with St. Louis Paint Association, Painting & Decorating Contractors, and National Decorating Products Association . . . Contributed $300 to University of Missouri at Rolla for scholarships . . . Held monthly meeting devoted to an education program for local high school teachers.

Toronto

Formed two new committees: Environmental Control and Specifications . . . Presented two technical papers at 1978 Annual Meeting in Chicago . . . Issued four certificates of completion of coatings courses held at George Brown University . . . Held joint meeting with Western New York Society . . . Donated $500 to PRI.

[The next meeting of the Federation Board of Directors will be held on May 18, 1979, at the Hilton Hotel in New Orleans.]

Roon Awards Competition Offers $1,750 in Prizes For Winning Technical Papers Presented in 1979

The Roon Foundation Awards, established in 1957, will be continued and the best technical papers offered for presentation at the Federation's 1979 Annual Meeting in St. Louis, Mo. will be eligible for cash prizes — $1,750 — donated by Leo Roon, former President of Nuodex Products Co., and a Director of the Roon Foundation.

Umberto Ancona, Chairman of the Federation's 1979 Roon Awards Committee, stated that the papers submitted in competition for the Awards must: (1) Be of such caliber that they will reflect a step forward in real scientific contribution to the coatings industries; (2) Be directly related to the protective coatings industry; and (3) Shall describe original work not previously published or presented.

At present, the schedule of prizes is as follows: First—$750; Second—$500; Third—$350; and Fourth—$150.

The 1979 Annual Meeting of the Federation will be held in St. Louis, Mo. from October 3-5, and the deadline for receipt of papers will be June 1.

1978 AWARDS

FIRST PRIZE ($750)—"Cathode Reactions and Metal Dissolution in Cationic Electrodeposition."—Dennis G. Anderson, Edward J. Murphy, and John Tucci III, of DeSoto, Inc., Des Plaines, Ill.

SECOND PRIZE ($500)—"Effect of Humidity and Other Ambient Conditions on Evaporation of Ternary Aqueous Solvent Blends."—Albert L. Rocklin, of Shell Development Co., Houston, Tex.

THIRD PRIZE (Tie-$250 each)—"Rheological Properties of Styrene/Acrylic Polymers"—H.P. Schreiber and G. Thibault, of Ecole Polytechnique, Montreal, Quebec, Canada; and "Single-Grade Rutile TiO_2 Concept for Interior Latex Trade Sales Systems"—Calvin C. Tatman, of Glidden Pigments, Chemical/Metallurgical Div. of SCM Corp., Baltimore, Md.

Principles Governing the Roon Awards

These awards, established in 1957 by Mr. Leo Roon, a Director of the Roon Foundation, and since 1977 have been administered by the Paint Research Institutes, are for the best technical papers (other than those by a Constituent Society of the Federation) submitted for presentation at a Federation Annual Meeting.

Papers to be considered for the competition will be those by individuals associated with the organic coatings industry, including raw material suppliers and educational institutions.

The Paint Research Institute, as sponsor of the competition, will supervise the judging of the papers. The principles governing the awards are as follows:

(1) The papers will be of such caliber that they will reflect a step forward in real scientific contribution to the coatings industries. The papers shall describe original work which has not been previously published or presented.

(2) Papers must be directly related to the protective coatings industry.

(3) None of the work shall originate from, be guided by or be any part of a Coatings Technology Society. These awards shall in no way detract from the cooperative efforts of Societies, Technical Committees and their convention papers.

(4) An Award Committee shall consist of five members who shall be appointed by the President of the Federation.

(5) The committee is not obligated to award prizes if in its opinion none of the submitted papers are of a caliber to be worthy of such recognition.

(6) The submitted papers may be presented at the Annual Meeting with the consent of the President of the Federation and the Chairman of the Program Committee. Although it is the intent of the Roon Awards that winning papers will be presented at the Annual Meeting papers accepted for presentation and papers awarded prizes are separate and distinct. An invitation from the Program Committee to present his paper should not be construed by any author as an indication that the Roon Committee has awarded his paper a prize.

(7) Winning papers will be published in the JOURNAL OF COATINGS TECHNOLOGY, which has prior rights to publication of all submitted papers.

(8) The papers shall be concise and informative discussions of up to approximately 6,000 words. Papers greatly exceeding this length should be divided into more than one paper. Multiple entries in the competition from a single author are acceptable. It is requested that manuscripts be prepared in accordance with JOURNAL OF COATINGS TECHNOLOGY style, as outlined in the Guide for Authors. Copies are available from the Federation office in Philadelphia upon request.

(9) A 75 to 100 word abstract shall accompany the paper.

(10) Papers will be rated with emphasis on: (a) Originality (40%); (b) Scientific Importance (20%); (c) Practical Value (20%); and (d) Quality of Composition (20%).

(11) The Awards will be open to anyone involved in study of or engaged in work related to the protective coatings industries, including paint, varnish and lacquer manufacturers, raw material suppliers, research laboratories and universities. (The committee, however, will not accept papers which involve raw material sales promotion or are self-serving in regard to exploiting a proprietary product.)

(12) The Committee may award three or four prizes, the total of which is not to exceed $1,750. Maximum for first prize is $1,000.

(13) It is requested that all papers be accompanied by company or educational institutional clearance for publication.

(14) Those planning to submit a paper in 1979 must let the Chairman (Umberto Ancona, McCloskey Varnish Co., 7600 State Rd., Philadelphia, Pa. 19136) know by March 1. He must have seven publication manuscripts by June 1.

(15) The 1979 Awards, and accompanying certificates, will be presented during the Annual Meeting in St. Louis.

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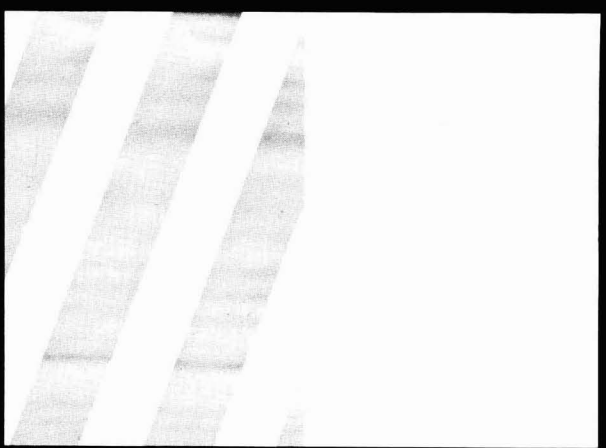

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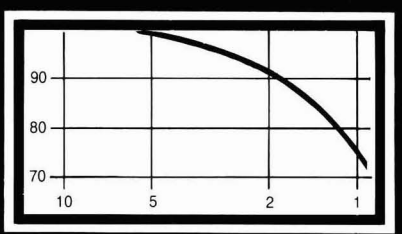

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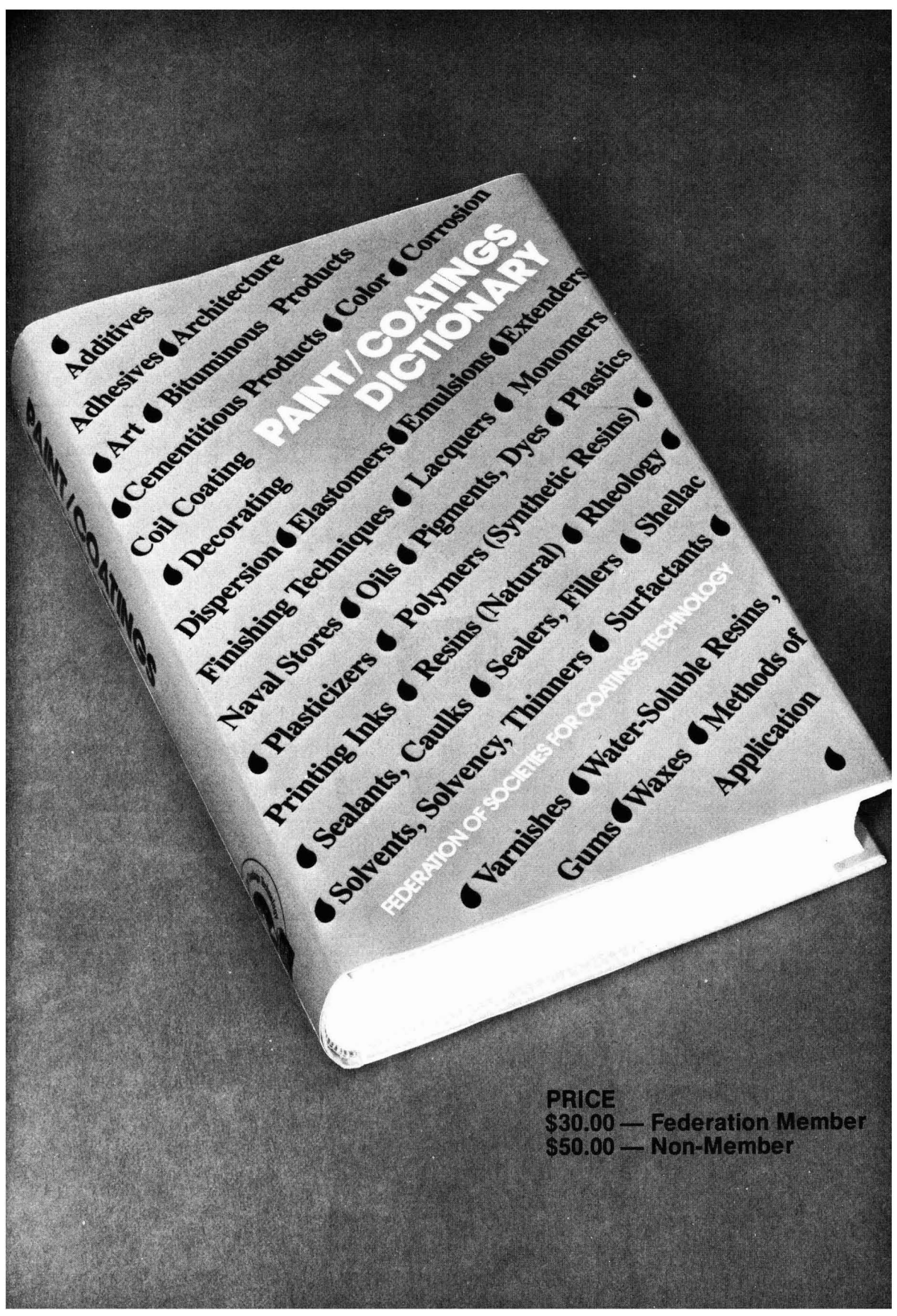

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PAINT/COATINGS DICTIONARY

An invaluable reference source containing definitions for more than 4500 coatings-related terms. . . . Classification section listing all terms in total of 73 categories. . . . Extensive bibliography (over 600 references). . . . 632 pages (6 x 9 in.), case-bound.

Approximately 4500 terms of the coatings industry and its interfacing technologies are defined in this comprehensive volume, which has been compiled by the Definitions Committee of the Federation of Societies for Coatings Technology. Unique feature is classification of these definitions into one or more of 73 categories (color, pigments, additives, methods of application, etc.). These categories have been number coded and appear as superscripts at the end of each definition. Conversely, all terms defined under each category are listed in back of the book and serve as a thesaurus for key words, research papers, and literature searches. Pigments have also been classified into their Color Index numbers, and pigment synonyms have been extensively cross-indexed to a commonly accepted name.

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GUIDE FOR AUTHORS

INTRODUCTION

THE JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology. Some 6,500 technical men of the paint industry—associated with 26 Constituent Societies in the United States, Canada, Great Britain, and Mexico—make up the membership of the Federation.

The purpose of the JOURNAL is the advancement of knowledge of the formulation and manufacture of paints, varnishes, lacquers, resins, and related coatings. Its worldwide circulation is about 9,000.

Papers should present new or original data of either a practical or scientific nature. Papers written in a manner which tend to promote proprietary products are specifically not acceptable. Papers must meet the standards of the JCT Editorial Review Committee and are accepted with the understanding that they are contributed exclusively to the JOURNAL OF COATINGS TECHNOLOGY and that the material has not been published elsewhere.

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 or symposia of the Constituent Societies. These papers, and others submitted for publication, must be approved by the JCT Editorial Review Committee, which has authority in all matters affecting the acceptance or rejection of papers and other technical material. Manuscripts not accepted for publication will be returned to the author.

MANUSCRIPT COPIES

GENERAL PAPERS: Four complete copies are required. Send to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, Pa. 19107.

CONSTITUENT SOCIETY PAPERS (*for presentation at the Annual Meeting*): Ten copies of manuscript are required. They should be mailed as directed in this year's "Guide for Speakers."

ROON FOUNDATION AWARD PAPERS: Seven copies of the manuscript must be sent to the Chairman of the Roon Awards Committee. For complete details, see the "Roon Awards" section of the January 1979 JCT.

MANUSCRIPT PREPARATION AND STYLE

In general, follow the "Handbook for Authors" published by the American Chemical Society Publications, 1155 Sixteenth St., N.W., Washington, D.C. 20036.

Manuscript should be typed, double spaced, on 8½ × 11 paper, typing on one side only with at least one-inch margins around all four sides. Indent paragraphs five spaces.

Title

Keep the title informative, yet as brief as possible consistent with defining the subject matter covered in the paper.

Authors

Give complete names and correct company affiliations and addresses of all authors. A photo (glossy 5 × 7) and brief biographical sketch of each author should be included with the manuscript. Photos should be identified by printing the subject's name on the reverse side, in the margin so as to avoid defacing the photos. Do not clip or staple.

CONSTITUENT SOCIETY PAPERS: Submit names and company affiliations of each member of Technical Committee which prepared paper. Include, if possible, a group photo of committee.

Abstract

A 75-100 word abstract should accompany the manuscript. Avoid exceeding the length, if possible. The abstract, which is published immediately after the by-line and on the abstract pages, should contain an informative, not descriptive, statement concerning the (a) scope, (b) experimental methods, and (c) results or conclusions.

Presentation Data

If the paper has been presented at a monthly or special meeting of a Society for Coatings Technology, or to some other technical group, list the name of the organization and the date of presentation. If someone other than the author presented the paper, this, too, should be noted. Papers presented to associations other than the Federation must be released before they can be considered for publication in the JOURNAL OF COATINGS TECHNOLOGY.

Oral presentations submitted for publication should be rewritten to conform to publication style and format.

Text

This Guide has been prepared in accordance with general publication style, except the type, which is 9 pt. instead of 10 pt. Note the use of subheads. These serve to divide the paper into sections and also to break up the monotonous appearance created by long, continuous lines of type. Use simplicity in word selection whenever consistent with content. Be neither stiff and trite, nor lax, but direct and concise. Include only as much history as necessary to provide background for the particular material covered in the paper.

Metric System

Metric units are to be used wherever applicable and are to be shown in parentheses after the English or other units.

An excellent reference publication for metric conversions is the ASTM Metric Practice Guide (E 380-72) published by the American Society for Testing and Materials, 1916 Race St., Philadelphia, Pa. 19103. A conversion slide, in accordance with E 380-72, is also available.

Tables

Tables should be used sparingly, especially extremely long or wide ones. It is preferred to have tables typed on a separate sheet of paper rather than included in the text. All tables should contain some reference in the text, e.g., "see *Table* 1."

Illustrations

Submit *original* drawings or sharp prints and good, clear glossy photographs. Graphs should be on good quality white, or blue-lined, graph paper. They should not exceed the 8½ × 11 size. Lines or curves should be relatively bold. The ordinate, abscissa, and title should be drawn outside the borders of the graph. Number all illustrations on the back. Captions are usually set in type, so they should be typed all on one separate sheet of paper. All illustrations must be black and white, as color is not acceptable. Slides, also, are not acceptable.

Nomenclature

Follow nomenclature style of *Chemical Abstracts*. Use chemical or common names when meaningful. Where tradenames or trademarks are helpful for more complete descriptions, show them in footnotes or in an appendix, rather than in the text. If special nomenclature is used, include a nomenclature section at the end of the paper giving definitions and dimensions for all terms.

Equations

These must be typed, or written, clearly. Number each consecutively. If special symbols or Greek letters are used, write out their names in the margin of the sheet at point of first use. Place superscripts[a] and subscripts$_b$ accurately.

Summary

The paper should be concluded with a summary which is intelligible without reference to the main text.

Acknowledgment

If used, it should follow the summary.

References

These should appear in numerical order within the text and be listed at end of manuscript in same order. Authors' names may or may not be shown in text with reference numbers. The following is a suggested style for periodicals[1,2,3] and books:[4]

(1) Marshall, N.J., *Official* DIGEST, *29*, No. 391, 792 (1957)

(2) Seymour, R.B. and Garner, D.P., JOURNAL OF COATINGS TECHNOLOGY, *48*, No. 612, 41 (1976).

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(4) Mattiello, J. J., "Protective and Decorative Coatings," Vol. IV, John Wiley & Sons, Inc., New York, 1955.

OTHER INFORMATION

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Total Instrumentation In Color Manufacture

Allan B.J. Rodrigues
E.I. du Pont de Nemours & Company, Incorporated*

Recent advances in light-scattering theory, colorimetry, and instrumentation have made it possible to transform color matching from an art to a science. However, to achieve maximum benefit from this science, instrumentation should be used through the entire process of color manufacture, from conception of the color (styling), through pigment selection (formulation), and final manufacture (shading). At the same time (color being very subjective) even a complete instrumental system cannot ignore the human observer. Human observation and judgement are the key to success. Hence, a total instrumental color system must be designed to allow user interaction at every stage.

INTRODUCTION

Until recently color matching in the paint industry was an Art. It was performed by naturally gifted visual shaders who after many years of experience were able to look at a color, make a guess at what pigments would match it and, through a laborious hit-and-miss procedure, adjust their initial formula to an acceptable match.

However, around the turn of the century artists and scientists were working towards an orderly arrangement of colors and its description in mathematical terms. They were laying the groundwork for the Science of Colorimetry. This science has enabled us to build instruments which "see" color as we do.

In 1905, an astrophysicist developed an equation in studying interstellar scattering of light. This equation was rediscovered in 1930 in studying scattering of light by pigmented objects. Today this equation (attributed to Kubelka and Munk) is used in predicting the color of pigment mixtures. The third piece that has made instrumental color control possible is the advent of computers. They have enabled the fast handling of bulky data files and extensive computations required to put the scientific discoveries of the first half of this century to practical use. It is now possible to integrate these three pieces to provide total instrumental color control of paints.

To achieve maximum benefit from this science, however, instrumentation should be used through the entire process of color manufacture from conception of the color (styling) through pigment selection (formulation) and final manufacture (shading). At the same time, color being very subjective, even a total instrumental system cannot ignore the human observer. Papers presented at the 1966 Inter-Society Color Council Williamsburg Meeting hinted at replacing visual shaders with computers. Yet the theme of that same meeting in 1976 was "Let's put Joe back into the system". Color technologists had realized that no objective instrumental system could replace "Joe", the shader, who is more attuned to the subjective human observers he represents.

STYLING

Styling is the most subjective part of the entire color-manufacture process. † The successful color stylist must observe his customer's color preferences, he must pass judgement on good color taste, and he must predict future color trends. Thus, by definition, color styling must be subjective. Instruments cannot be programmed to encompass all aspects of these changing subjective judgements, yet they can be used to aid the stylist in making his decisions. Some progress has been made in quantifying the psychological responses to color (its effect on a person's mood[1]) and this will further aid the stylist.

Instrumental color styling simulates the object to be colored (e.g., the house in *Figure* 1) while allowing the stylist to vary its color through the complete gamut of attainable color space. The color of different portions of the object can be changed independently (e.g., alumi-

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† Note that the colorist's product is color itself. His product is incorporated into another intermediate product (e.g., colored paint) which in turn is part of the finished product (e.g., the painted house). Hence, we use the term color manufacture, rather than manufacture of colored products.

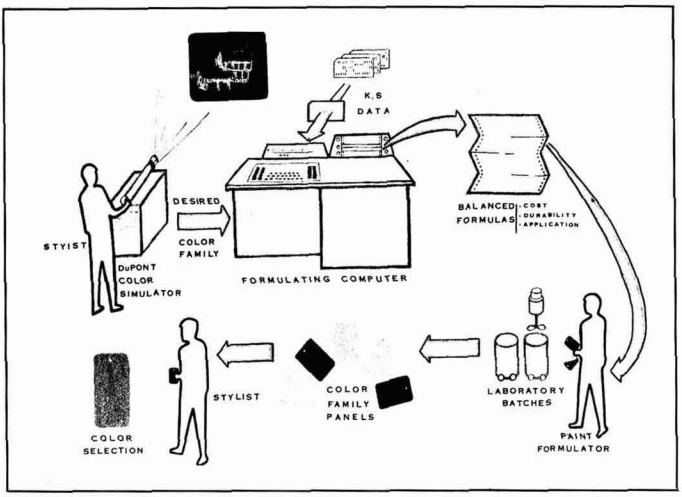

Figure 1—Instrumental color styling

num siding vs. trim). The stylist is thus able to visualize his finished product. He could also obtain a hard copy of the projected image and use it in conducting customer surveys. While the experienced stylist can visualize the finished product unaided by the simulator, the customer usually cannot. In this way, final color choice, whether by customer survey or by group management decision, can be made quickly without the expense of actually painting the product in a myriad of colors.

The simulator is interfaced with a computer which can be programmed to display only those colors attainable with available pigmentation. Pigment costs can be computed and the color effects of cheaper pigmentation can also be determined. Color constancy can be assessed through spectral integration under several light sources. Weathering and durability information for pigments can also be stored in the computer. These capabilities make the simulator a useful tool even to the most experienced stylist. He is able to harness his creativity, giving form to his mental images so that they may immediately be viewed by not only his peers, but also his sometimes less imaginative management!

Once the color choice has been made, the computer will print out a balanced paint formula. Difficult to reproduce colors would be flagged by the computer right at this stage. For example, if a color happens to be at the saturation limits of its pigmentation the computer could suggest the extent of desaturation necessary to ensure manufacturability within expected raw pigment variation. These color deviations can also be assessed before actually loading any wet paint. Once loaded in the laboratory, any deviations from this choice would also be made instrumentally using the color shading techniques described later.

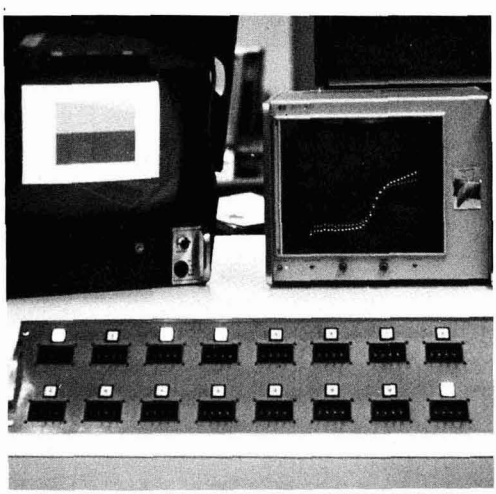

Figure 2—A user-interactive color formulation computer

COLOR FORMULATION

Instrumental styling would all but eliminate the formulation step of paint making. Unfortunately, a competitor's color standard must often be matched. Also, lab batches of a new color are often necessary for quality and application testing. Instrumental color formulation is primarily a task of spectral curve matching although tristimulus matching is adequate when metamerism can be ignored. The theory and algorithms for automatic computer matching are well documented in the literature.[2,3] Automatic processes are quite satisfactory when available pigmentation permits an exact spectral match. This, however, is not always the case. Pigmentation used in the original color standard may be unavailable, ecologically unacceptable, have insufficient durability, or be too expensive. Human judgement is then necessary in determining permissible deviation from a spectral match. This is partially because no color difference equation is exact throughout color space. Chromatic adaptation cannot be fully accounted for, so

that a complete mathematical determination of metamerism is not yet possible. Preference in color offset is even more vague, making its mathematical description difficult. Hence, the color formulation system should be designed to make full use of shader "Joe's" skills.

A user-interactive color formulation computer developed by Du Pont's Engineering Physics Laboratory is shown in *Figure* 2. The spectral curve of the color to be matched is displayed on an oscilloscope. Colorants can be assigned to each of 16 switches on a colorant selection keyboard. A colorant mixture can then be computer-simulated by turning on the switches of the desired colorants using the adjoining thumbwheels to increase or decrease the quantity of each pigment. The spectral curve of this simulated mixture is also displayed on the oscilloscope. A trial-and-error process is then used in choosing pigments and optimizing their concentrations either manually or through mathematical routines. The color coordinate differences (ΔL, Δa, Δb) between standard and simulated batch under various light sources are also displayed to aid in assessing metamerism. Color of the standard and simulated batch are also displayed on a color television screen. While true color reproducibility is limited by the television phosphors, displayed color difference is accurate enough in most cases to visually assess color difference and metamerism, the display being dependent on tristimulus values rather than color difference equations. Chromatic adaptation is accomplished by a surround on the screen simulating either standard light sources or any desired chromaticity and lightness.

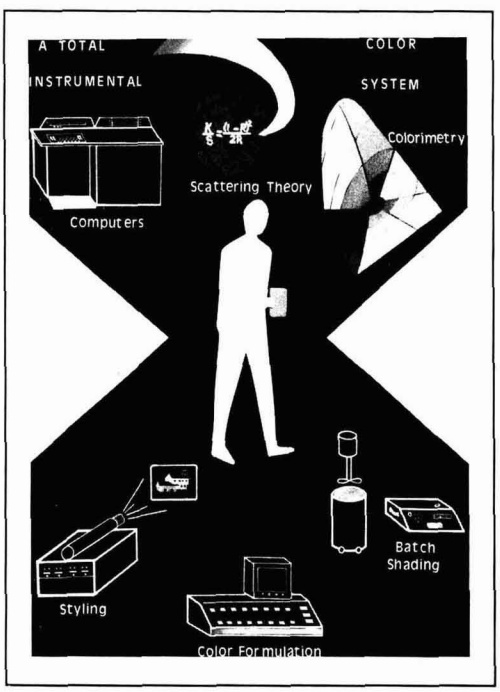

Figure 3—A total instrumental color system

DR. ALLAN B.J. RODRIGUES received the B.Sc. Degree in Chemistry from the University of Bombay and the Ph.D. Degree in Chemical Engineering from the University of Notre Dame. He joined the Fabrics and Finishes Dept. of Du Pont in 1969 and is currently a staff engineer in the Color Operations Group. He is a member of Inter-Society Color Council and is currently co-chairman of the subcommittee on Indices of Metamerism.

Thus, the system is designed to operate at any desired level of automation. The naive user may feed it a list of pigments and let it automatically choose the "best" formula. At the other extreme the old visual shader may simply use it to quickly test the pigment recipes suggested by his visual assessment of the color standard. Computer simulation is very much faster than actually mixing and spraying wet colorants. The sophisticated user, however, in addition to making use of his previously acquired visual skills, will develop expertise in spectral curve analysis, recognizing each feature of the computer as an additional tool making his job more efficient. Our experience is that such a user is the most successful color formulator.

The formula predicted by the computer when weighed out and sprayed in the laboratory, should not be expected to yield a perfect match to standard. Apart from measurement and equipment errors, Kubelka-Munk Theory does not permit such accuracy. However, the formulator can be confident that he has chosen the best possible combination of pigments available to him and that the "on-load" position is instrumentally shadeable to a commercial match. The procedure for making this adjustment can also be used for instrumental control of color during paint manufacture and is described in the next section.

BATCH SHADING

A batch shading system should be designed to operate in a manufacturing environment. Some shading systems simply utilize aforementioned formulation programs to predict formulas for the standard to be matched and the batch to be shaded. The required adjustment is then the difference between these formulas. This technique, of course, requires use of spectrophotometers, most of which do not meet the durability, cost, and speed requirements of a manufacturing environment. Tristimulus colorimeters do qualify under these preconditions in addition to being easy to operate.

Metamerism should not be a problem since pigmentation in standard and batch should be identical. The problem then is one of reducing the color differences between standard and batch to acceptably small values. The concentration adjustments required to eliminate

these color differences can be calculated through the use of color vectors which are simply the magnitude and direction of movement of the batch in color space caused by a unit concentration change of each colorant in the batch. Stated mathematically, we are solving the matrix equation:

$$\overline{\Delta t} = \overline{B}\ \overline{\Delta C} \qquad (1)$$

for $\overline{\Delta C}$ where;

$\overline{\Delta t} = \begin{bmatrix} \Delta L \\ \Delta a \\ \Delta b \end{bmatrix}$, the color difference to be corrected. Any tristimulus color space can be used, but a uniform one is preferred.

$\overline{\Delta C} = \begin{bmatrix} \Delta C_1 \\ \Delta C_2 \\ \Delta C_3 \end{bmatrix}$, the concentration adjustment for each colorant.

$\overline{B} = \begin{bmatrix} \partial L/\partial C_1 & \partial L/\partial C_2 & \partial L/\partial C_3 \\ \partial a/\partial C_1 & \partial a/\partial C_2 & \partial a/\partial C_3 \\ \partial b/\partial C_1 & \partial b/\partial C_2 & \partial b/\partial C_3 \end{bmatrix}$, the color vectors for each colorant.

The required concentration adjustment may be calculated by multiplying the color difference by the inverse matrix of the color vectors. These color vectors can readily be computed[3] knowing the colorant formula and the absorption and scattering coefficients for each colorant.

Thus, shading is the least dependent on human judgement of all steps of color-manufacture. However, the instrumental shading system should still be capable of drawing on the shader's experience. For example, it is often more economical and efficient to shade a batch to the edge of a tolerance zone in color space. Visual experience is necessary in defining this tolerance zone,[4] which can be very wide in certain directions (e.g., more saturation) for some colors. The shader can often salvage a batch in a poor color position by "telling" the computer to ignore tolerances on certain axes. Computers work strictly on color numbers. Colorimeters provide no information on appearance which also affects our perception of color (e.g., milky side tone in a bright red). Shader interaction allows a computer to overcome such deficiencies. The advantages of instrumental batch shading are:

(1) Fewer shading adjustments per batch, hence, fewer tests per batch. The computer can simultaneously adjust all three color axes whereas visual shaders tend to emphasize only two dimensions at a time.

(2) Improved equipment utilization. Sampling tests cost in both money and time. Fewer tests obviously reduce turnover time.

(3) Better Quality Control. Instrumental shading results in more batch-to-batch uniformity of product. It is somewhat paradoxical that to achieve this, final color acceptance should be strictly instrumental, replacing the fickle human by the C.I.E. Standard Observer. There are, of course, some practical limitations to strict instrumental acceptance.

(4) Fewer Customer Complaints. Specified instrumental tolerances eliminate all arguments with the customer about whether or not a batch is within specification.[4]

(5) Improvements in inventory control and scheduling. The use of computers in making color adjustments lends itself to integration of these programs with computer scheduling and inventory control.

CONCLUSIONS

It is important to distinguish between totally and total instrumental systems. Our goal is not to have a *totally* instrumental color system. This would eliminate "Joe" whose necessity is recognized in duplicating the ultimate customers' subjective evaluation. Our goal is a *total* system comprising objective instrumentation at every stage, enhanced by the subjective human observer. As illustrated in *Figure* 3, it integrates the discoveries started at the turn of the century—colorimetry, scattering theory, and computers—to provide instrumentation through the entire color manufacture process from styling, through formulation and shading, in assisting the human observer—the central figure in this process. Such a system of color control truly transforms color matching from an Art to a Science.

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People Make or Break An Instrumental Color Control System

Robert T. Marcus
PPG Industries, Incorporated*

The excellent results modern color control systems are capable of producing are only achievable by having competent, well-trained production, technical, and quality control personnel associated with the system. Many times only those people directly operating the instruments and computer are given training. Unfortunately, formulators and other key people involved with the total pigmentation process often do not understand instrumental color control. Without their understanding, a good color system may produce disasterous results.

This paper describes the degree of knowledge and type of training required at different operational levels of involvement with color control. Commercially available sources of training are discussed.

INTRODUCTION

"The most common question asked of any so-called expert is 'what is the best instrument or the best program?' The answer is and always has been that there is no such thing. You have to have the best people; one or more people who know what they are doing—who know the field of color and color matching, as well as your specific field of technical activity, and can intelligently put the two together."—Max Saltzman[1]

When instrumental color control was in its infancy, there was not much question that well-trained, highly skilled people were needed to run the new color control systems. Looking at the front panel of COMIC I was, in itself, an intimidating experience and, after going through the instruction manual, it was obvious that the operator had to understand the shading process.

Today, the benefits of instrumental color control are well substantiated. Perhaps the greatest current force in making instrumental color control as common as it is today is the utilization of dedicated minicomputers. Color measuring instruments can be directly interfaced to computers; programs are conveniently stored on magnetic tapes and disks; and interactive programs can be written in a conversational mode, making them easier to run.

Unfortunately, the apparent ease of running the programs, presents the false facade that the total digital color control system is as simple to utilize. Occasionally, enthusiastic color control salesmen, who are well aware of both the benefits and problems of digital color control, promote this illusion of simplicity.

In reality, digital color control systems still contain complex mathematics, and there is still some "know-how" necessary to make them work well. Almost anyone who has had a chance to observe closely several different systems in operation will verify that the overall success of the system is somewhat independent of the instrumentation or the programming, but is highly dependent upon the knowledge and dedication of the personnel operating the system.

With a carefully planned training program, the knowledgeable personnel at a location can be shown the skills required to transform them into color control professionals. Color training must include the system operator and other operating personnel since the principles of color control impact on a large segment of an organization.

HIERARCHY OF COLOR CONTROL

For color control to be successful within an organization, several levels of involvement must be represented. Each of these levels has its own degree of color know-how and technique associated with it, although any given individual may have functional knowledge of more than one level.

Each company should have a color control expert to help coordinate the remaining levels. This individual would have responsibilities in the areas of choosing the color control system; of maintaining a state-of-the-art knowledge of color science and control; of implementing new technology into the color control system; and of training personnel in the various aspects of color control.

Involved daily in the greatest depth is a person at each operating location who the author will refer to as the location technical expert in digital color control. This expert serves as the local focal point for color

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*R & D Center, 151 Colfax St., Springdale, Pa. 15144.

Table 1—A Week-Long Course in Color Science

Monday am	The perception of color; color communication and specification.
pm	The CIE system of specifying color; color measurement and instrumentation.
Tuesday am	Color differences and tolerances.
pm	Colorants; formulation practices.
Wednesday am	Introduction to Kubelka-Munk theory.
pm	Introduction to computers.
Thursday am	Computer color matching.
pm	The PPG Digital Color Control System.
Friday am	The PPG Digital Color Control System.
pm	General Discussion.

technology, fields questions about the system, and defines problems to help the company expert develop new programs.

The next level would be that of the system operator who, on a day-to-day basis, actually runs the instrument and computer.

Formulators, quality control batch adjusters, tinting foremen, and certain other key production people comprise the next level. Effective digital color control has a significant impact on the way they perform their duties. However, it is an often overlooked fact that this group can definitely influence the overall performance and, thus, influence the success or failure of the entire system.

Completing the hierarchy are the company's customers, sales personnel, management, and suppliers. Since the quality of the product will depend upon the color system, customers should be made aware of some basics of color control and how it can improve the product. At times, the competitive nature of the market has been the justification for a color control system.

A digital color control system can affect the methods by which a product is manufactured and marketed. Sales personnel who understand the benefits and limitations that a system place on the shading process can be more effective in selling while generating fewer problems to production groups.

Not only must management be convinced of the initial value of a color control system, but they must be convinced to continually support the complete color control program. They must be educated about the necessity of keeping the system current and healthy.

A number of suppliers are new to, and perhaps even a little apprehensive about, the role digital color control plays in evaluating incoming raw materials. By maintaining an open channel of communication, suppliers can be taught how the analytical nature of the system removes some of the subjectivity from the evaluation and, thus, hopefully, lessen the number of problems and disputes.

Ultimately, the overall success or failure of a digital color control system depends upon the interaction of all of the hierarchical levels of involvement.

LEVELS OF KNOWLEDGE

Although the company expert and the location technical expert require roughly the same breadth of knowledge, the company expert is differentiated by an increased depth of knowledge and an increased awareness of the complete color control program, its implementation, and its affects on the company.

The location expert must have a good grounding in color science and technology so that he or she can understand the theoretical basis of color control and color measurement. Some basic knowledge of computer operations and programming is preferred as the computer is an integral part of the system. Complete familiarity with the actual control programs and the particular color-measuring instrument is essential. The location expert must also understand the process of pigment calibration, the procedure by which the computer is taught how pigments behave. Finally, it is also desirable that this expert understand paint and paint production since many questions asked of that person relate specifically to the products being manufactured.

System operators must believe that digital color control is a reasonable, workable procedure. They require only some basic color theory such as what is meant by the terms tristimulus value, illuminant, observer and color difference. Operators must know how to operate the color-measuring instruments, run the computer, and work the programs. Pigment calibration may also be the responsibility of the operator necessitating some knowledge in that area. Since the system operator is among the first to see a production batch, and since the color addition may also affect other properties of the paint, it is preferable that the operator know something about paint and paint production.

Formulators, quality control batch adjusters, tinting foremen, and key production personnel must be given a good introduction to the color control system including what it can and cannot do. Coupling the introduction with some basic color theory (at the same intensity as for operators), this group can learn to keep the process under control by proper color formulation and precise batch adjustment. A controlled process is a prerequisite for successful color control.[1]

The company's customers, sales personnel, management, and suppliers generally need an overview of the color control system so that they may understand the implications of the system on their functions. Color

Table 2—A One to Two-Day Color Training Seminar

(A) What is color control?
(B) Looking at the sample—the first step.
(C) How does an instrument see color?
(D) Formulating good color matches.
(E) Demonstration of a formulation problem.
(F) Understanding the black box.
(G) Hiding will change a formula.
(H) How do we judge the match—to correct or not to correct?
(I) Why wasn't the computer right?
(J) Demonstration of a batch correction.
(K) To err is human (?).

Table 3—Members of the Manufacturers Council on Color And Appearance Giving Courses on Applied Color And Appearance

(1) Applied Color Systems
P.O. Box 5800
Princeton, N.J. 08540

(2) Diano Corporation
8 Commonwealth Ave.
Woburn, Mass. 01801

(3) Gardner Laboratory, Inc.
P.O. Box 5728
Bethesda, Md. 20014

(4) Hemmendinger Color Laboratory
R.D. Pequest Bend
Belvidere, N.J. 07823

(5) Hunter Associates Laboratory
9529 Lee Highway
Fairfax, Va. 22030

(6) Macbeth Color & Photometry Div.
Kollmorgen Corp.
(In conjunction with Davidson Colleagues)
P.O. Box 950
Newburgh, N.Y. 12550

theory is introduced as required by the specific involvement of the individual with color control.

TRAINING AT PPG

An example of what the author considers to be a successful training program in digital color control can be found in the Coatings and Resins Div., of PPG Industries. Drawing heavily on internal resources, the fundamentals of color science are taught along with specific details of the PPG Digital Color Control System in a series of courses and seminars. The involvement level of the particular group determines the length of the presentation which have been as long as a week to as short as a couple of hours.

Initially, week-long courses are taught for Plant (location) experts at the Springdale Research Center. *Table* 1 contains an outline of one such course. To increase the effectiveness of the training program, one and two-day seminars are held at various manufacturing locations containing material such as shown in *Table* 2. Some lesser involved personnel are given introductions to digital color control lasting only a couple of hours. New chemists and engineers for manufacturing locations are also encouraged to spend time in the Color Research Laboratory as part of their training program at the Research Center.

Management is periodically briefed on the digital color control system with short presentations in conjunction with other meetings.

Customer contacts are also kept to relatively short presentations and meetings as they are required. By letting customers know how the digital color control system is at work to help them, many of the problems that have occurred in the past are minimized. An educated customer is less apt to make what a seller might feel are capricious decisions.

At the present time, sales personnel receive their training either during the meetings with customers or by sitting in on the seminars at the manufacturing plants. In the future, it is planned that the sales force will have a more formalized introduction to color and color control.

Digital color control is still a new concept to a number of PPG suppliers. Explaining the principles of the system and how it will be used in monitoring their product during both brief and extended (for less sophisticated suppliers) meetings help to avoid misunderstandings which might develop into problem areas or disputes.

DR. ROBERT MARCUS is a Research Associate at PPG Industries' Coatings and Resins Div. Research Center where he is in charge of the Color Science Research Group. He received the B.S. Degree in Physics in 1968 and the PhD. Degree in Chemistry in 1974 from Rensselaer Polytechnic Institute. Dr. Marcus is President-Elect of the Pittsburgh Society for Coatings Technology and is currently Chairman of the FSCT Inter-Society Color Council Committee.

COMMERCIALLY AVAILABLE TRAINING

Whereas large companies may be able to afford to conduct internal training programs, the smaller company must rely on commercially available courses, seminars, and consultants.

Most vendors of color-measuring instrumentation will provide their customers with start-up assistance on-site and/or at the vendor's facility. For a digital color control system, training usually involves instruction in operating the computer, the instrument; instruction on how to run the computer programs; and instructions on how to calibrate pigments, but may also include some color science theory.

Industrially-oriented courses on color and color control lasting from half-day seminars to week-long courses are given either on-site or at specific locations by the members of Manufacturers Council on Color and Appearance (MCCA) listed in *Table* 3. With this list, as

Table 4—Academic Institutions Offering Courses in Color

(1) Clemson University
Clemson, S.C. 29631
"Basic Color Science" (Two days)
"Advanced Color Science Applications" (Two days)

(2) Lehigh University
Bethlehem, Pa. 18015
"Optics and Formulation of Colorants" (Four days)

(3) Rensselaer Polytechnic Institute
Troy, N.Y. 12181
"Principles of Color Technology" (Five days)
"Advances in Color Technology" (Five days)
"Color Technology for Management" (Two days)

(4) University of Rochester
Rochester, N.Y. 14627
"Colorimetry" (Five days)

Table 5—Professional Societies and Trade Associations Presenting or Sponsoring Courses Or Educationally-Oriented Symposia on Color

(1) Federation of Societies for Coatings Technology
Suite 832
1315 Walnut St.
Philadelphia, Pa. 19107

(2) Graphic Arts Technical Foundation
4615 Forbes Ave.
Pittsburgh, Pa. 15213

(3) Inter-Society Color Council
Fred W. Billmeyer, Jr., Secretary
Department of Chemistry
MRC - Room 217
Rensselaer Polytechnic Institute
Troy, N.Y. 12181

(4) Plastics Institute of America
Stevens Institute of Technology
Castle Point
Hoboken, N.J. 07030

(5) Society of Plastics Engineers
656 West Putnam Ave.
Greenwich, Conn. 06830

well as for any others, the author strived for completeness. However, since courses can be organized or cancelled without prior notice to the author, the accuracy or completeness of these lists cannot be guaranteed.

A second source of courses are the academic institutions listed in *Table* 4. Included in the table is the length of the course and a general title when available.

Pigment suppliers, such as CIBA-GEIGY, in Ardsley, N.Y., have offered courses in color as related to the use of pigments.

The professional societies and trade associations shown in *Table* 5 have either sponsored or co-sponsored courses or educationally-oriented symposia.

CONCLUSIONS

Successful digital color control is dependent upon level of knowledge of the personnel connected with the system. Training should not be limited to the system operator, but should encompass a much larger segment of an organization including formulators and key production personnel. As the degree of knowledge about and training on a digital color control system increases, so should the amount of happiness and satisfaction.

"Thus, people are the first and most important ingredient for success in computer color matching, and we cannot ignore it. You can buy instruments; it is only a matter of money. You can try to buy people, but that is more difficult. This need for intelligent, well-educated people emphasizes the need for more education and greater support for education. We cannot do without it."—Max Saltzman.[1]

Reference

(1) Saltzman, M., "Computer Color Matching - A View From Retirement," *Color Res. Application*, *1*, 167-169 (1976).

Reactions Of UV Curable Resin Formulations And Neat Multifunctional Acrylates II.

Photoinitiated Polymerization Of Neat 1,6-Hexanediol Diacrylate

George L. Collins and John R. Costanza
Celanese Research Company*

The course of the benzoin isobutyl ether photoinitiated polymerization of 1,6-hexanediol diacrylate was monitored by changes in the IR spectra. The reaction profile revealed that the polymerization was inhibited by dissolved oxygen. This inhibition could be eliminated by the addition N,N-dimethyl aminobenzaldehyde and eosin-Y. The mechanism of this suppression of inhibition is discussed. With these additives, propagation appears to be quite rapid even at a level of 0.5% benzoin isobutyl ether. Residual unsaturation is lowered from 10-15% in neat hexanediol diacrylate to 3% by diluting the diacrylate monomer with butoxyethyl acrylate.

INTRODUCTION

The motivation for developing nonpolluting coating techniques which do not require thermal curing steps has been reinforced by the occurrence of shortages in natural gas and fossil fuels. The 5.7 million pounds of UV resin produced in 1975 is projected to increase to reach as much as 100 to 300 million pounds by 1985. The realization of such a growth depends on the development of technology that will overcome some of the current limitations of UV cured resins such as slow "cure response", high cost of some photoinitiator systems, and residual unsaturation.

This report describes the results of an experimental investigation that was directed at a general clarification of the chemical principles that operate in the UV photoinitiated polymerization of 1,6-hexanediol diacrylate initiated with benzoin isobutyl ether. This multifunctional acrylate was chosen as an experimental model because it is currently widely used in the formulation of UV curable resins. The interpretations that have been assigned to the observed experimental results are consistent with those results but these interpretations have by no means been rigorously demonstrated. The observations reported in this article may be useful to others working in the area of UV curable resins and may provide a basis for further investigations into the chemistry of UV curable formulations.

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EXPERIMENTAL

All the acrylate and multifunctional acrylates described in these experiments were obtained from the Celanese Chemical Co. The principal monomers utilized for this investigation were 1,6-hexanediol diacrylate (HDODA) and trimethylol propane triacrylate (TMPTA). The benzoin isobutyl (BIBE) used in these experiments was obtained from Stauffer Chemical Co. and was used as received although it was apparent from liquid chromatography that the BIBE did contain aromatic coproducts.

The "shutter-IR" technique of generating experimental data for the rate of photoinitiated polymerization of multifunctional acrylates (MFA) has been previously described.[1] In order to systematically investigate induction, propagation, and residual unsaturation of various MFA's, the generalized reaction profile was divided into three "interpretational zones" that were analyzed separately. *Figure* 1 illustrates a generalized reaction profile which is divided into an induction region, an initiation/propagation region, and a region of remaining unsaturation.

The presence of impurities in the BIBE and the minimum error of 5% inherent in calculations from IR data both impose some limitation on the interpretation of the experimental data. Under these conditions, meaning can only be confidently assigned to large differences in observed phenomena.

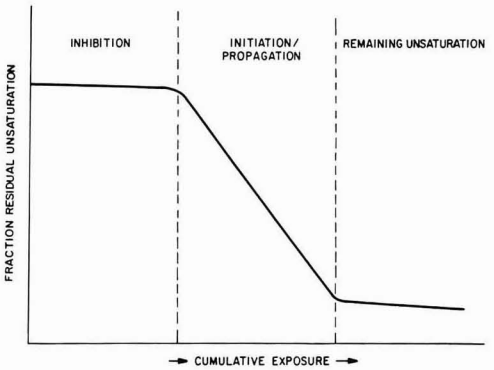


Figure 1—Interpretational zones for residual unsaturation (RU) plots

Exposures to UV radiation were accomplished by passing the monomer samples on a conveyor to the 200 watts per linear inch medium pressure Mercury Lamp, of a Hanovia Laboratory UV Curing Unit.

Inhibition by Oxygen

Figure 2 depicts the reaction profile of HDODA with 5% BIBE. For this sample, there is clearly an induction of about 5/60 sec before polymerization begins. During this induction it is assumed that the UV radiation induces the decomposition of benzoin isobutyl ether to primary radicals, however, these radicals are being consumed before they can initiate polymerization. Using the steady state condition of primary radical production and immediate consumption, an empirical equation was derived to account for the disappearance of the moiety, Q, that causes inhibition,

$$(Q) = (Q)_o - (BIBE)_o (1 - \exp\{6.99 \times 10^{-2}\, t\}) \qquad (1)$$

where (Q) = inhibitor concentration
$(Q)_o$ = initial concentration of inhibitor
$(BIBE)_o$ = initial concentration of BIBE
t = cumulative exposure time

Inhibition is over when (Q) = 0. This means that equation (1) can be used to calculate induction times at various initial concentrations of BIBE by solving for t when (Q) = 0. *Table* 1 compares the observed inhibition times with those calculated. The agreement is quite reasonable. The implication of this is that the inhibitor is some sort of molecular species that is present at an initial concentration of 8-9 × 10^{-4} mole/liter and reacts rapidly with the initially formed radicals.

Table 1—Comparison of Observed and Calculated Induction Times for Photoinitiated HDODA[a]

$(BIBE)_o$, % w/w	t Ind. (Observed)	t Ind. (Calculated)
5.0%	4/60	4/60
4.0%	4/60 - 5/60	5/60
3.0%	5/60	7/60
2.0%	7/60	10/60
1.0%	NDR[b]	20/60
0.5%	NDR[b]	41/60

(a) $(Q)_o$ = 8.7 × 10^{-4} mole/liter.
(b) No detectable reaction on 10/60 second scale.

During the production of HDODA, p-methoxyphenol and oxygen are added to suppress spontaneous polymerization during shipment and storage. In combination these molecules are capable of inhibiting radical polymerization. *Figure* 3 depicts the reaction profile of HDODA with 3% BIBE and 500 ppm of p-methoxyphenol added to the monomer. The only apparent effect is a slight shortening of the induction time. As illustrated in *Figure* 4, there was very little change in the reaction profile of HDODA when the level of p-methoxyphenol was increased from 500 ppm to 5000 ppm. It appears that in this photoinitiated polymerization of HDODA, the presence of p-methoxyphenol does not act as the limiting factor in this inhibition.

An attempt was made to determine whether O_2 was responsible for inhibition by bubbling N_2 through samples of HDODA and TMPTA to which 3% BIBE had been added. As is apparent from *Table* 2, the monomer samples could not be placed into the normal salt cell assembly because the samples all gelled in 8-12 min even in a completely dark room. There is a small thermal decomposition of BIBE which normally is not im-

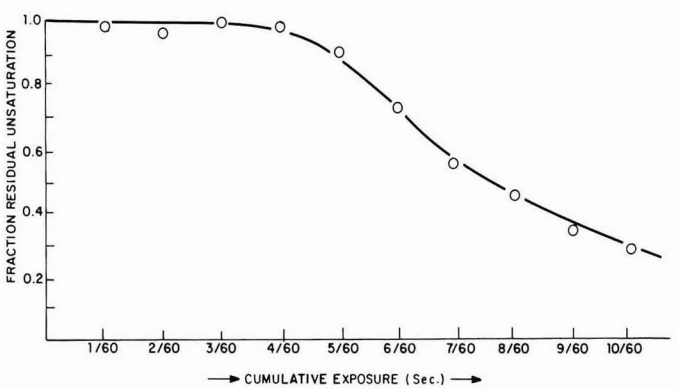


Figure 2—Reaction profile of HDODA/5% BIBE

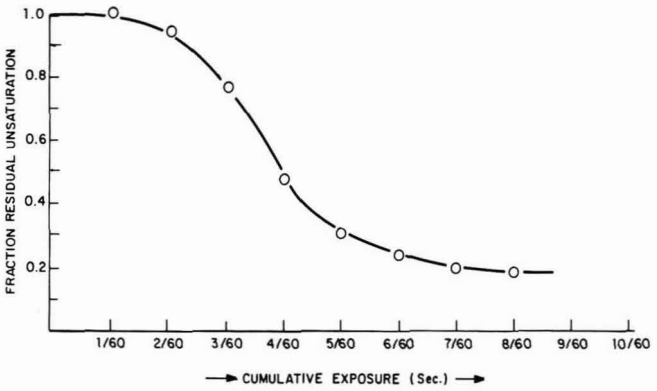


Figure 3—Reaction profile of HDODA/3% BIBE/500ppm p-Me0-ϕ-0H

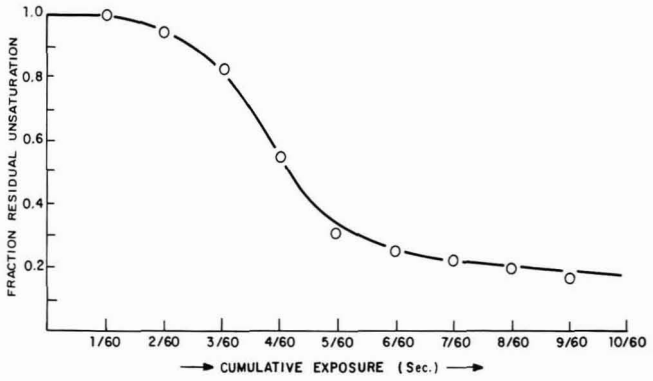


Figure 4—Reaction profile of HDODA/3% BIBE/ 5000ppm p-Me0-ϕ-0H

portant; however, apparently with the elimination of O_2, the small concentration of radicals that result from this decomposition are enough to initiate polymerization and result in gelling. The polymerization that ensues when oxygen is displaced strongly indicates that dissolved oxygen is very important in the inhibition of these monomers.

Mechanism of Inhibition

When BIBE is present at a 3% (w/w) level, the molar concentration is about 0.11 m/l. The suspected inhibitor is present at a much lower concentration, 3.7×10^{-4} m/l based on the calculations from equation (1). Although O_2 may trap active radicals directly, the occurrences of inhibition at such a large concentration of photoinitiator relative to the inhibitor concentration, suggests that the interaction between the photoinitiator and the inhibitor could be highly specific. Based on reports of the interaction of molecular oxygen and aromatic compounds, it is speculated that induction of BIBE photoinitiated polymerizations occur because an "oxyplex" between the aromatic benzoin ether and molecular oxygen is formed when BIBE is photochemically excited.[2-5] This specific interaction brings oxygen into the "solvent cage" with the BIBE thereby enormously increasing the probability that the initially formed radical will react with oxygen. The proposed reaction scheme is depicted as follows:

$$\text{BIBE} \underset{\leftarrow}{\overset{h\nu}{\rightarrow}} (\text{BIBE-}0_2) \quad \text{(oxyplex)} \qquad 1$$

$$(\text{BIBE-}0_2) \rightarrow 2R\bullet + 0_2 \qquad 2$$

$$R\bullet + 0_2 \rightarrow R00\bullet \quad \text{(unreactive)} \qquad 3$$

R • in this scheme is a generalized representation of the primary radicals formed from the photochemical decomposition of BIBE.

Oxyplexes are also probably formed between p-methoxyphenol and molecular oxygen. The occurrence of such an oxyplex could explain why, as previously stated, the addition of as much as 5000 ppm of p-meth-

Table 2—Gelling of Charcoal Treated Polyfunctional Acrylates With 3% BIBE

	Time to Gel (min.)	
	Lighted Room	Dark Room
TMPTA	5	12
HDODA	7	20

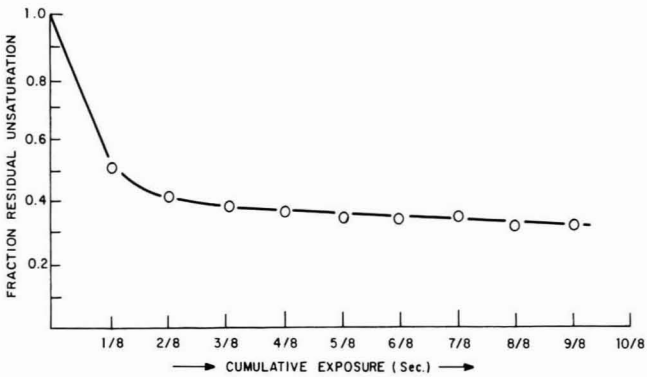


Figure 5—Reaction profile of TMPTA/3% BIBE

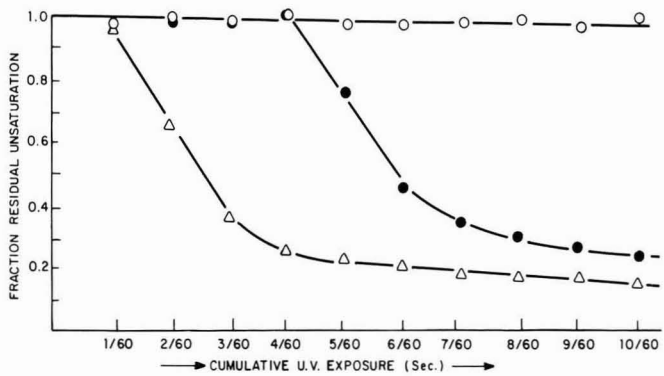


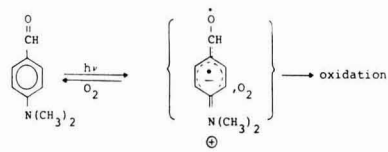
Figure 6—Effect of DMABA and eosin-Y on rate profile of HDODA; ○ HDODA/0.5% BIBE, • HDODA/0.5% BIBE/0.5% DMABA, Δ HDODA/0.5% BIBE/0.5% DMABA/eosin-Y

oxyphenol did not preclude photoinitiated polymerization. Indeed, since the phenol competes with BIBE for the available oxygen, it probably increases the effectiveness of the BIBE by complexing with some of the oxygen and thereby reducing the amount of oxygen available to interact with BIBE.

It should be noted that, as *Figure* 5 depicts, there is usually no observed induction in the photoinitiated polymerization of TMPTA with 3% BIBE. Currently, it is proposed that this lack of induction in TMPTA is a result of higher viscosity of TMPTA which has a viscosity of 50-150 cps compared to HDODA with a viscosity of 5-8 cps. If the formation of the oxyplex is diffusion controlled, then the higher viscosity could result in a lower rate of oxyplex formation. This, in turn, would lead to less primary radical deactivation. It is also possible that the lower solubility of O_2 in TMPTA could result in less oxygen available for radical deactivation.

Photo-oxidation

It is apparent that if it were possible to form a strong oxyplex that would irreversibly fix the dissolved oxygen, it would be possible to remove oxygen as an interference to the initiation of polymerization. Aromatic amines are suspected of forming relatively stable oxyplexes in their photochemically excited states; in addition, benzaldehyde is known to be easily and irreversibly oxidized to perbenzoic acid. For these reasons, p-dimethylaminobenzaldehyde (DMABA) was selected as a substrate for photo-oxidation that would selectively remove oxygen and allow BIBE to initiate without oxygen inhibition. In its photochemically excited state, the aromatic portion of the DMABA molecule can assume a radical anion-like character which strongly favors oxyplex formation and subsequently leads to irreversible oxidation,



In *Figure* 6, various HDODA polymerizations are depicted which were photoinitiated with 0.5% (w/w) of BIBE. The open circles show that within the 10/60 sec time frame, no detectable polymerization occurred without DMABA. On the other hand, when 0.5% DMABA is added to HDODA and 0.5% BIBE, the reaction, as represented by the closed circles, proceeds rapidly after 4/60 sec. The fact that the HDODA polymerization can proceed at such a low concentration

of BIBE is attributed to the photochemical fixing of oxygen.

Originally, it was felt that the observed increase in initiator effectiveness was due to some sort of mechanism involving the abstraction of hydrogen from the methyl group of the DMABA in a manner similar to that which occurs between benzophenone and triethylamine.[5] However, the abstraction of hydrogen would not increase the number or reactivity of active radicals so that even with abstraction there would be no reason to expect an increase in reaction rate. Furthermore, although Michlers Ketone is known to undergo such a reaction, not all aromatic amines are capable of this abstraction reaction.[6]

Further Increased BIBE Effectiveness

Although the apparent rate of initiation can be increased by the removal of oxygen, many of the initially formed radical fragments are probably lost by "cage recombination" to the starting BIBE. Benzoin isobutyl ether photochemically decomposes from the excited singlet state and both radical fragments are capable of initiating polymerization.[7-9] As a consequence, the radical fragments that form are likely to have paired spins which means that there would be little energetic obstruction to recombination. Cage products can be suppressed if decompositions that normally occur from the singlet state are caused to occur from the triplet state instead.[10] The spins of the radical fragments that result from decomposition from the triplet state are not paired and, as a consequence of spin inversion, there is an energy barrier that must be overcome if recombination is to occur directly.[11]

It is proposed that the addition of trace amounts of eosin-Y sensitizes at least a portion of the BIBE to the excited triplet state from which it decomposes to radical fragments that do not readily recombine. This fragmentation of benzoin ethers by low energy sensitization has been previously observed.[12] The triangles of *Figure* 6 demonstrate the effect of about 2-3 × 10^{-4} m/l eosin-Y in HDODA with 0.5% DMABA and 0.5% BIBE. The observed further increase in initiator effectiveness is tentatively accounted for by the fact that more BIBE radical fragments are now available for initiation due to at least partial suppression of cage recombination.

The overall reaction path of BIBE radical fragments is depicted in *Figure* 7. In Scheme I, with no additives, radical fragments are lost by oxygen deactivation and cage recombinations. In Scheme II, with DMABA, oxygen deactivation is eliminated and radical fragments are lost by cage recombination. In Scheme III, with DMABA and eosin-Y, oxygen deactivation is eliminated and cage recombination is suppressed resulting in an increase in effectiveness of initiation.

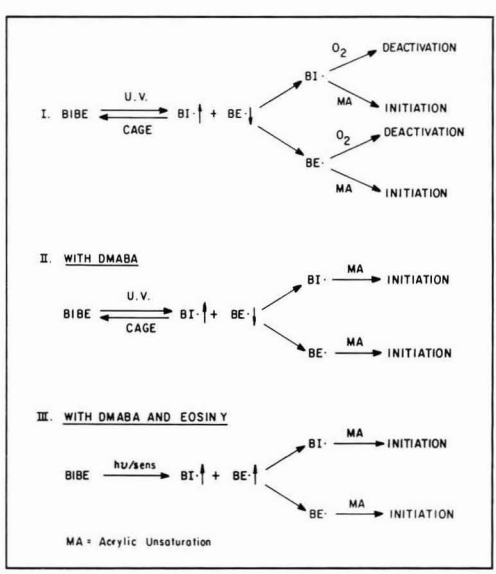


Figure 7—Proposed reaction schemes for BIBE with DMABA and eosin-Y

DR. GEORGE L. COLLINS, Senior Research Chemist at Celanese Research Co., received the A.B. Degree from Occidental College in Los Angeles, Calif. in 1967 and the Ph.D. Degree from the State University of New York, College of Environmental Science and Forestry in 1972. At Celanese, Dr. Collins has been concerned with the fundamentals of electropolymerization, UV photoinitiated polymerization, and cationic acetal polymerization.

JOHN R. COSTANZA, Research Associate at Celanse Research Co., received the B.S. and M.S. Degrees from the City University of New York. Since 1957 at Celanese, Mr. Costanza has conducted research and development studies on monomer and polymer synthesis as well as investigations into the utlization of polymers for coating, adhesives, plastics, and fiber applications.

Propagation

Because of the complications that result from the rapid network formation, a detailed description of the propagation would be quite difficult. However, it is useful to note the slopes of the decrease in acrylic unsaturation in *Figure* 2 and *Figure* 6. A typical free radical propagation of a neat monofunctional acrylate monomer would have a propagation described by expression 4.[13]

$$Rp = \frac{d(MA)}{dt} = kp\,(BIBE)^{1/2}$$

where (MA) = concentration of monofunctional acrylic monomer
kp = propagation constant (includes bulk monomer concentration)

At sufficiently high photoinitiator concentration, the rate of polymerization is zero order with respect to photoinitiator,

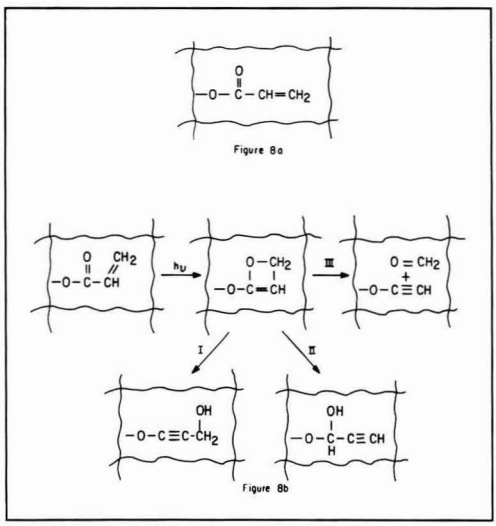


Figure 8—(a) Occluded acrylic groups in HDODA polymer matrix; (b) Proposed photochemical reaction of occluded acrylic groups

$$Rp = -\frac{d(MA)}{dt} = kp \qquad 5$$

In *Figure* 6 with 0.5% BIBE and DMABA/eosin-Y, the decrease in unsaturation in the propagation region is linear down to 35% residual unsaturation. This suggests that under these conditions, the rate of propagation is zero order with respect to BIBE; this, in turn, implies that 0.5% BIBE is still a "sufficiently high" concentration.

Ultimate Residual Unsaturation

During the course of the polymerization of these MFA's the reaction becomes very slow and results in unreacted acrylic unsaturated groups or residual unsaturation. This probably occurs because the polymer network that is formed is highly crosslinked and results in occluded acrylic groups as schematically depicted in *Figure* 8a. The ultimate structure of the networks formed from these neat MFA's probably depends only on the functionality and structure of the multifunctional monomer and not on the mode of initiation. As a result, some indication of the ultimate residual unsaturation that is characteristic of the network structure can be obtained by examining the residual unsaturation that remains when these monomers are fully polymerized with conventional thermal, free radical initiators. *Table* 3 gives the residual unsaturation for HDODA and TMPTA that were initiated in an oven at various temperatures using benzoyl peroxide/triethyl amine as an initiator system. For HDODA, the data at 120°C and 70°C with higher initiator concentration suggest that about 10% is about the minimum ultimate residual unsaturation that is characteristic of a network formed from neat HDODA. In the photoinitiated polymerizations of HDODA, the residual unsaturation was observed to be 10-15%. The value of 48% residual unsaturation for TMPTA at 70°C reflects the occlusion of more acrylic unsaturation that is the manifestation of the increased crosslinking in TMPTA relative to HDODA which, in turn, is a consequence of the increased functionality of TMPTA. This inherently higher level of residual unsaturation is also apparent in the photoinitiated polymerization of TMPTA as represented in *Figure* 5.

In the polymerizations photoinitiated with BIBE, complete reaction of the acrylic group can be achieved by exhaustively exposing the monomer sample to the UV radiation. However, as these exposures continue, the IR spectra reveal the growth of new absorptions at 2340 cm^{-1} and 2120 cm^{-1}. These absorptions are characteristic of alkyl substituted acetylenic groups. It is speculated that after the network reaches the ultimate residual unsaturation, these triple bond moieties arise from the intramolecular photochemical cycloaddition of the unsaturated portion to the carbonyl portion of the acrylic groups that are isolated in the network. This reaction scheme is illustrated in *Figure* 8b. Intermolecular photochemical reactions involving unsaturated oxetane as an intermediate have been described and initial considerations indicate that such an intramolecular reaction is theoretically plausible.[14-15]

In view of the characteristic nature of residual unsaturation in networks formed from neat HDODA, it would seem that two possible approaches to the reduction of this characteristic level would be to dilute the multifunctional monomer and/or to include a chain transfer step in the propagation mechanism.

It was observed that slightly lower values of ultimate residual unsaturation for difunctional monomers were obtained when diacrylates of low molecular weight polyethylene glycol were added to HDODA. It is known that the vicinal hydrogens in ethers are susceptible to abstraction by radicals.[16] It is postulated that chain transfer to molecules containing the ether groups allows for the radical chain process to continue without forming a crosslink site which would rapidly increase the network structure of the reaction medium and could eventually lead to occluded unsaturated groups as previously described.

In this light, two monofunctional ethers containing monomers were evaluated for their effect on ultimate residual unsaturation; trimethylolpropane formal acrylate, TMPFA, and butoxyethyl acrylate, BEA. In

Table 3—Residual Unsaturation With Thermal Initiation[a]

Initiator	36°C	56°C	70°C	120°C
HDODA				
0.1% BP[b]/0.05% TEA	...30%	25%	24%	10%
3.0% BP/1.5% TEA	..... —	—	10%	—
TMPTA				
0.1% BP/0.05% TEA	..... —	—	48%	—

(a) Salt cell assemblies containing thermal initiators and polyfunctional monomers were placed in ovens at various temperatures for 24 hr.
(b) BP = Benzoyl peroxide; TEA = triethylamine.

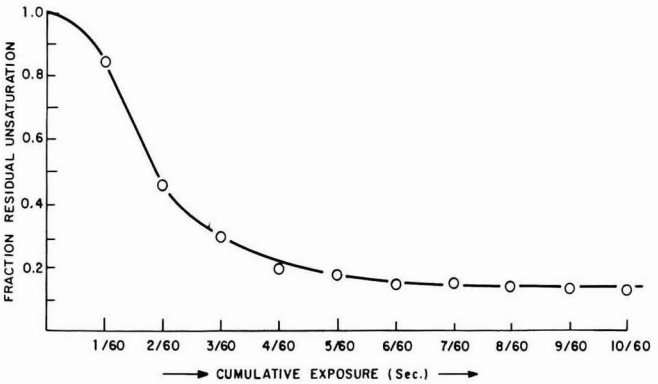


Figure 9—Reaction profile of 50-50 HDODA-TMPFA/3% BIBE/ 0.5% DMABA/eosin-Y; 13% residual unsaturation

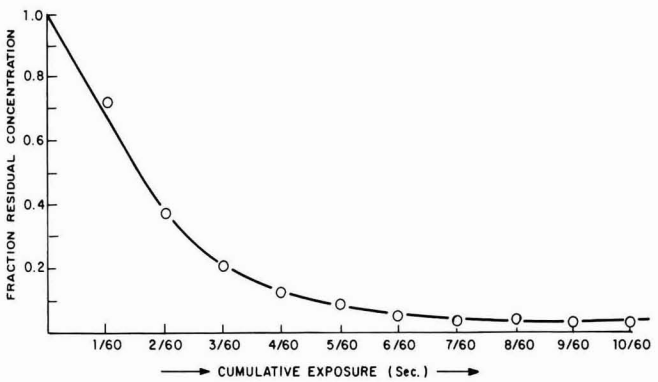


Figure 10—Reaction profile of 50-50 HDODA-BEA/3% BEA/0.5% DMABA/eosin-Y; 3% residual unsaturation

Figures 9 and 10 the "RU-plots" reveal that for TMPFA mixed with HDODA, 50% w/w, the final residual unsaturation is about 13%. However, for BEA, 50% w/w, the final residual unsaturation is only 3%. The implication is that BEA is quite effective in allowing the photoinitiated polymerization to proceed further to completion.

SUMMARY

Using the previously developed "shutter-IR" technique, some elements of the UV photoinitiated polymerization of 1,6-hexanediol diacrylate have been examined. Results indicate that inhibition is caused by dissolved oxygen in the bulk of the multifunctional monomer. This induction can be suppressed by fixing the oxygen to a chemical substrate by photo-oxidation. The effectiveness of the benzoin isobutyl photoinitiator can be increased by using a triplet sensitizer, eosin-Y, to cause the benzoin ether to fragment from the triplet state rather than the singlet state. This mode of fragmentation can reduce primary radical "solvent cage" recombination.

Exhaustive exposure of the samples leads to the spectroscopically observed formation of acetylenic groups. The overall residual unsaturation of hexanediol diacrylate is lowered from 13% to 3% by use of butoxyethyl acrylate as a diluting comonomer.

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Internal Strain In Solvent-Cast Coatings

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After mercury amalgamation of their tinplate substrates, the shrinkage of physically drying coatings was measured and identified with their internal strain. This strain arose from the solvent lost between the solidification point of the coating and its final "dry" state. The measurements showed no variation of internal strain with coating thickness or initial solution concentration.

A model is presented which explains the results quite successfully. It is based on the assumption that the solidification point can be identified with the solvent concentration which depresses the glass transition of the polymer to the ambient temperature.

INTRODUCTION

Coatings, for decorative or protective purposes, are commonly produced by brush, dip, or spray application of a polymer solution. The coating must shrink as it dries because the solvent evaporates. However, whereas the thickness can contract, the area is constrained by adhesion to the substrate. Further solvent is lost after solidification, but the coating can no longer flow to satisfy the change in volume. Because of this constraint internal stress arises in the plane of the coating.

Previous investigations[1,2] have measured the stress in solvent-cast coatings and found it to be independent of dried coating thickness and initial solution concentration. The stress also proved to be sufficiently large to endanger the cohesive and adhesive qualities of the coating. Thus, reduction in internal stress may extend the service life of a coating. A greater understanding of this problem is required. This paper presents the results of measurements of strain corresponding to the internal stress. They confirm previous measurements of internal stress and the theory developed to explain them.[2]

In the present experiments, the shrinkage of coatings released from tinplate substrates was measured. This shrinkage was assumed to be identical with the strain corresponding to the internal stress and, as such, was compared with the predictions of the theory. The experiments were conducted on the same coatings as used before, polystyrene and polyisobutyl methacrylate.

THEORY

Calculation of Internal Strain

The theory is concerned only with the equilibrium value of the internal stress or the potential shrinkage, i.e., internal strain. An exact description of how it arises as the coating solidifies would be extremely complicated and probably unedifying.

It is assumed that the residual internal stress is due solely to the difference between the volume fraction of solvent present in the film at solidification, ϕ_s, and the volume fraction retained in the "dry" film, ϕ_r. Before solidification, the coating can flow to accommodate the volume change demanded by the solvent evaporation. The area is constrained at its original wet size by adhesion to the substrate so the volume change appears as a change in thickness. After solidification the polymer can no longer flow and further solvent evaporation produces internal stress in the plane of the coating. The dry polymer film has been formed in such a way that the polymer molecules are not at their equilibrium position with respect to one another and, thus, are in a strained state. The thickness is not constrained and can still contract in response to the component of stress in that direction.

The volume of solvent lost produces internal bulk strain within the coating, equivalent to an isotropic linear strain field. The two components of strain remaining in the plane of the coating give rise to the internal stress. In this work the internal strain is measured as the shrinkage in coating length after it has been removed from its substrate.

The volume of solvent lost from the coating after solidification, ΔV, is given by

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$$\Delta V = \phi_s V - \phi_r (V - \Delta_z V) \quad (1)$$

where V = volume of coating at solidification;
ϕ_r is measured in free, unstrained films.

Equation (1) can be rewritten as

$$\frac{\Delta V}{V} = \phi_s - \phi_r \left(1 - \frac{\Delta V}{V}\right) \quad (2)$$

$$= \text{internal bulk strain, assuming an exact correspondence with the volume of solvent lost}$$

$$= 3\epsilon \quad (3)$$

where ϵ = isotropic linear strain, which is equivalent to the internal bulk strain.

In fact, the bulk strain does correspond to the solvent loss, for the coatings used here, as demonstrated previously.[2]

From equations (2) and (3), the internal linear strain is given by

$$\epsilon = \frac{\phi_s - \phi_r}{3 (1 - \phi_r)} \quad (4)$$

It is this result that will be compared with the experimentally determined values of shrinkage. Previously, the internal stress was measured and compared with an equation for the stress derived from equation (4) as follows.

For a plane stress situation the stress, σ, is given by

$$\sigma = \frac{E(\sigma)_s \epsilon}{1 - \nu} \quad (5)$$

where $E(\sigma)$ = Non-linear modulus of the material
ν = Poisson's ratio.

Thus, the internal stress could be predicted from equations (4) and (5). Measurements of ϕ_s, ϕ_r, ν, and $E(\sigma)$ produced predictions that agreed well with the independently measured internal stress (*Table* 1). However, $E(\sigma)$ is difficult to measure accurately for thin coatings and is, in any case, insensitive to differences in strain. A more stringent test of this theory would be to compare equation (4) with experimental values of shrinkage, as is done in this paper. The previous published values of internal stress differ due to a miscalculation of substrate modules, but the error does not affect any conclusions.

Identification of Solidification Point

The solidification concentration, ϕ_s, occurs when the wet coating first behaves like a solid rather than a viscous liquid, i.e., when large-scale molecular motion ceases in the polymer. At this point, the solution is highly concentrated and the macromolecules retain their positions relative to each other. Solidification of a polymer solution thus resembles the glass-rubber transition in solid polymers: above the transition temperature, T_g, large-scale molecular motion is allowed; below, the polymer is "frozen" into a glassy state. A somewhat different discussion along the same lines can be found in reference (3).

A solvent or plasticizer incorporated in a polymer will lower T_g greatly, the depression increasing with solvent concentration. Thus, ϕ_s might be identified as the solvent concentration at which T_g of the polymer solution coincides with ambient temperature. This transition is not due to temperature changes but to the changing of solvent concentration during drying. In previous work ϕ_s was determined by plotting T_g as a function of solvent concentration and choosing ϕ_s as the concentration that corresponded to the ambient temperature. The glass transition, however, is rather diffuse and molecular motion does not cease altogether at the transition temperature.

Table 1—Comparison of the Values for Internal Stress (MPa) Measured and Predicted from Equation (4)

	PIBM	PS
Experimental	4.5 (±0.30)	14.3 (±0.7)
Predicted	3.9 (±0.9)	10.8 (±1.7)

EXPERIMENTAL

The polyisobutyl methacrylate (PIBM) used was Du Pont Elvacite® 2045, and the polystyrene (PS) was Dow Styron® 685; both were dissolved in reagent grade toluene. The materials came from the same batches as used before.[2] All experiments took place at 23°C (±0.25°). Both of these materials produce amorphous coatings from solution so there are no complications due to crystallization.

Tinplate was chosen as the most reliable substrate on which to prepare coatings that were to be detached subsequently.[4] The substrates were masked to a convenient length, 60 mm, and width, 12 mm and coated using a variety of doctor blades. Drying was monitored by weighing to 0.1 mg and when there was no further systematic loss in weight the coating was considered dry. A typical coating weight was 15 mg. After a coating was completely dry (3 to 4 weeks) its length was found using a travelling microscope capable of measuring to 25 μm. The coating was then freed by amalgamating the tin with mercury, in a fume chamber. The length of the now free film was measured periodically until it stabilized, approximately two weeks for PIBM and two to three days for PS. Internal strain was calculated as the change in length divided by the original dried coating length.

free film and using a calibration of weight/length versus the film thickness obtained previously. It proved difficult to obtain consistent measurements from either coating material at thicknesses less than 15 μm; it seems that they were too delicate to withstand the handling necessary in this process.

There were two added complications with the PS coatings. Firstly, crazing and cracking were very prevalent. No measurements taken from crazed or cracked samples were used in the final results. Secondly, many of the thicker films spontaneously peeled from the substrate. However, provided these films had not crazed, they gave shrinkage results consistent with those that retained their adhesion.

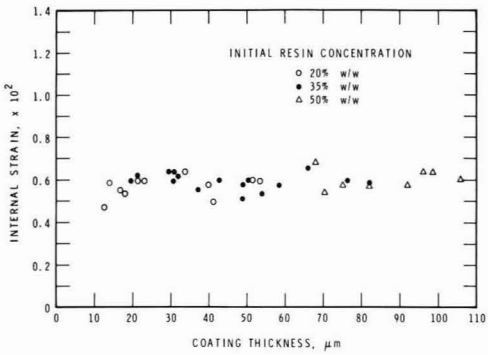

Figure 1a—Internal strain in PIBM coatings

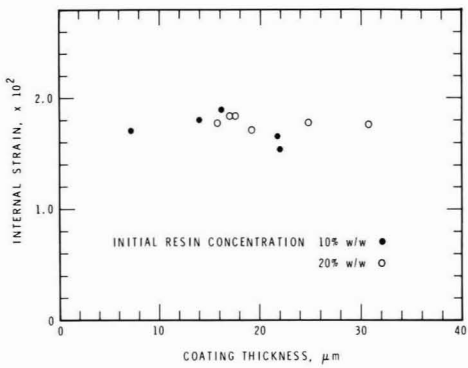

Figure 1b—Internal strain in PS coatings

Tinfoil substrates were also tried. They have two disadvantages. One is that being wholly tin they require more mercury to free the coating. The second is that tin is very soft and allows the coating to contract whilst adhering to the substrate. Consequently, it was necessary to use the "masked" length to calculate internal strain, not the dried coating length. On tinplate these two lengths were identical. The PS coatings adhered better to tinfoil than to tinplate, presumably because the foil allowed some relaxation of the internal stress.

All the results presented here were taken from coatings formed on tinplate.

RESULTS AND DISCUSSION

Shrinkage Measurements

In *Figures* 1a and 1b measurements of internal strain for PIBM and PS are plotted against thickness for various initial solution concentrations. One can see that there is no systematic dependence on dried coating thickness or solution concentration, which confirms the previous results on internal stress.[1,2]

For PIBM:

Average internal strain	$= 5.8 \times 10^{-3}$
standard deviation	$= 4.4 \times 10^{-4}$ (31 values)

For PS:

Average internal strain	$= 1.75 \times 10^{-2}$
standard deviation	$= 9.9 \times 10^{-4}$ (11 values)

A least squares fit to the PIBM data gives:

Slope	$= 2.7 \times 10^{-6}$ (std. dev. 1.7×10^{-5})
Intercept	$= 5.7 \times 10^{-3}$ (std. dev. 9×10^{-4})

i.e., there is no significant slope to the data.

The relative decrease in length of those PS specimens which crazed was typically 5×10^{-3}. Obviously, much of the internal stress had been relieved by crazing or cracking. If this small scale damage is tolerable it might be regarded as a practical means of internal stress relief.[6]

Those PS samples which completely peeled off spontaneously did not craze or crack often, because there was no constraint on them and they could shrink freely. The spontaneous detachment from the substrate should have only a negligible effect on the shrinkage value because the coating will not detach until the stress builds up and overcomes adhesion, i.e., the coating is almost completely dry. Thus, the endpoint is practically the same as in the regular procedure.

Comparison with Theory

The theory presented here does not take into account transport phenomena within the drying coating; in other

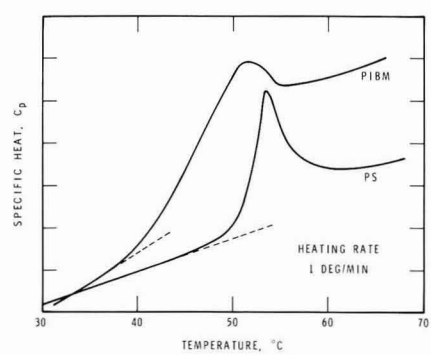

Figure 2a—Specific heat of dried coating material (vertical scale is arbitrary, to aid comparison of the curves)

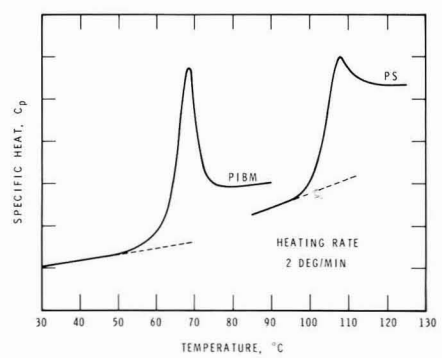

Figure 2b—Specific heat of polymer resin, as received (vertical scale is arbitrary, to aid comparison of the curves)

words, it does not allow any dependence on thickness or coating solution concentration. Qualitatively, the results agree with this assumption. They also permit a sensitive test of the quantitative predictions of the theory.

Values of ϕ_s and ϕ_r measured previously are presented in *Table* 2, together with the resultant prediction for internal strain, ϵ. The measured values of ϵ were 5.8×10^{-3} and 1.75×10^{-2} for PIBM and PS, respectively. Although the agreement is not good, it is at least within an order of magnitude and the discrepancy is easily accounted for.

Solidification was assumed to occur when the glass transition temperature, T_g, coincided with ambient temperature. No allowance was made for the fact that it is not a sharp transition and some molecular motion takes place below T_g, i.e., at solvent concentrations less than ϕ_s. An illustration of this point is seen in *Figure* 2a for dried coatings and in *Figure* 2b for the original resins. These are graphs of specific heat against temperature obtained from conventional Differential Scanning calorimetry. The vertical scales are arbitrary. It can be seen that the peaks in specific heat, which give a measure of molecular motion, are not at all sharp. In fact, it is possible to obtain thermally induced changes in the structure of solid polymers at temperatures below T_g,[5] which again indicates significant molecular motion below T_g.

Assuming that equation (4) is correct, a better estimate of ϕ_s is necessary. This requires knowledge of exactly at what point in the transition molecular motion freezes. This knowledge, however, does not seem to be available at present, either experimentally or theoretically. The shape and size of the transition are a function of the particular polymer involved, its flexibility, molecular weight and distribution, plasticizer content, etc.

Insight into this problem might be gained by approaching it from another direction. Using the experimental values of internal strain and ϕ_r, a new value of the solidification point, ϕ_s', can be calculated using equation (4), with the following results:

$$\text{PIBM}, \phi_s' = 0.094$$

$$\text{PS}, \phi_s' = 0.143$$

These new values correspond to glass transition temperatures of 33°C (PIBM) and 28°C (PS) derived from *Figures* 3a and 3b, which show the relationship between T_g and solvent volume fraction, ϕ, determined previously.[2] The differences, ΔT, between the foregoing values and ambient temperature are 10°C (PIBM)

Table 2—Previously Measured Values Of ϕ_s and ϕ_r

	PIBM	PS
ϕ_s V/V	0.162	0.176
ϕ_r V/V	0.078	0.096
ϵ	0.030	0.029

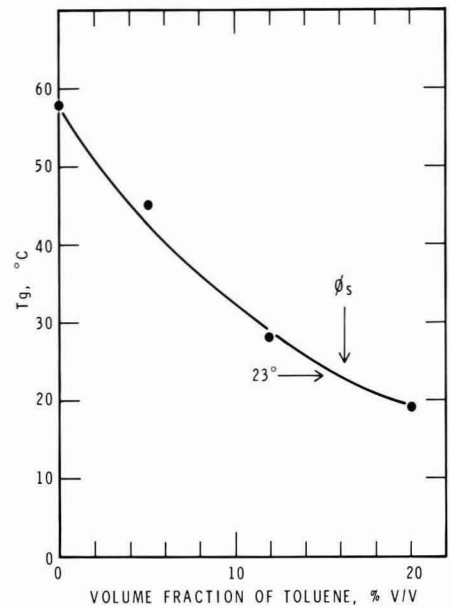

Figure 3a—Depression of T_g in PIBM by retained solvent, toluene

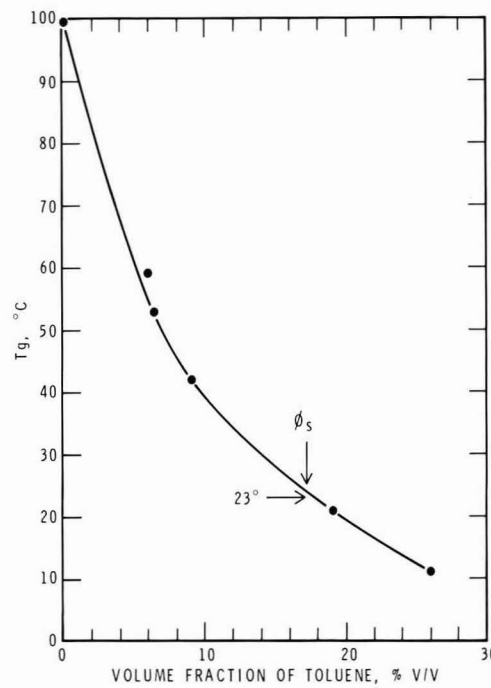

Figure 3b—Depression of T_g in polystyrene by retained solvent, toluene

and 5°C (PS), which might be construed as measures of the effective width of the two glass transitions. The ΔT are more correctly a reflection of the steepness of the curves in *Figures* 3a and 3b, which represent the internal kinetics of the polymer-solvent system.

Inspection of *Figures* 2a and 2b does, indeed, reveal that the transition in PIBM is a few degrees wider than that for PS and that these ΔT do still fall within the transition widths.

Consequently, it remains reasonable to associate the solidification of a physically drying coating with the glass transition, but in a rather more complex way than before which is, as yet, impossible to describe accurately.

CONCLUSIONS

Internal strain in physically drying PIBM and PS coatings has been determined by measuring their shrinkage upon release from tinplate substrates, by mercury amalgamation. This method is simple, direct and, with care, non-toxic.

The results confirm conclusions drawn earlier from measurements of the internal stress in the same systems, i.e., that the stress depends neither on dried coating thickness nor initial solution concentration.

It seems reasonable to expect this behavior in all physically drying coating systems where the residual internal stress/strain results from the volume of solvent lost after solidification, rather than the kinetics that govern the rate at which it is removed.

A theory has been presented that accounts for the lack of variation of the internal stress/strain with coating thickness or initial solution concentration. It does overestimate the internal strain, however. This was not apparent in previous measurements of the internal stress because the stress/strain curve of the coating is insensitive to changes in strain above a certain point. The overestimation may be due to the assumption that the solidification point of a coating is the solvent concentration which depresses the T_g of the polymer-solvent mixture to the ambient temperature. One must make allowance for the diffuse nature of the glass transition, which permits significant molecular motion at temperatures (or solvent concentrations) lower than T_g. At present it is impossible to predict the width of the glass transition or the exact point at which solidification occurs.

In PS coatings the internal strain, or stress, is large enough to provoke cohesive and adhesive failure. However, the cohesive failure is on a small scale and may be tolerable and, thus, a means of stress relief.

ACKNOWLEDGMENT

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Some Factors Affecting Cure Of UV Curing Inks and Varnishes

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Metal Box Limited*

The influences of pigmentation, photoinitiator type, curing atmosphere, radiation intensity, and film thickness, on the UV curing of inks and varnishes, were studied using infrared spectroscopy. The UV absorption spectra of the components, and theories of photoinitiation and oxygen inhibition, were used to interpret the results. Competition between photoinitiator and pigment for radiation was shown to influence both the degree of cure and the uniformity of cure in thicker films. Oxygen inhibition was greatly influenced by the choice of photoinitiator. The benefits of using focused radiation were found to disappear when an inert atmosphere was used.

INTRODUCTION

Although much has been written about the curing of UV curing materials, most of the published information concerns either clear coatings or coatings pigmented with titanium dioxide. Furthermore, assessment of cure has been either by a simple subjective test such as thumb twist or scratch resistance, or by measuring the extent to which the cured film provides desired functional properties such as solvent resistance, hardness, etc.

Recently, several authors have recognized the value of infrared spectroscopy for the measurement of cure,[1-5] as this provides an objective method of measuring the actual conversion of functional groups.

The work which will be described in the present paper shows how infrared spectroscopy has been used to demonstrate some general principles which govern the cure of UV curing inks and varnishes based on the acrylate functional group. The variables examined were pigment type; photoinitiator type; curing atmosphere, air or nitrogen; radiation intensity; and film thickness.

The results are in no way comprehensive, but the experiments have been selected to illustrate concepts which may be of use in the formulation and use of UV curing inks and varnishes.

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MATERIALS

The inks examined were formulated to the composition:

Oligomer	60%
Monomer	23%
Pigment	12%
Initiator	5%
	100%

The oligomer chosen was Lankro RCP 157, an aliphatic urethane acrylate, supplied by Lankro Chemicals Ltd., Eccles, Manchester, U.K. This material was selected because it has little UV absorption at wavelengths greater than 240 nm, and will therefore not compete to any appreciable extent with the photoinitiator for radiation.

The monomer chosen was trimethylol propane triacrylate (TMPTA), also supplied by Lankro Chemicals. This again only absorbs short-wave UV radiation, and has very low volatility. *Figure* 1 shows the UV absorbance spectrum of a three micron film of a mix of RCP 157 and TMPTA (60 parts : 23 parts).

Two pigments were examined, chosen for their markedly different UV absorption characteristics. These were Irgalite LGLD Blue (CIBA-GEIGY) a stable β phthalocyanine blue (C.I. Pigment Blue 15.3), and Irgalite NBS Red (also from CIBA-GEIGY) a barium 2B toner (C.I. Pigment Red 48.1). Their UV absorption characteristics will be described in a later section of the article.

Two photoinitiator systems were used. The first was 2,2 diethoxyacetophenone (DEAP), and the second was a mixture of 2-chlorothioxanthone (2CTX) and ethyl paradimethyl aminobenzoate (EPDMAB). Samples of all these materials were supplied by Ward Blenkinsop Ltd., Wembley, Middlesex, U.K.

The two photoinitiator systems were chosen because of their greatly differing characteristics. The UV absorption spectra of the three materials in solution in

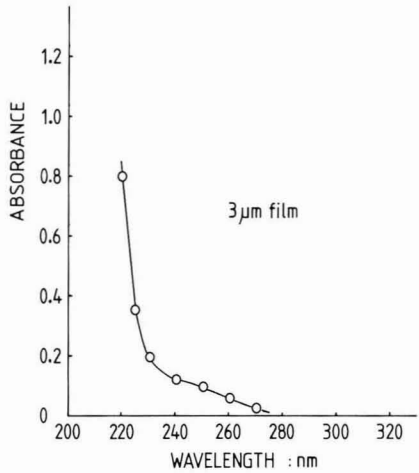
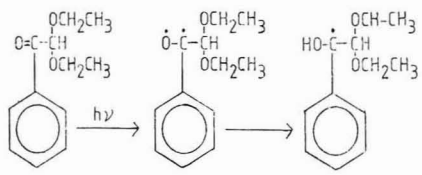


Figure 1—UV absorbance spectrum of a mix of RCP 157 resin (60 parts) and TMPTA (23 parts)

ethanol are shown in *Figures* 2, 3, and 4. It can be seen that while DEAP absorbs strongly at 248 nm, it absorbs very little above 300 nm. 2CTX absorbs very strongly at 259 nm, but a lesser absorption peak at 385 nm can be seen. The tertiary amine group in EPDMAB shifts the main absorption to 308 nm.

The other main difference between the initiator systems lies in the mechanisms of primary radical production. Various suggestions have been made for the mechanism involved with DEAP. Osborn and Sandner[6,7] have indicated that DEAP yields a biradical as the chain initiating species, the mechanism involving intramolecular hydrogen transfer:



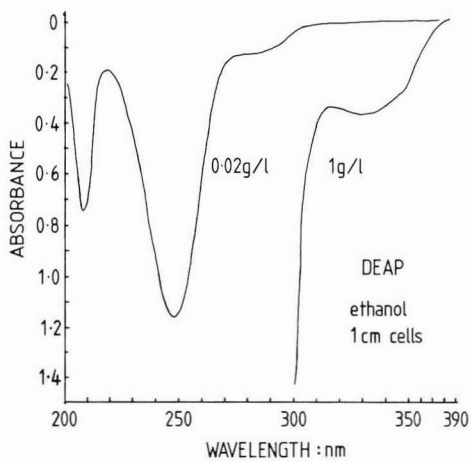
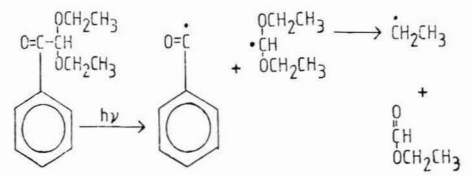
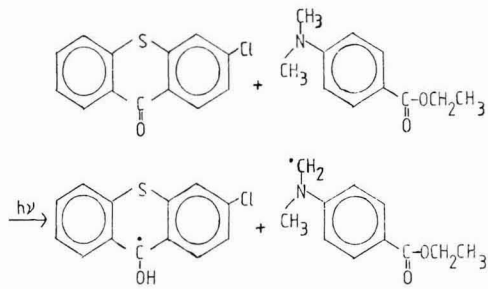


Figure 2—UV absorbance spectrum of DEAP in ethanol

while Berner, Kirchmayer, and Rist[4] have found that a Norrish Type 1 cleavage predominates:



2CTX operates by a hydrogen abstraction process as does benzophenone, and EPDMAB provides the active hydrogen:



This mechanism is oversimplified, and it is likely that an intermediate charge transfer complex is formed.[8,9]

Four inks and two unpigmented formulations were made with the following compositions:

	Ink				Varnish	
Component	A	B	C	D	A	B
RCP 157	60.0	60.0	60.0	60.0	68.7	68.7
TMPTA	23.0	23.0	23.0	23.0	26.3	26.3
NBS Red	12.0	—	12.0	—	—	—
LGLD Blue	—	12.0	—	12.0	—	—
DEAP	5.0	5.0	—	—	5.0	—
2CTX	—	—	2.0	2.0	—	2.0
EPDMAB	—	—	3.0	3.0	—	3.0
	100.0	100.0	100.0	100.0	100.0	100.0

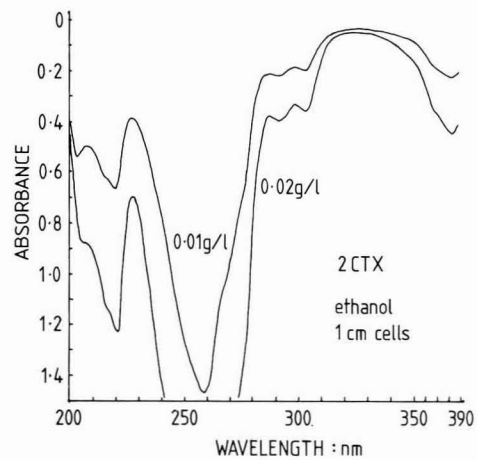


Figure 3—UV absorbance spectrum of 2CTX in ethanol

The resin-to-monomer ratio was the same in all cases. Both inks and varnishes were mixed between ground glass plates using an Ault and Wiborg automatic muller.

USE OF INFRARED SPECTROSCOPY FOR MEASUREMENT OF CURE

When UV curing materials containing the acrylate functional group are irradiated, initiator molecules are excited and give primary radicals which initiate chain polymerization. During cure, the group

$$CH_2 = CH - C(=O) - O -$$

is converted to

$$- CH_2 - CH(-) - C(=O) - O -$$

and corresponding changes take place in the infrared spectrum. The absorption peaks associated with the vinyl group decrease, while those associated with the - CH_2 - group increase.

Quantitative infrared analysis relies on the fact that the measured absorbance at a wavenumber corresponding to a particular bond or functional group is proportional to the concentration of that bond or functional group and also to the path length. Reaction of a functional group can therefore be followed by measuring the change in absorbance at the appropriate wavenumber.

The inks and varnishes used in the work described here could be applied easily as thin films to the surface of a polished sodium chloride disc and excellent transmission spectra obtained. A particularly well resolved peak was obtained at 808 cm^{-1} (acrylate = CH_2 twist) and changes in the absorbance of this peak were used to calculate the percentage of original double bonds remaining after cure.

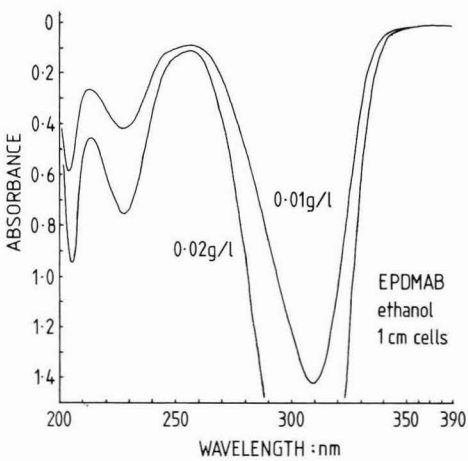


Figure 4—UV absorbance spectrum of EPDMAB in ethanol

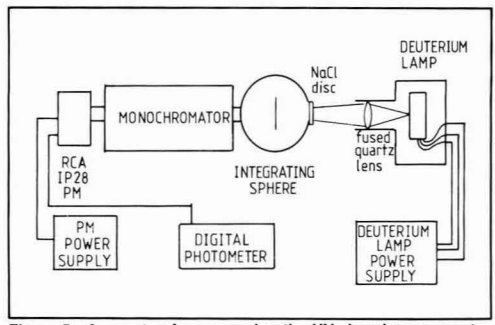


Figure 5—Apparatus for measuring the UV absorbance spectra of pigments

UV ABSORPTION BY PIGMENTS

There is a lack of published information about the absorption of UV radiation by organic pigments and the effect of this absorption on the cure of UV curing inks. Hencken[10] measured the UV absorption spectra of some organic pigments and related the results to the cure of inks pigmented with these materials. He found that when the pigment absorbs in the same region of the spectrum as the photoinitiator there is competition for the radiation and cure is impaired. Hencken measured the absorption spectra of pigments dispersed in a water/glycol mixture. Similar work has been described by Bassemir and Bean[11,12] who dispersed magenta, cyan, yellow, and black pigments at 10% concentration in mineral oil and measured the absorption spectra of films applied to a quartz plate. Vincent[13] dispersed yellow and black pigments in a clear thiol/ene photopolymer and measured the UV absorption spectra of thin films applied to a Mylar® polyester substrate. Wicks and Kuhhirt[14] have calculated the amount of radiation absorbed by a photoinitiator at various levels in a pigmented film. Bridgeman[15] has discussed the influence of pigments on cure, and has suggested that the ability of a pigment to stabilize free radicals may be an important factor in reducing cure rate.

Some care is required in the choice of a method for measuring the UV absorption spectra of pigments if the results obtained are to have the maximum relevance to the UV curing situation. It is worth choosing a vehicle of appropriate polarity, a pigment concentration of the order used in inks (i.e., 5-25%), and a dispersing technique which will provide a realistic particle size distribution.

There are several complications which must be considered. Pigment particles may scatter radiation, and if this scattered radiation is diverted from the normal radiation path through the film it may not reach the detector and, therefore, will be considered to be absorbed. However, in the UV curing situation, this scattered radiation will still be available for initiating cure, and in fact scattering may increase the effective path length and the likelihood of absorption of the radiation by the photoinitiator, particularly in thin films.

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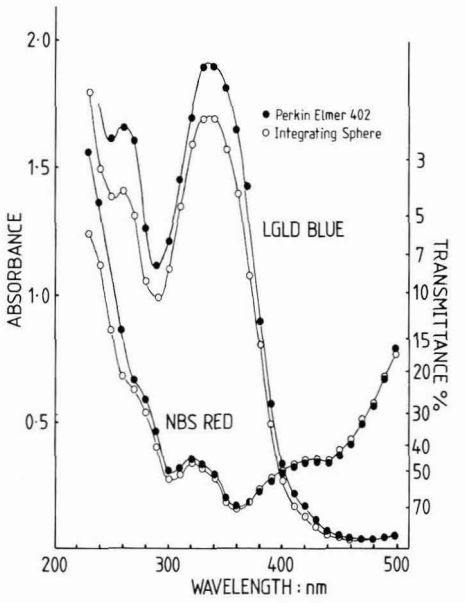

Figure 6—UV absorbance spectra of pigmented mixes

A further problem is that when the surface of an ink is irradiated, some of the radiation will pass through the ink film, some will be absorbed by the components of the ink, and some will be reflected from the surface. The reflected component will depend on the angle of irradiation and the refractive index of the ink.

The UV absorption spectra of the two pigments employed in the work described in this paper were measured by a technique designed to overcome as much as possible the various potential problems which have been mentioned. The technique was as follows:

(1) For each pigment the following mix was made:

RCP 157	63.6
TMPTA	24.4
Pigment	12.0
	100.0

(2) The apparatus shown in *Figure* 5 was assembled. It consisted of a Cathodeon C70-3V-H deuterium lamp, radiation from which was focused by a quartz lens onto a 1.5 cm diameter circle concentric with the 2 cm diameter entrance port of an integrating sphere coated internally with Eastman Kodak barium sulphate reflective coating. Radiation passed from the exit port of the integrating sphere into an Applied Photophysics monochromator. Radiation leaving the monochromator was detected by an RCA 1P28 photomultiplier sensitive to wavelengths between 200 and 600 nm. All the components were aligned on an optical bench. The current from the photomultiplier was measured with an Alphametrics DC1010 digital photometer.

(3) A clean polished NaCl disc 4 mm thick and 20 mm in diameter was placed in the entrance port of the integrating sphere. The deuterium lamp was switched on, and after allowing time for the stabilization of the output and the photomultiplier response, the photomultiplier current was measured for wavelengths at 10 nm intervals between 200 and 500 nm.

(4) The NaCl disc was printed with a thin film of one of the pigmented mixes, using a Duncan Lynch proof printer to apply a uniform film to a hand roller. The IR spectrum of the film was measured using a Perkin Elmer 157G spectrophotometer. The printed disc was replaced in position in the entrance port of the integrating sphere and measurements of the photomultiplier current were again made every 10 nm. These measurements were compared with those obtained with the clean disc, and the apparent absorbance of the film was calculated for each wavelength. The procedure was repeated for films of different thickness. The thickness of each film was calculated from the absorbance of the 808 cm^{-1} peak in the IR spectrum, a calibration having been made by comparing absorbance values for this peak with measured weights deposited on the disc.

(5) From the data, it was possible to plot graphs of the absorbance at any wavelength against film thickness. Straight line graphs were obtained but not all these lines passed through the origin. There was sometimes observed a small intercept on the absorbance axis which was thought to be due to radiation being reflected from the surface of the film. Absorbance spectra for films of different thickness were calculated from the gradients of the lines. *Figure* 6 shows the absorbance spectra of 3 μm films of the two pigmented mixes. The contribution of the resin/monomer mix is small, as can be seen from *Figure* 1.

One of the main attractions of the method described is that use of the integrating sphere allows all the radia-

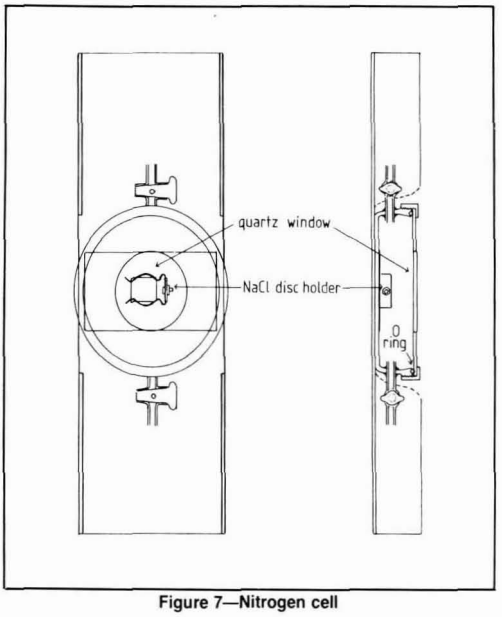

Figure 7—Nitrogen cell

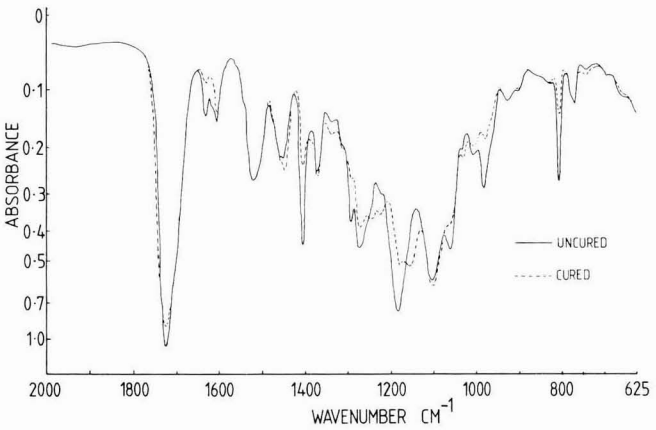

Figure 8—IR spectra of Varnish B (2CTX/EPDMAB) before and after cure

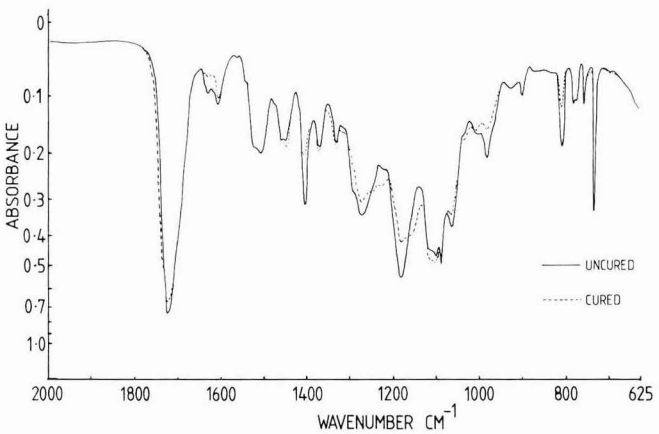

Figure 9—IR spectra of Ink D (LGLD/2CTX/EPDMAB) before and after cure

tion passing through the film to be measured. To assess the benefits of this, parallel measurements were made using a Perkin Elmer 402 UV/Visible spectrophotometer. These are also shown in *Figure* 6. As may be expected with relatively transparent pigments, the results of the two methods are very similar, although lower absorbance figures were obtained with the integrating sphere method at shorter wavelengths.

UV CURING EQUIPMENT

A single medium pressure ozone producing mercury discharge lamp, supplied by Primarc Jigs and Tools Ltd., Slough, U.K., of arc length 22.6 cm, and with a nominal input of 80 watts/cm, was used to cure the inks and varnishes. The lamp was used with an elliptical aluminum reflector, and was situated across the direction of travel of a conveyor belt, the speed of which was normally 1.02m/sec.

Although, in keeping with normal practice, the lamp module was, in general, positioned so that reflected light from the lamp was focused on the print, in order to observe the effect of intensity of irradiation on cure, the lamp was raised so that the print was 9 cm below the

GRAHAM PLEWS joined Metal Box Ltd. as an apprentice litho printer in 1969. On completion of his apprenticeship in 1974 he entered Watford College of Technology and is now in the final year of a B.Sc. degree course in printing and packaging technology. This paper is part of a final year research project to fulfill his degree requirements. He will be rejoining Metal Box Ltd. on completion of his degree course in June 1978.

ROGER PHILLIPS obtained the Ph.D. degree in Physical Chemistry from University of Bristol in 1966. Between 1966 and 1969 he was a Research Associate in the Department of Materials Science at Pennsylvania State University. Dr. Phillips joined Morganite Carbon Ltd. as a senior process chemist in 1969, and has been head of the Printing Technology Research Laboratories of Metal Box Ltd. since 1974.

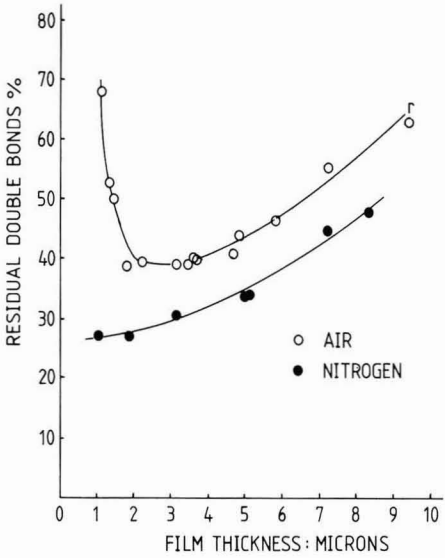

Figure 10—Curing of Ink A (NBS/DEAP)

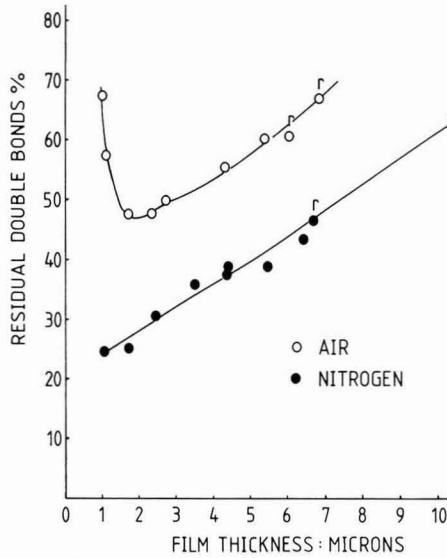

Figure 11—Curing of Ink B (LGLD/DEAP)

focus position. It had been hoped that raising the lamp would dramatically reduce the intensity of irradiation (i.e., watts/cm^2) but that the total radiation (i.e., joules/cm^2) would remain unchanged, as was found by Rubin.[16] However, it was discovered, by measuring the integrated intensity with an International Light 'Light Bug' and IL745 UV Curing Photometer, that as the lamp was raised there was a reduction in the total amount of light falling on the center of the conveyor belt. The apparent discrepancy between these results and those of Rubin can probably be explained by the fact that Rubin used a much longer lamp and was working closer to it.

To compensate for the light loss when the lamp was raised to the defocused position, the conveyor belt speed was reduced to 0.66m/sec. Measurements made previously with an Ashdee Power Density Analyzer, set to the peak intensity mode, with a different lamp, but with a reflector of the same dimensions, indicated that raising the lamp reduced the peak intensity of irradiation by a factor of about six.

CURING IN AN INERT ATMOSPHERE

As atmospheric oxygen is well known to have an inhibiting effect on the surface cure of UV curing materials which polymerize by a free radical mechanism, it was considered instructive to compare the cure obtained in an inert atmosphere with that obtained in air.

To this end a cell was constructed which would enable a sample to be irradiated either in a vacuum or in any chosen gas. The cell is shown schematically in *Figure* 7. It consists of a shallow brass cylinder into which are sealed two small glass stopcocks. A brass plate, in the center of which is sealed a 50 mm diameter, 2.5 mm thick, polished spectrosil window, is held in position on the top of the cylinder by a threaded ring. An O-ring rubber seal around the top of the cylinder prevents gas leakage. The dimensions of the cylinder are such that an NaCl disc in a spectrophotometer holder fits neatly into the base of the cylinder. The interior of the cylinder is painted matte black so that radiation passing through the disc is not reflected. The cylinder is attached to a steel plate, the edges of which are turned up to protect the glass stopcocks. The whole assembly can easily be passed on a conveyor belt under a UV lamp.

CURING EXPERIMENTS

Inks A - D and Varnishes A and B were coated at various film weights on NaCl discs. The inks were applied from a hand roller inked from the rollers of a Duncan Lynch proof printer. Film thickness could be varied between about 1 and 10 μm by varying the volume of ink applied to the proof printer. The varnishes were applied with a 2 mm diameter glass rod. This allowed film thickness to be varied from about 1 μm to about 40 μm.

Each coated disc was placed in a spectrophotometer holder and its spectrum from 2000 cm^{-1} to 625 cm^{-1} was recorded using a Perkin Elmer 157G spectrophotometer. The disc holder was then placed in the gas cell. For curing in air, the stopcocks were left open and the cell was passed once under the lamp at 1.02m/sec. For curing in an inert atmosphere, the cell was filled with oxygen free nitrogen. After cure, the disc holder was removed from the cell and the spectrum was recorded again. A typical pair of spectra, before and after cure, for a varnish, is shown in *Figure* 8, and for an ink in *Figure* 9. It can be seen that the pigment has little effect on the quality of the spectra obtained.

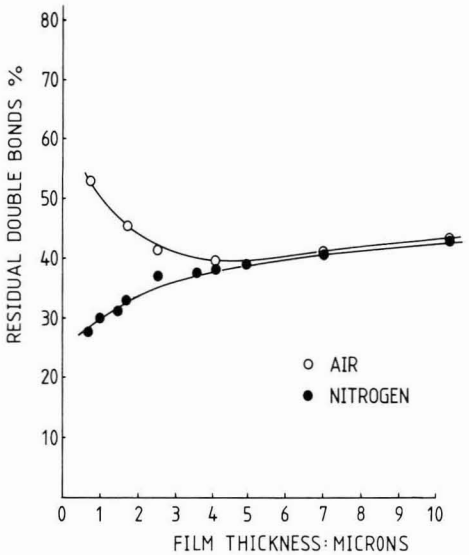

Figure 12—Curing of Ink C (NBS/2CTX/EPDMAB)

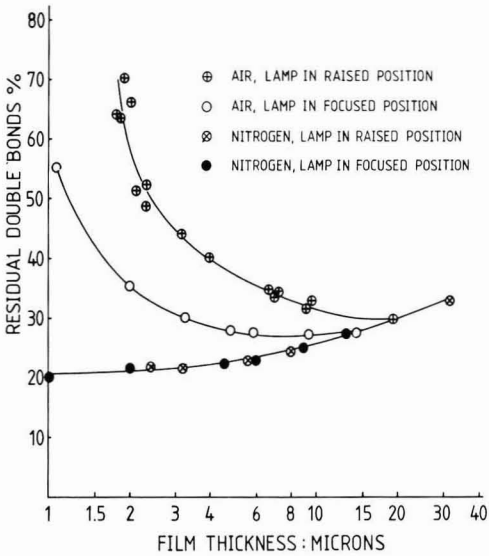

Figure 14—Curing of Varnish A (DEAP)

Changes in the vinyl group absorbances can readily be seen. The cure of the ink or varnish was calculated from the change in absorbance of the 808 cm^{-1} peak.

The effect of intensity on cure was investigated only for the varnishes. Cure measurements both in air and nitrogen were made with the lamp in the raised position and with the conveyor speed reduced to 0.66m/sec.

A calibration was made to allow the film thickness to be calculated from the 808 cm^{-1} absorbance of the uncured material. In fact, a printed ink film is not uniform in thickness and will usually show a cyclical variation related to the method of application. Also, shrinkage takes place during cure, so that the dry film thickness is less than the wet film thickness.

The results of the curing experiments are shown in *Figures* 10-15.

DISCUSSION

When samples are cured in nitrogen, an increase in film thickness causes a decrease in the measured cure. This decrease is far less pronounced in the case of

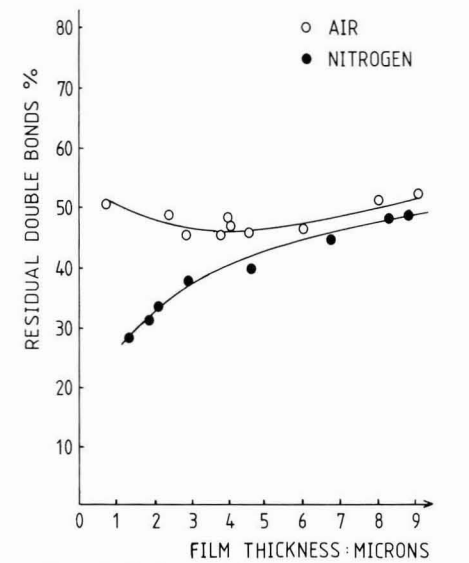

Figure 13—Curing of Ink D (LGLD/2CTX/EPDMAB)

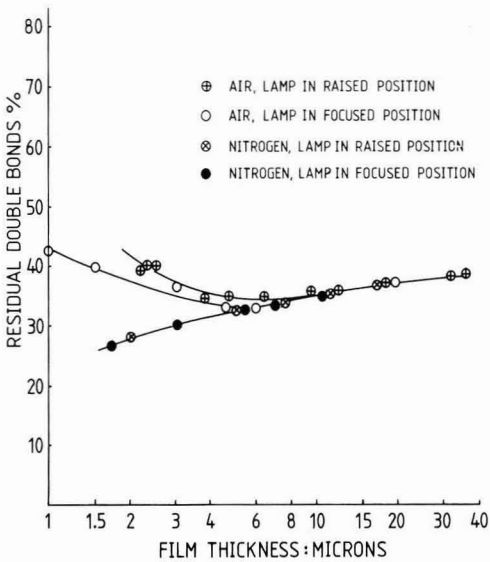

Figure 15—Curing of Varnish B (2CTX/EPDMAB)

unpigmented materials, which indicates that it is a result of the attenuation of the radiation as it passes through the film.

When samples are cured in air, the cure measured for very thin films may be very poor and will pass through an optimum value as the film thickness is increased. The poor cure in thin films must be a result of oxygen inhibition.

Figure 14 shows that decreasing the intensity of irradiation causes a dramatic deterioration in the cure of thin films of Varnish A in air. The effect is less pronounced in the case of thick films. A similar observation was made by Rubin[16] who concluded that increasing the intensity of irradiation reduces the effects of oxygen inhibition. Confirmation of this conclusion can be found in the observation that decreasing the intensity of irradiation has no effect on the cure of films in nitrogen.

The same effects are found to a much less pronounced degree with Varnish B, as can be seen in *Figure* 15, and all the results obtained indicate that the combination of 2CTX and EPDMAB is far less affected than DEAP by oxygen inhibition.

Oxygen is a very effective quencher of excited states. 2CTX by itself is a very poor initiator of acrylate polymerization because the rate at which it can create monomer radicals by hydrogen abstraction from the acrylate group is slow compared with the rate at which its excited state is quenched by oxygen. Tertiary amines such as EPDMAB are very effective H donors and the hydrogen abstraction reaction is exceedingly fast and consequently oxygen quenching is minimized.[17]

The second way in which oxygen affects the free radical polymerization process lies in the fact that oxygen is a ground state free radical and as such can react with other radicals, in particular those which are intermediates in the polymerization process, i.e., $R^{\bullet} + O_2 \rightarrow RO_2^{\bullet}$. The peroxy radical so formed is not an effective chain initiator.[17] However, if an effective H donor is present, and in particular an amine, an effective radical may be generated by a hydrogen transfer reaction:[7]

$$RO_2^{\bullet} + \text{-}CH_2\text{-}NRR' \rightarrow RO_2H + \text{-}\dot{C}H\text{-}NRR'$$

This may be the most significant reason why amine containing systems are less prone to oxygen inhibition than those in which amines are absent. In the case of 2CTX and EPDMAB, the α amino radical derived from the excited charge complex will act as an effective scavenger of oxygen by a chain process during which amino radicals are constantly regenerated, maintaining their concentration for the chain initiation process.

It is interesting to note that amines will enhance the surface cure of formulations containing DEAP and 2,2 dimethoxy 2-phenylacetophenone[4], and that decreased oxygen sensitivity can be built into polymer systems by incorporating groups containing abstractable hydrogen atoms into them, e.g., ethers.[18]

In nitrogen, DEAP is seen to be considerably more effective than 2CTX/EPDMAB in the varnishes and in thin films of the inks. There are three major factors which influence the effectiveness of an initiator system. Firstly, the initiator molecule must be excited and, therefore, a high extinction coefficient in the region of available radiation is required. Secondly, there must be a facile production of primary radicals and, thirdly, these radicals must be effective in initiating polymerization.

Examination of the absorption spectra of DEAP and 2CTX shows that the latter will absorb more of the radiation from a mercury lamp than the former. However, if it is assumed that each molecule of DEAP could yield two primary radicals, it can be calculated that 1g of a mix containing 5% of DEAP could yield 2.89×10^{20} primary radicals if every molecule of DEAP absorbed a photon. When 2CTX is used at 2% with 3% of EPDMAB, the EPDMAB is in excess and, therefore, the potential primary radicals yield is limited by the concentration of 2CTX. Each molecule of 2CTX could produce one charge transfer complex molecule and then two primary radicals. Therefore, if every molecule of 2CTX absorbed a photon, 1g of a mix containing 2% of 2CTX and 3% of EPDMAB could yield only 9.8×10^{19} primary radicals.

However, the irradiation levels normally used in UV curing are such that not all the photoinitiator takes part in the curing process. Indeed, Geary[19] has been able to extract the bulk of DEAP intact from a cured film.

Also, the primary radicals produced from the two initiators will differ in their effectiveness for chain initiation. All the radicals derived from DEAP may be expected to be highly active in this respect. On the other hand, the semipinacol radical derived from 2CTX may not be an effective initiator by direct addition,[20] if it behaves in a similar way to that derived from benzophenone, and the α amino radical derived from EPDMAB may be responsible for the bulk of the initiation, although it has been suggested that the semibenzpinacol radical can create monomer radicals by a hydrogen transfer process.[21] It is also possible that a semipinacol radical could act as an oxygen scavenger by being oxidized back to the parent ketone.

Figures 10 through 13 show that thicker films of the red inks cure more readily than thicker films of the blue inks, and that there is less variation in cure with film thickness when 2CTX/EPDMAB is used than when DEAP is used.

This is not surprising, as both pigments absorb quite strongly in the 250 nm region of the spectrum and compete effectively with DEAP for radiation. 2CTX however has a broad absorption centered at 385 nm and will respond well to the 365 nm and 405 nm lines in the mercury spectrum. Both pigments transmit well at 405 nm and the red has a very high transmission at 365 nm also.

Although the differences in cure between the inks containing these two pigments can readily be explained in terms of the absorbance spectra of the pigments, in general, there may be other factors involved.[15] Chang[5] has recently examined the cure of inks pigmented with carbon blacks and has found that inhibition of cure can be related to the quinone content of the black.

It will be seen that some of the points in *Figures* 10 and 12 are marked with the letter 'r'. This indicates that

a 'rivelling' effect was observed,[22] as has often been found with UV curing white coatings, and is a result of gross nonuniformity of cure. It was found in the present work only with the thickest films of ink containing DEAP.

Hulme, et al.[22] have suggested that one of the reasons for the effectiveness of EPDMAB as a synergist with 2CTX lies in its very strong absorbance at 308 nm, well placed to respond to the 302 nm and 313 nm lines in the mercury spectrum. This is interesting in view of the fact that most authors consider that the intermediate donor acceptor complex is formed by the interaction of the excited ketone and the ground state amine. Ledwith,[23] however, has suggested that this is too simple a picture and that either donor or acceptor may be excited prior to the formation of the complex.

SUMMARY

IR spectroscopy has been used to provide a sensitive and objective method of measuring the cure of UV curing inks and varnishes. The type of initiator used has been shown to strongly affect the degree of oxygen inhibition at the surface of the film and also the uniformity of cure within the film. The benefits of using a focused beam of radiation have been shown to be due to the minimizing of oxygen inhibition. A method has been described for the measurement of the UV absorption spectra of pigments, and the results for two commonly used pigments have been related to the curing of inks containing them.

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The Role of the Company Expert In Product Liability Litigation

Louis A. Lehr, Jr.
Arnstein, Gluck, Weitzenfeld and Minow*

We find ourselves in the midst of what many regard as a product liability crisis. Various estimates have been given concerning the extent of this crisis with some figures as high as one million claims per year at an average cost of $50,000 per claim. Manufacturers, wholesalers, and distributors are finding that product liability insurance may not be available or, if available, only with a high deductible. Where insurance coverage can be obtained, premiums in some instances have risen 300% to 500% or more. Corporate financial officers have realized that in some instances the loss of one lawsuit may seriously affect the profitability of the company.

Manufacturers often ask, "What has happened?" Products are being made with the same due care and they are being thoroughly tested. Despite this, more and more product liability suits are being filed. While more product is being made than ever before, one of the causes for the increase in litigation is a change in the rules. Technical people are used to participating in standard making where they have a voice in rule changes, but they now find that courts have made the changes and that these changes affect their way of doing business. The rule change is referred to in legal circles as "strict liability in tort".

Simply stated, under the theory of strict liability in tort, the plaintiff need only prove that there was a defect in the product at the time it left the hands of the manufacturer or, as to other parties, someone else in the chain of distribution, and that the defect was the proximate cause of the injury.

Most product liability litigation becomes a battle of the experts and corporate technical personnel have been thrust into a new role as expert advisors and witnesses in product liability litigation.

The plaintiff ordinarily will attempt to prove the existence of a defect through the testimony of an expert witness. The alleged defect may be one of design or specification, or, it may be one of manufacture or, it may be a failure to warn or to properly warn.

Obviously, the best line of defense is to counter with proof that the product is not defective in the way claimed. Experience has taught that this evidence should be accompanied by proof of an alternate cause for the injury. Obviously, if there is an injury, the jury knows that something must have caused it. Throughout the trial, the jurors are waiting for that "something" to be explained.

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To understand the role of the company expert in products litigation, we should look at the anatomy of a lawsuit. Litigation begins with the filing of the complaint by a plaintiff. To start the suit, the plaintiff need only take this document to the court and pay a nominal filing fee. Thus, by the payment of a small sum, it is possible to put into action a suit which, even if successfully defended, can still cost the defendant thousands of dollars in time and money.

The defense files an answer to the complaint and generally speaking denies that there was any defect in the product. Affirmative defenses, such as misuse of the product, may be raised.

At the outset of the litigation, it is important to make prompt identification of the product. The technical staff aids the trial lawyer by telling him what information is needed for the purpose of identification. If the plaintiff's attorney will not voluntarily provide the necessary information, it can be determined through the discovery process.

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After the initial pleadings have been filed, the lawsuit enters its "discovery stage". During this phase of the litigation, both sides have an opportunity to find out exactly what the other side knows about the facts which are in issue. With the help of the scientist-expert, the defense lawyer should prepare a set of interrogatories to be served on the plaintiff. Interrogatories are written questions which must be answered under oath and which can ask for any information relevant to the lawsuit or which could lead to admissible evidence. This set of product liability

". . . corporate technical personnel have been thrust into a new role as expert advisors . . ."

Presented at the 56th Annual Meeting of the Federation of Societies for Coatings Technology in Chicago, Ill., Nov. 2, 1978.

*75th Floor, Sears Tower, Chicago, Ill. 60606.

"... never respond with more than the question calls for ..."

interrogatories is designed to pin the plaintiff down to the specifics of the defect claimed as well as to obtain other information pertinent to the defense.

Other discovery is available from the plaintiff and defense counsel may make use of a request served on the plaintiff to produce documents, photographs, drawings, etc. relating to the plaintiff's claim. Oftentimes photographs taken shortly after the occurrence are in the possession of plaintiff. Other sources for photographs are federal and local government investigative agencies, such as police, fire departments, and plaintiff's own insurance carrier. Close inspection of such photographs by the scientist-expert has been the key to the successful defense of many cases.

At the appropriate time depositions (oral questions answered under oath) can be taken of not only the plaintiff but of any one else involved in the litigation including, in many jurisdictions, the plaintiff's expert. After consultation with his technical advisors, defense counsel may decide to forego the oral deposition of the opposing expert, preferring instead to save his examination for the time of trial.

It is also possible there will be an inspection of the place of the occurrence and of the product involved. Photographs, movies, or videotape pictures may be taken to preserve anything of interest.

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Of course, discovery is a two way street. Plaintiff may obtain exactly the same type of information from the defense. Long sets of product liability interrogatories have been developed by the organized plaintiff's bar and are available to those members of the profession trying plaintiff's lawsuits. Some courts have taken steps to limit the number of interrogatories but in the hands of a skilled plaintiff's lawyer they are a burdensome, but necessary, evil to be handled by the defendant company.

Many of the interrogatories will relate to technical subjects and can only be answered by the technical staff of the company involved. Recognizing that this takes time and effort, it will pay dividends to develop standard answers to the standard type interrogatories received in almost every products lawsuit. As in the preparation of any answers to interrogatories, the product liability attorney employed by the company should be consulted with respect to this program.

The scientist-expert should also realize that anything he writes may one day come to light during the course of a lawsuit. Notes, diaries, reports written 15-20 years ago, have been used in litigation much to the dismay of the author. Once again, the company's counsel should be consulted relative to reporting and record retention.

●

Probably the greatest fear anyone has is the fear of the unknown. In the case of the uninitiated expert witness, the unknown is plaintiff's counsel and the questions he will ask either during a deposition or on cross-examination at the time of the trial. The defense trial attorney cannot tell a witness "how to testify" but he can work with him to anticipate the questions that will be asked and to discuss the response which is called for by the question. As an abstract principle, any witness should never respond with more than the question calls for.

At the time of trial, the plaintiffs expert will testify first. Defense counsel is ready to cross-examine him because in advance of trial he has gone over all of that expert's material with his scientific-experts. They will have helped him prepare the cross-examination deemed to be necessary. One of the scientist-experts should be in the courtroom during the testimony of plaintiff's expert in order to provide the technical assistance that trial counsel may need. Your role as a technical expert may not require you to testify. However, if you do, be assured that defense counsel will work with you so that your testimony will be presented to the jury in a manner which is easy to understand. Visual aids are now as common in the courtroom as they have been in the teaching environment.

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The key to comfort and success in the litigation arena is the certain knowledge of the company expert witness that he knows more about the product than anyone else in the world. Working together, the trial attorney and the company expert can present the product facts in their best possible light and their teamwork will assure the optimum defense of the lawsuit.

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Society Meetings

Chicago — Nov. 13

Guest speakers for the meeting were Robert A. Smith, of Abbott Laboratories and John A. Gordon, of the University of Missouri at Rolla. Mr. Smith's topic was "PRACTICAL FILM BIOCIDE TESTING" and Mr. Gordon spoke on "SOLVENT RESTRICTION — LIMITATION OR OPPORTUNITY."

R.M. HILLE, *Secretary*

C-D-I-C — Nov. 13

D. Curtis Marshall and John A. Paul, of the Regional Air Pollution Control Agency, spoke on "AIR POLLUTION AND ITS IMPACT ON THE COATINGS INDUSTRY."

Hugh M. Smith, of Sun Chemical Corp., spoke on "IMPACT OF REGULATORY AGENCIES ON COATINGS COMPANIES."

Some of the factors which cause industry to change, said Dr. Smith, are environment, strikes, ownership, products, processes, technology, regulations, and costs. He mentioned that increased costs for waste water disposal are inevitable. Dr. Smith said that in the area of toxic substances, the ability to detect trace components has greatly improved, resulting in detection of previously unknown impurities and a desire to clean up products to a higher degree of purity than necessary. We can expect a more reasonable approach to toxicity as recognition of the trace analyses becomes more general. Dr. Smith concluded by saying that there may also be recognition that "toxic" materials are not toxic, sometimes even beneficial, in trace quantities.

Q. Is the climate better for allowing chromium compounds?

A. European studies indicate that traces of hexavalent chrome are neither as mobile or as harmful as has been suspected. Engineering improvements and adequate ventilation should allow for normal usage.

W.J. FROST, *Secretary*

Golden Gate — Nov. 13

Bill Sawyer was presented with the First Prize in the Technical Category from the American Paint Journal, for the presentation of his committee's technical paper at the Paint Show in Chicago. The second place Trigg Award was presented to Ted Favata for his excellent job of preparing the minutes of the Society's meetings.

Louie Sanguinetti announced that the Manufacturing Committee will present a June seminar on mixing, blending, and dispersing, called "Mixing Time '79."

Larry Sheets, of Macbeth, Div. of Kollmorgen, spoke on "COLOR COMMUNICATIONS."

Mr. Sheets, aided by a slide demonstration, discussed the definition of color scales and absolute color measurement vs. differential color measurement. He showed ways of maintaining and controlling standards over a long term period and how to communicate with customers and suppliers in the development and maintenance of standards.

SHARON VADNAIS, *Secretary*

Baltimore Society Officers for the year 1978-79. (left to right): President-Elect—Harry Schwartz, of Baltimore Paint & Chemical Co.; President—W. Thomas Cochran, of Bruning Paint Co.; Council Representative—Alex Chasen, of G.S.A.-FMBP; Treasurer—Mitchell Dudnikov, of Harry T. Campbell Sons Co.; and Secretary—Gordon Allison, of McCormick Paint Works Co.

Los Angeles — Nov. 8

The Material Marketing Associates' Award and a check for $350 were presented to the Society in recognition of their contribution in the field of air pollution.

Don Jordan was presented with the Trigg Award First Prize of $100. The award is presented to the Society Secretary who furnishes, to the JOURNAL OF COATINGS TECHNOLOGY, the most interesting reports on their regular meetings.

Dale Mosier, of Macbeth, Div. of Kollmorgen, spoke on "COLOR COMMUNICATIONS."

Mr. Mosier discussed the definitions of color scales and absolute color measurement vs. differential color measurement and maintenance of standards.

Q. Is there any published correlation between the instrument measured values and the PMS color chips now widely used in the printing industry?

A. No, not that I'm aware of.

Q. How do you justify purchasing a spectrophotometer just to get absolute color measurement? Evidently freezer storage is just as good.

A. The justification does not come from getting absolute color measurement, however, the ease of maintaining the standards is better with the numerical samples. Other advantages such as batch control may justify such a purchase.

Q. How do you measure a color on dissimilar substrates, such as cloth vs. a wall.

A. Very carefully. When using a sphere measurement there are two modes of operation, spectro component included and spectro component excluded. The spectro component excluded is the technique you would want.

JAN P. VAN ZELM, *Secretary*

Louisville — Oct. 18

President Joe Lococo was presented with the Tenneco gavel by Ton Disney.

Ed Antonucci, of Drew Chemical Corp., spoke on "FOAM CONTROL AGENTS, TYPES, MECHANISMS, AND PERFORMANCE."

Mr. Antonucci discussed three broad classes of defoamers: silica, silicone, and organic. Silica types include both conventional and "high solids" defoamers. Organic types are based on waxes, fatty acids, and alcohols. He briefly discussed the mechanisms of bubble breaking, which helped explain why certain foams are more stable than others. He also explained the difference between "anti-foamers" and "defoamers."

Mr. Antonucci concluded his presentation with a short film entitled "*Foam Control Agents*," which dealt with foam control in other industries as well as the paint industry.

P.W. HARBAUGH, *Secretary*

Pacific Northwest — Oct. 19

Ada Nielsen, of Nalco Chemical Co., spoke on "SCREENING PROCEDURES OF ANTI-FOAMS — DILEMMA OF PREDICTING SUCCESS IN USE."

Ms. Nielsen's talk centered around anti-foam selection. She highlighted some case studies and explained how problems had been solved. A discussion of anti-foam screening techniques and specific formulating hints for various coatings systems concluded the presentation.

R.P. STEWART, *Secretary*

Philadelphia — Oct. 12

A moment of silence was observed in memory of Gerould Allyn, of Scientific Communications, Inc., who died Sept. 21.

Among honored guests in attendance was Frank Borrelle, Federation Executive Vice-President. Mr. Borrelle presented Stanley LeSota with the first copy of the *Paint/Coatings Dictionary*.

Violet Stevens, of Dow Chemical Co., spoke on "CHLORINATED SOLVENTS IN INDUSTRIAL COATINGS."

Mrs. Stevens said that replacing conventional organic solvents with chlorinated solvents such as methylene chloride and 1,1,1-trichloroethane is a good way to reduce total oxidant generation. In the lower atmosphere, they are reactive with hydroxy radicals and, therefore, have a half life of 3-6 years. F-11 or F-12 fluorocarbons have an infinite life in the troposphere.

Methylene chloride and 1,1,1-trichloroethane are attractive substitutes for many conventional solvents in the coatings industry because they are among the safest and most environmentally acceptable hydrocarbons currently available.

Other considerations make these chlorinated solvents attractive. Methylene chloride, 1,1-trichloroethane, and perchloroethylene show no flash point in either open or closed cup test methods. The solubility parameter is similar to MEK, toluene, and ethyl acetate with lower hydrogen bonding values. They have good thermal stability, however, high temperature contact with metal surfaces may result in the formation of HCl.

Q. Can 1,1,1-trichloroethane or methylene chloride be used in water systems?

A. No, there is a hydrolysis problem. Perchloroethane, however, is stable in water.

Q. How can the production of corrosive HCl be handled in ovens?

A. The ovens must be designed to keep the air flow away from hot metal surfaces or flames.

BARRY OPPENHEIM, *Secretary*

Philadelphia — Nov. 9

Douglas Eveleigh, of Rutgers University, spoke on PRI's "MILDEW CONTROL PROGRAM."

Dr. Eveleigh named *Aureobasidium pullulans* as the predominant fungus found on mildewed coatings. This fungus which gets its characteristic color from black melanin granules requires high humidity to grow. It exhibits some adaptive characteristics which contribute to its success on paint films, and can tolerate dry periods and high temperatures, stated Dr. Eveleigh. A pigmented layer protects against UV exposure, and sticky cell exudations aid adhesion to surfaces. This fungus can also produce antibiotics to inhibit competing fungi. In the final analysis, Dr. Eveleigh said, its ability to prevail in hostile environments can be ascribed to its efficiency in utilizing a wide range of substances.

The key phase of PRI's mildew control program is "changing patterns." The basic idea is to find a method of attacking the fungus without harming humans and thus remove mildew control from governmental regulation. There are currently three approaches, mentioned Dr. Eveleigh. By discovering the primary site of fungicidal attack, a more selective substance can be used for control. The second approach involves the search for a method to inhibit the formation of the black melanin, then the fungus is susceptible to UV radiation. Lastly, he said, PRI has taken to chemically combining one or more funguides to the polymer. This allows release of the fungicide thru enzymatic cleavage. Hydrolysis by amidases and esterases secreted by the fungi release the biocide as required. Preliminary lab work indicates this approach is feasible, concluded Dr. Eveleigh.

Q. Has there been any work on substrate preparation?

A. No.

Q. Can the bound fungicide principle be applied to different polymer systems?

A. Yes, but more work is required.

Q. How much fungicide is bound on the polymer?

A. About 20-25% of the acrylate monomer has bound fungicide.

BARRY OPPENHEIM, *Secretary*

Piedmont — Oct. 18

Roland Duncan, of Kelco Div., Merck & Co., spoke on "EFFECTS OF ENZYME ATTACK ON THICKENERS."

Mr. Duncan discussed the multipurpose polysaccharide Zanflo-10 and its distinctive qualities such as ease of dispersion, stability under high shear, and compatibility with inorganic salts.

Q. Does this product effect the viscosity of paint flow?

A. Not if pH is constant.

W.J. CUNANE, *Secretary*

Pittsburgh — Oct. 2

Ada Nielsen, of Nalco Chemical Co., spoke on "SCREENING PROCEDURES OF ANTI-FOAMS — DILEMMA OF PREDICTING SUCCESS IN USE."

Several concepts were discussed in defining foams and foam stabilization. An anti-foam was defined as having to prevent and destroy foam. It must have

persistency over a period of time, not cause color change by pigment flocculation or floating, and must not cause craters, pinholes or eyeholes. The basic components of an anti-foam were given as active agents which include silicone oils and hydrophobic silica; spreading agents which include fatty esters and aocohols; and carriers which are aliphatic hydrocarbons. Ms. Nielsen recommended selecting anti-foams empirically rather than calculating theoretically. As a basic recommendation, silicon types were suggested for pigment grinding and non-silicone types in the let down. She concluded by stating there is no universal anti-foam.

RAY UHLIG, *Secretary*

Pittsburgh **Nov. 6**

M.H. MacKay, of MacKay Machine Co., spoke on "DISPERSION EQUIPMENT."

Mr. MacKay's talk covered many factors concerning continuous media mills, including an in depth discussion on the media used in this type of mill. Consideration was given to media size, composition, and density. He said that the media available range in specific gravity from 2.6 to 7.5 and that these consist of sand, glass beads, ceramic beads, steel shot, and high chrome steel. The sizes range from less than 1 mm in diameter to 2.0 mm. At the lower end of this size and density scale, floating can be a problem, he said. At the upper end, excessive mill wear can occur. Mr. MacKay concluded by giving some suggestions to correct these problems, such as slowing mill speed and changing media size and density.

RAY UHLIG, *Secretary*

Toronto **Nov. 13**

Ad van de Werff, of Scado, Netherlands, spoke on "POWDER COATINGS — TEN YEARS EXPERIENCE OF APPLICATION TECHNOLOGY."

Mr. van de Werff began by saying that powder coatings did not "explode" as forecast some years ago. Instead, steady advances have been made to the point where many high quality finishes are being applied in numerous industries, including automotive. The speaker believed that, eventually, 40% of industrial coatings will be applied in powder form in the not too distant future.

A.G. MORRIS, *Secretary*

Western New York **Nov. 14**

Ada Nielsen, of Nalco Chemical Co., spoke on "SCREENING PROCEDURES OF ANTI-FOAMS — DILEMMA OF PREDICTING SUCCESS IN USE."

Ms. Nielsen said that pure liquids do not foam, and some conditions that cause foam formation could include a soluble surfactant, liquid moving from an area of lower surface tension to higher, and formation of a gelatinous surface layer. A defoamer must have a spreading coefficient greater than zero. The anti-foam component includes an active agent, a spreading agent (such as hydrophobic silica), and carriers (such as aliphatic hydrocarbons), she said. Conditions that affect anti-foam performance include pH shift (most operate better on basic side), temperature (may affect surface viscosity), and the anti-foam must have lower surface tension than the coating. In conclusion, Ms. Nielsen listed some problems caused by surfactants on anti-foams, including a too high level which will lower the surface tension too much, surfactants may tend to solubilize the anti-foam, and flow control agents may work like more surfactant.

GEORGE C. REID, *Secretary*

Western New York **Oct. 11**

Robert Zeller, of Pfizer, MPM Division, spoke on "ASSESSMENT OF PIGMENT DISPERSION BY A COLORIMETRIC TECHNIQUE."

Some points mentioned were: a better dispersion is needed than indicated by the Hegman Gauge which indicates particles to 10 microns; particles smaller than 1 micron give excellent dispersion; the range from 1 to 10 microns is important; method similar to NYSPT Method-Measure color strength development against dispersion time; 120 min on a Cowles was considered 100% strength, interval samples were plotted against time; and standard formulation used a long oil alkyd and TiO_2.

Mr. Zeller showed graphs that gave an 8% difference between an easy dispersing red iron oxide and standard red iron oxide after 20 min on a Cowles. The same comparison with yellow iron oxides showed about 3% difference.

Evidence of interest in this talk came with the many questions that followed. The question period was as long as the talk itself.

GEORGE C. REID, *Secretary*

Future Society Meetings

Birmingham

(Feb. 1) — "WATER-BORNE FINISHES" — G. Robinson, of Synthetic Resins Ltd.

(Mar. 1) — "COMMENCING PRODUCTION IN IRAN AND ALASKA" — J.R. Taylor, of B.P. Ltd.

(Apr. 5) — "WASTE DISPOSAL" — H.G. Pullen, of Redland Purle Ltd.

(May 3) — "CATHODIC ELECTRODEPOSITION—CURRENT STATUS" — E. Millington, of International Paints.

Chicago

(Feb. 5) — "FSCT SLIDE PRESENTATION" — Federation Officers; and "SURFACTANTS AS RELATED TO THE PAINT INDUSTRY" — Julius Deutsch, of Stepan Chemical Co.

(Mar. 5) — "AMINE SOLUBILIZERS FOR WATER-SOLUBLE INDUSTRIAL COATINGS" — Dr. Zeno W. Wicks, Jr., of North Dakota State University; and "MARKETING - RESEARCH INTERACTIONS" — Dr. Robert Bumb, of Dow Chemical Co.

(Apr. 2) — "ACCELERATED WEATHERING" — George Grossman, of Q-Panel Co.; and "YOU CAN'T AFFORD TO BE WITHOUT SAFETY" — Gilbert Cain, of Hercules Incorporated.

C-D-I-C

(Feb. 12) — PLANT TOUR - Inland Manufacturing, GM Div.

(Mar. 12) — FSCT SLIDE PRESENTATION — Federation Officers.

(May 14) — "A NEW, IMPROVED THICKENER SYSTEM" — R.J. Duncan, of Kelco Div., Merck & Co., Inc.

Cleveland

(Jan. 23) — Annual joint meeting with Cleveland Paint & Coatings Association. "LIVING WITH GOVERNMENT REGULATIONS" — Panel Discussion.

(Feb. 21) — Joint meeting with Cleveland Section of American Chemical Society. "METAL CLUSTERS;" "SURVEY OF COATINGS AND POLYMER CHARACTERIZATION TECHNIQUES;" "WHAT DOES A (PAINT) CHEMIST DO? WHAT ARE THE CAREER OPPORTUNITIES IN (PAINT) CHEMISTRY?;" and "WOMEN IN CHEMISTRY."

(Mar. 13)—"FSCT SLIDE PRESENTATION"—Federation Officers; Panel Discussion on "NEW CONCEPTS IN PAINTS/COATINGS APPLICATION TECHNOLOGY."

(Apr. 12) — Meeting to be held at Ohio Edison Nuclear Power Plant, Perry, Ohio.

(May 17) — "ART OPENS WAY FOR SCIENCE" — Dr. Jon B. Eklund, of Smithsonian Institution.

Golden Gate

(Mar. 19) — "NEW DEVELOPMENTS IN THE FIELD OF GLOSS EMULSION PAINTS" — John Bax, of Scott-Bader.

(Apr. 16) — "ACCELERATED WEATHERING AND FADING" — R. Metzinger, of Atlas Electric Devices Co.

(May 14) — "USE OF ORGANO TITANATES IN COATINGS" — Salvatore J. Monte, of Kenrich Petrochemicals, Inc.

Los Angeles

(Feb. 14) — "SLEUTHING WITH A MICROSCOPE" — Dr. Walter C. McCrone, of Walter C. McCrone Associates.

(Mar. 14) — "NEW DEVELOPMENTS IN THE FIELD OF GLOSS EMULSION PAINTS" — John Bax, of Scott-Bader.

(Apr. 11) — "ACCELERATED WEATHERING AND FADING" — R. Metzinger, of Atlas Electric Devices Co.

(May 9) — "USE OF ORGANO TITANATES IN COATINGS" — Salvatore J. Monte, of Kenrich Petrochemicals, Inc.

Montreal

(Feb. 7) — "FLOW IMPROVEMENT IN LATEX GLOSS AND SEMI-GLOSS PAINTS" — Panel discussion.

(Mar. 7) — Annual joint meeting with Quebec Paint Industry Association. "MARKETING OF CONSUMER PAINT PRODUCTS" — B. Wayne, of International Paints (Canada) Ltd.; and "THE PROFESSIONAL CHEMIST IN THE COATINGS INDUSTRY" — F. Bonnier, of Carter White Lead.

(Apr. 11) — "FSCT SLIDE PRESENTATION" — Federation Officers.

(May 2) — WORKSHOP NIGHT: *Color Matching, Metrification, Quality Control,* and *Technical Service.*

New York

(Feb. 8) — Joint meeting with New York Paint and Coatings Association. "LEGISLATIVE UPDATE" (Tentative).

(Mar. 13) — MINIWORKSHOPS — Speakers to be announced.

(Apr. 10) — "CLASSES OF WATER DISPERSIBLE BAKING FINISHES" — Nicholas Roman, of Rohm and Haas Co.

(May 8) —PAVAC AWARD NIGHT.

Philadelphia

(Feb. 15) — "THE TRANSITION FROM LABORATORY TO SALES" — Donald Denny, of E.W. Kaufman Co.

(Mar. 15) — "NEW TECHNOLOGY IN ANTI-FOULING PAINTS" — Dr. Dodd Carr, of International Lead Zinc Research Organization.

FSCT Scholarship Program

Meeting the challenges of increasing governmental regulations and raw material costs require more technically trained people in the coatings industry. To meet these demands, the Federation's scholarship program has been increased again this year, with funds made available to various universities in the U.S.

These funds are to be used as grants-in-aid for students in the coatings technology program at each institution, with preference given to qualified scholarship applicants who are children of members of the Federation.

Members who have children wishing to make application for the 1979-80 academic year should contact Federation headquarters. Deadline for receipt of applications is April 1, 1979. Write Scholarship Fund, Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 830, Philadelphia, Pa. 19107.

Elections

BALTIMORE

Active

AUSTIN, HUGH C. — Conchemco, Inc., Baltimore, Md.
CORBY, JAMES E. — FBI, Washington, D.C.
KURNAS, JR., JOHN S. — Conchemco, Inc., Baltimore.
PLICHTA, BERNADETTE — Conchemco, Inc., Baltimore.
RASZEWSKI, LEWIS — Bruning Paint Co., Inc., Baltimore.

LOS ANGELES

Active

BOSE, FRED J. — PPG Industries, Inc., Torrance, Calif.
DANKERT, WILLIAM R. — Durall Plastics, Inc., Anaheim, Calif.
DULLUM, BRUCE E. — Ameron Protective Coatings Div., Brea, Calif.
ELLIS, DOUGLAS C. — Bauer Coatings & Chemicals, Los Angeles, Calif.
FIFER, VERN — Deft, Inc., Irvine, Calif.
GIACONA, PETER — Zynolyte Products Co., Compton, Calif.
GROSS, EDWARD A. — Koppers Co., Inc., Los Angeles.
IMOBERSTEG, ANNE — Cargill, Inc., Lynwood, Calif.
KRONISH, PHILIP — Silmar Div., Vistron Co., Hawthorne, Calif.
LEE, MYOUNG K. — Lawson Chemical Products Co., Torrance.
LOWE, ALEX E. — Stain Specialties, Santa Fe Springs, Calif.
MCMAHON, DONALD A. — Fine Line Paint Corp., Santa Fe Springs.
MEADOWS, WILLIAM D. — Cyprus Industrial Minerals Co., Los Angeles.
MORENO, ROBERT — Engard Coatings Corp., Huntington Beach, Calif.
OURA, HOWARD Y. — Shiva, Inc., Torrance.
PHONG, DAVID K. — Koppers Co., Inc., Los Angeles.
PIZARRO, JR., RODRIGO A. — Zynolyte Products Co., Compton.
RAMIREZ, JOSE — Old Quaker Paint Co., Carson, Calif.
RAWDING, BURTON R. — Advanced Coatings & Chemicals, South El Monte.
ROLFES, JOHN F. — PPG Industries, Inc., Torrance.
SETH, S.B. — Arrow Paint Prod. Co., Cudahy, Calif.
SOETERIK, ERNOLFF — San Diego Coatings Co., San Diego, Calif.
WHITESIDE, ALEX E. — Ihmont Corp., F & BP Div., Anaheim.

Associate

FARBER, BRUCE M. — McCloskey Varnish Co., Los Angeles, Calif.
GARTLAND, JAMES J. — Western Paint Industry, Los Angeles.
LUNDBLAD, PAUL D. — Union Chemicals Div., La Mirada, Calif.
MCLAUGHLIN, EDWARD J. — Hercules Incorporated, Los Angeles.
O'FARRELL, ROLAND J. — Synres Chemical Corp., Anaheim, Calif.
PALMER, THOMAS A. — Emery Industries Inc., Downey, Calif.
PRATT, PHILIP W. — Air Products & Chemicals, Inc., Santa Ana, Calif.
ROMERO, FRANK — Saramco Inc., DBA, Samson Raw Materials Co., Gardena, Calif.
SCHRANTZ, MURRAY — Pfizer, Inc., Los Angeles.
SOWERBY, JOHN L. — PVO International, Inc., Los Angeles.
WASHBURN, REBECCA — Union Carbide Corp., Long Beach, Calif.
WHITTAKER, JOHN W. — Wilson & Geo. Meyer & Co., Los Angeles.

Retired

DEWAR, WILLIAM J. — Canoga Park, Calif.

LOUISVILLE

Active

ANDERSON, H. WAYNE — Guardsman Chemical Coatings, Inc., Louisville, Ky.
LANNING, JOHN A. — Porter Paint Co., Louisville.
MAHORNEY, HORACE — Progress Paint Co., Louisville.
MARTIN, PAUL F. — Spencer Kellogg, Div. of Textron, Cincinnati, Ohio.
SPECHT, JOYCE — Porter Paint Co., Louisville.
VOLZ, ROBERT C. — Reliance Universal, Inc., Louisville.

Associate

AVERY, JOHN A. — Deeks & Company, Louisville, Ky.
BUCKLEY, MICHAEL J. — Polysar Packaging, Louisville.
MORRIS, W. JERRY — Drew Chemical Corp., Jeffersontown, Ky.
WENDT, DAVID N. — N L Industries, Titanium Pigments Div., Louisville.

NEW ENGLAND

Active

CARROLL, JAMES D. — Sherwin-Williams Co., Medford, Mass.
CRONIN, JR., ARTHUR F. — Weber & Smith, Inc., Reading, Mass.
DERNAGO, THEODORE P. — Digital Equipment Co., Westfield, Mass.
FIORELLI, ARTHUR C. — Monsanto Co., Indian Orchard, Mass.
FONCELLINO, MICHAEL — Lynch Paint & Varnish, East Providence, R.I.
HUGHES, JOSEPH — Raffi & Swanson, Inc., Wilmington, Mass.
IONAS, LUCIA C. — Stahl Finish Co., Inc., Peabody, Mass.
KOEBERT, FRAN — Kyanize Paints, Inc., Everett, Mass.
MORGENTHAU, ALAN S. — Markem Corp., Keene, N.H.
SCHIRRIPA, THOMAS J. — Cabot Corp., Billerica, Mass.

Associate

BUTCHYK, ROGER J. — Tenneco Chemicals, Inc., Fords, N.J.
WIEGERS, CAL R. — J.M. Washburn-Linder Co., Framingham, Mass.

PIEDMONT

Active

ANDERSON, JON E. — Ashland Chemical Co., Charlotte, N.C.
BLANTON, HARRISON D. — The Lilly Company, High Point, N.C.
CREAMER, GERALD C. — Sherwin-Williams Co., Greensboro, N.C.
DIMEO, SR., ARMAND — Guilford Mills, Inc., Greensboro.
KIDD, ROBERT V. — Sonoco Products Co., Hartsville, S.C.
MCDONALD, JR., CHARLES M. — Inmont Corp., Morgantown, N.C.
MORETZ, NELLIE M. — Reliance Universal, Inc., High Point.
SAUNDERS, ANNETTE — Reliance Universal, Inc., High Point.

Associate

FAYSSOUX, JR., RICHARD — Eastman Chemical Products, Inc., Kingsport, Tenn.
MAYHEW, TERRY R. — Burks, Inc., High Point, N.C.
MILEY, DAVID B. — duPont Co., Charlotte, N.C.
NAVOLANIC, JOE E. — N L Industries, Inc., Atlanta, Ga.

WESTERN N.Y.

Active

DESESA, ROBERT J. — Spencer-Kellogg, Buffalo, N.Y.
KRESSIN, DONALD M. — Spencer-Kellogg, Buffalo.

Meetings / Education

Rolla Announces Spring Paint Short Course Schedule

The Spring series of Paint Short Courses sponsored by the University of Missouri at Rolla has been scheduled from February 26 to April 27, 1979.

The series of week-long courses will feature lecturers experienced in various fields of paint production and use. John A. Gordon, Jr., Adjunct Professor of Chemistry at Rolla, will serve as Director, while Lewis P. Larson, Guest Lecturer in Chemistry, will act as Co-Director for the series.

(Feb. 26-Mar. 2) 29th Painting Contractors and Maintenance Engineers Short Course — Emphasis will be placed on the painting of various types of surfaces and structures encountered by the painting contractor and methods of application to meet specifications in an economical way. New developments will be presented in the field of maintenance coatings, paint application methods, cost estimation, and government regulations. Cost of the course is $225.

(Mar. 5-9) 38th Introductory Short Course on the Composition of Paints and Coatings — Designed for the newcomer, the course will present the history of paint, ingredients used in modern coatings, the machinery and handling equipment used, basic laboratory testing apparatus, some simple formulating techniques and calculations, and some of the recent regulatory restrictions on coatings manufacture and application. Cost of the course is $225.

(Mar. 26-30) 9th Quality Control and Paint Inspectors Short Course — This combined laboratory and lecture course is designed to cover the basic essentials of quality control of incoming raw materials, coatings in process, finished products, and the field testing of applied coatings. Cost of the course is $225.

(Apr. 2-6) 5th Introductory Short Course on Tinting, Shading, and Matching of Colored Paints — This is a lecture and laboratory course designed to give participants an understanding of color, color classification systems, colored pigments and their dispersion, and colorant systems. Students will put their learning to the test in properly designed laboratory experiments of a practical nature. The cost of the course is $225.

(Apr. 23-27) 32nd Advanced Coatings Workshop — Experienced guest lecturers will present comprehensive summaries of recent progress in their special fields of interest. Open discussions will examine such topics as hiding and extender pigments, additives, dispersion, equipment, government regulations, and other, participant-raised questions. The cost of the workshop is $225.

For additional information, or to register, contact Norma Fleming, Extension Div., University of Missouri — Rolla, 501 W. 11th St., Rolla, Mo. 65401; or, for technical information, contact John A. Gordon, Chemistry Dept., U. of Mo. — Rolla, Rolla, Mo.

Summer Short Course Added to Kent State Program

Three Short Courses designed for specialists interested in coatings, polymers, and rheology will be presented by the Coatings and Rheology laboratory at Kent State University, Kent, Ohio, during May and June 1979.

A course new to this year's program, "Dispersion of Pigments and Resins in Fluid Media," will be presented May 21-25. The course will cover the chemical and mechanical aspects of dispersion ranging from principles of wetting and electrical effects to the operation of a variety of dispersion equipment and plant practice.

A second program repeats last year's successful course, "Coatings and Polymers Characterization." The course, to be held June 11-15, will feature lecturers who will discuss the use of many instruments for the characterization of coatings and polymers, interpret data, and introduce new analytical methods.

The final program for 1979, "Applied Rheology for Industrial Chemists," will be held June 25-29. Lecturers will present talks on the principles and applications of kinematic and dynamic rheological measurements on dispersions, polymers, and liquids.

Additional information on all programs can be obtained by contacting Carl J. Knauss, Chemistry Dept., Kent State University, Kent Ohio 44242.

Detroit Society Co-Sponsoring Resin Technology Course

A 12-week course on Modern Resin Technology is being co-sponsored by the Detroit Society for Coatings Technology, in conjunction with the Detroit Paint and Coatings Association and the University of Detroit's Polymer Institute.

The two-hour sessions are being held at the University of Detroit's Engineering Building on Monday evenings, beginning January 8, and include lectures on modern resin technology and laboratory demonstrations illustrating the properties of resins and coatings.

Subjects to be covered include introductory chemistry, simple polymer chemistry concept, basic safety principles and lab procedures, oils for organic coatings, modern varnish technology, alkyd resin technology, amino resins, acrylic resins, urethane resins, and epoxy resins.

A certificate will be issued upon completion of the course.

Spring Coatings Tech Course Planned by NY Society

The Joint Education Committee of the New York Society for Coatings Technology and the New York Paint and Coatings Association have announced plans to offer "Fundamentals of Coatings Technology II" starting February 7, at the New York City Community College. The course consists of 13 two-hour evening sessions.

This is the second part of a two-semester course designed to meet the needs of people just entering the coatings industry, as well as those who wish to gain a broader background in coatings fundamentals. Enrollment in Part II is limited to those who have successfully completed Part I, or to individuals who already have a good grounding in coatings raw materials (covered in Part I).

Emphasis will be placed on coatings formulation calculations of important paramenters, application methods, and equipment and test methods.

Students completing the course successfully are entitled to receive three College Extension Units of Credit.

Registration fee is $120 per semester. Complete information is available from M. Jay Kolaya, Interstab Chemicals, Inc., 500 Jersey Ave., P.O. Box 638, New Brunswick, N.J. 08903.

People

Edward H. Neuwirth has been promoted to the position of Executive Vice-President of the Watson-Standard Co. He has been with the company since 1946. Mr. Neuwirth is a member of the Pittsburgh Society for Coatings Technology.

Michael Pisetzner, Assistant General Manager, Chemical Group, Sun Chemical Corp., was elected President of the Dry Colors Manufacturing Association at its recent Annual Meeting at White Sulphur Springs, W. Va. He succeeds **Herbert A. McKenzie,** of American Cyanamid Corp.

Two new officers of the Manufacturing Chemists Association are **Gary C. Herrman,** Vice-President and Treasurer, and **Bruce M. Barackman,** Vice-President and Secretary. **George E. Best,** formerly Vice-President and Secretary, served as Senior Vice-President until his retirement in December.

The American Cyanamid Co. has appointed **Ronald D. Anderson** to the position of Eastern Regional Sales Manager, Resins and Additives, in the Industrial Chemicals Div. He will be located in Wallingford, Conn. The company has also named **Stephen M. Lustig** to the position of Sales Manager in the same division. Mr. Lustig will be located at the company headquarters in Wayne, N.J.

Allied Colloids, Inc. has appointed **Michael Dorf** Market Development Manager for the firm's General Industries Div. He will be headquartered in Ridgewood, N.J.

John W. Murray has joined Spencer Kellogg Div., of Textron Inc. as Marketing and Advertising Assistant. Mr. Murray will be located at the company's headquarters in Buffalo, N.Y.

Air Products and Chemicals, Inc. has named **Edward V. Sherry** Director of Energy Supply. He will head the newly formed Energy Dept., which will be responsible for the procurement of electric power and hydrocarbons to meet the company's present and future needs. Mr. Sherry also serves as a member of the Energy Steering Committee of the National Association of Manufacturers.

E.H. Neuwirth

M. Pisetzner

E.G. Bozzi

H.A. Wittcoff

In a series of managerial appointments, CIBA-GEIGY Corp. has named **Dr. Edward G. Bozzi**—Manager of the Development and Applications Laboratory in the Plastics and Additives Div., Ardsley, N.Y.; **Dr. Robert F. Siegmund**—Manager of the Resins Department's Development and Applications Laboratories, Plastics and Additives Div., also in Ardsley, N.Y.; **Joseph Farber**—Manager of New Product Development, Additives Dept.; **William J. Reid**—Technology Manager for Elastomers and Styrenics, Additives Dept.; **James Usilton**—Product Manager, Commercial Products, Additives Dept.; **Geoffrey W. Broadhurst**—Business Manager for Coatings, Ink, and Photography, Plastics and Additives Div., Ardsley, N.Y.; **Frank Molesky, Jr.**—Sales Manager, Resins Dept., Midwest Region, based in Detroit, Mich.; and **John F. Aleckner**—Sales Manager, Additives Dept. Mr. Aleckner will be responsible for sales to the polyolefins market.

Dr. Ismail A. Elmiligy, of Ghent, Belgium, has been elected to the Board of Directors of Buckman Laboratories, Inc. Dr. Elmiligy has been General Manager of Buckman Laboratories, SA since 1976.

The O'Brien Corp. has named **Clarence R. Claeys** to the position of Manager of Materials and Distribution for the company's Central Region.

Morehouse Industries, Inc. has named **Robert F. Goodwin** Vice-President of European operations and **Roland E. Swett** Vice-President/General Manager of the Fullerton Div. Mr. Goodwin will be headquartered in Belgium.

Dr. Harold A. Wittcoff, who began his career as a research chemist in 1943 and achieved the position of Vice-President of Corporate Research, has retired after 35 years with General Mills, Inc. He has taken the position of Director of Research and Development for Koor Chemicals Ltd., Beer-Sheva, Israel, and will also continue as Adjunct Professor of Chemistry at the University of Minnesota, a post he has held since 1973.

A 34-year member of the American Chemical Society, Dr. Wittcoff has been Chairman and Councilor of the Minnesota Section. He is a member and past officer of several other technical societies including the Northwestern Society for Coatings Technology, and the American Oil Chemists Society.

W. Terrence Paletta has been promoted to Senior Technical Sales Representative for Thiokol Corp., Chemical Div. He will be responsible for sales in the states of Massachusetts, Rhode Island, New Hampshire, Maine, Vermont, Connecticut, and New York.

Henry B. Linford has been appointed Director of Research and Development of Polychrome Corp. He is a member of the American Chemical Society.

The Ameron Protective Coatings Div. has appointed **Thomas D. McIver** to the position of Technical Sales Representative in the Pittsburgh, Pa. area.

Robert H. Buckman has been elected Chairman of Buckman Laboratories, Inc., Memphis Tenn. He will succeed the late **Dr. Stanley J. Buckman.** At the same time, **Steven B. Buckman** was elected as a new member of the Board of Directors, and he will serve as Secretary of the corporation.

People (Continued)

Three vice presidents at Wyandotte Paint Products Co., **Robert Jurczyszyn, Craig Larson,** and **Jim Swint,** have been given new responsibilities as part of a management reorganization. Mr. Larson has been placed in charge of manufacturing, Mr. Swint is in charge of engineering services, and Mr. Jurczyszyn has been placed in charge of employee training, governmental and association affairs, and product liability.

Jean Berry has been named Sales Coordinator at Sylvachem Corp., a joint venture of SCM Corp. and St. Regis Paper Co. She will be responsible for product shipment and scheduling. Meanwhile, **Gregory L. Kaiser** has been named Manager, Commercial Development, for the Glidden Organics Div., SCM Corp.

The Sherwin-Williams Co., Professional Coatings Div., has named **P. Wayne McInnis** Regional Marketing Representative. Headquartered in Palestine, Texas, he will be responsible for providing technical support and coating products to professional contractors as well as to industrial and manufacturing operations. **Thomas E. Ballway** has been promoted to Account Executive, Coil Marketing, for the company's Cleveland sales district, and **Donald C. Ferch** has been promoted to Coatings Specialist, Chemical Coatings Div., also in the Cleveland area.

PVO International, Inc. has entered into a joint venture with Scott Bader Co. Ltd. of England to manufacture and market aqueous polymers in the U.S. **Colin G. Hull,** of PVO, was elected President and **Norman Parkinson,** of Scott Bader, was elected Chairman of the Board of the new company. **James W. Shannon,** of PVO, and **Ralph Woolf,** of Scott Bader, will serve as directors.

The following changes in executive assignments at the Ball Corp. have been announced. **Frank A. Bracken** has been elected Vice-President—Administration. He is succeeded as General Counsel by **George A. Sissel. Charles E. Wild** will succeed **Ralph L. Hoover,** who is retiring, as head of the employee and industrial relations department. **John D. Griem,** Vice-President—Purchasing and Transportation, is also retiring, but will continue to be of service as a part-time consultant.

The O.A. Both Corp. has been purchased by Carl Schlenk AG. **Murray Both,** previous owner of the company, plans to remain active in a consulting capacity.

Robert Zwack has been promoted to the position of Senior Research Associate in the PPG Industries Coatings & Resins Div., Research & Development Laboratory, Allison Park, Pa.

Jack B. St. Clair, President of Shell Chemical Co., has been presented with the Chemical Industry Medal. The medal, to be awarded annually by the American Section of the Society of Chemical Industry, was presented to Mr. St. Clair in recognition of his leadership, foresight, and contributions to the progress of the chemical industry. Mr. St. Clair is on the Board of Directors of the American Petroleum Institute and the Manufacturing Chemists Association. He is the former Chairman of the Executive Committee and Vice Chairman of the Board of Directors of the Manufacturing Chemists Association.

Mrs. M.L. Blinoff was re-elected Chairman of the Board and Chief Executive Officer of Alcolac, Inc. Other directors elected for a one-year term were **Frank J. Weibel, W. Alec Jordan, Julian Paul, Frederick B. Hard, Jr., Charles N. Anderson, Jr., General Wallace H. Robinson, Jr., Dr. Peter B. Bouroff,** and **J. Stevenson Peck.**

The following have been appointed to serve as officers of the company during the ensuing year: Frank J. Weibel, Vice-Chairman of the Board; Charles N. Anderson, Jr., President; Dr. Peter B. Bouroff, Vice-President; Julian Paul, Vice-President; **Edward H. McLaughlin,** Secretary and Treasurer; and **Edith Polack,** Assistant Secretary

Meanwhile, **John Kent** has been named Southeastern District Sales Manager for the company. He will be based in the Charlotte area.

In a series of executive appointments, Benjamin Moore & Co. has named **Russell P. Carlson** Director of Sales and **Charles R. Arnau** Sales Manager.

Meanwhile, in the company's Eastern Div., **Joel J. Mayor** has been named to the position of Divisional Sales Manager and **Floyd Langner** and **Salvatore J. Rozzi** to the position of Assistant Divisional Sales Manager.

Drew Chemical Corp. has named **Eugene Q. Belote** Vice-President—Sales, Water and Waste Treatment Div. He served most recently as Director of Sales for the division.

James Ward has been named a Technical Sales Representative for the Dexter Chemical Corp. He will cover the south central area which includes Georgia, Alabama, and Tennessee.

Glidden Organics Div., SCM Corp., has named **Clayton B. Hamby** Manager—Technical Services. He will be responsible for the Technical Service and Quality Control Laboratories. Mr. Hamby is a member of the American Chemical Society.

Sylvachem Corp., Jacksonville, Fla., has named **Tom Douglas** Manager—Specialty Chemical Products and **John Krueger** Manager—Marketing and Sales.

Robert E. Rechtin has joined the Fatty and Dibasic Acids Group of Emery Industries, Inc. as a Technical Sales Representative. He will be responsible for sales in the New England and eastern, upstate New York areas.

H.L. Payton has been named Executive Vice-President of the Cordova Chemical Co., Sacramento, Calif.

Meanwhile, **Ken J. Houle,** the company's Vice-President of Marketing and Sales, has been elected to the National Board of Directors of the Drug, Chemical, and Allied Trade Association, Inc.

Phillips Chemical Co., a division of Phillips Petroleum Co., has named **Virgil E. Gaede** Manager—Specialty Chemicals. He will be responsible for worldwide production, marketing, and product development of specialty chemicals.

Edward R. Krueger, of Amchem Products, Inc., has been promoted to the position of Field Sales Manager, Metalworking Chemicals Div., based in Ambler, Pa.

D. Patrick Curran has been appointed Executive Vice-President and Chief Operating Officer of Cook Paint and Varnish Co., Kansas City, Mo. He previously held the position of Vice-President—Corporate Planning.

Union Carbide Corp., Chemicals and Plastics Div., has named **Anthony A. D'Onofrio** Vice-President—Marketing. He succeeds **Dr. N.L. Zutty** who has been appointed to the position of Vice-President and General Manager of the Coatings Materials Dept., Performance Chemicals and Polymers Div.

Daniel L. Toombs has been appointed Vice-President—Sales of the Lukens Chemical Co., Inc., Cambridge, Mass. Mr. Toombs is a Past-President of the New England Society for Coatings Technology, Director of the Eastern New England Society for Plastics Technology, a member of the Boston Rubber Group, and was the Chairman of the 1978 Mattiello Lecture Committee of the Federation.

John R. Hall has been named Chief Executive Officer for Ashland Oil, Inc. In his new capacity he will be responsible for the general direction of the company's petroleum and chemical operations.

The Rohm and Haas Co. has appointed **David B. Frearson** to the position of Technical Representative for its Polymers, Resins, and Monomers business team. He will be located at the company's district office in Bristol, Pa., and he will serve the eastern Pennsylvania and southern New Jersey areas. **Ronald A. DiMuro** has been transferred from a field assignment to a new position in the company's home office in Philadelphia, Pa. He has assumed the responsibilities of Market Planning Manager for the Transportation, Machinery, and Equipment group of the company's Polymers, Resins, and Monomers, North America, business team.

David J. Frede has been appointed Resident Technical Sales Representative for the Minneapolis/St. Paul area of the Central Solvents and Chemicals Co. He has been assigned the Minnesota and northwestern Wisconsin sales territory.

The Frisch Paint Div., of The Enterprise Companies, has named **Lawrence L. Benner** National Sales Manager.

John W. Malone has been appointed Powder and Paste Aluminum Pigment Specialist for Reynolds Metals Co., Central Sales Region, Cleveland, Ohio.

Dr. Melvin Calvin, Nobel Laureate in Chemistry, has been named to receive the 1979 Gold Medal of The American Institute of Chemists. The award is bestowed annually on a person who has stimulated activities of service to the science of chemistry or the chemical professions in the United States. The award will be presented to Dr. Calvin at a special banquet to be held during the Institute's 56th Annual Meeting in Philadelphia, Pa., May 5, 1979.

Dr. Calvin holds the rank of Professor of Chemistry at the Berkeley Campus, University of California. He also serves as Director of the Laboratory of Chemical Biodynamics at Berkeley. He won the Nobel Prize in 1961 for tracing the carbon cycle in photosynthesis and revealing a key link in the process by which plants use sunlight energy to convert atmospheric carbon dioxide to carbohydrates.

Donald C. Fergusson has been elected Assistant Vice-President—Planning and Distribution by Rust-Oleum Corp. He will be responsible for the overall coordination of the corporation's planning functions and for product distribution. The company has also named **C.E. Brann** to the position of Manager Technical Sales, International Dept. He will be responsible for increasing the market penetration of the company's coating products in Asia, South America, Africa, and the Middle East, as well as developing and implementing instructional programs for foreign distributors. Mr. Brann is a member of the Chicago Society for Coatings Technology and the National Association of Corrosion Engineers.

International Minerals & Chemical Corp. has promoted **Michael Bashir** to General Manager of its McWhorter Resins business within the company's Industry Group. Mr. Bashir is a member of the Chicago Society for Coatings Technology.

The Air Pollution Control Association (APCA) has named **Dr. Lewis H. Rogers** as Executive Vice-President Emeritus upon his retirement as Chief Administrative Officer of APCA, headquartered in Pittsburgh, Pa. He is succeeded as Executive Vice-President by **W.G. Hamlin.** Dr. Rogers is a member of the American Chemical Society, and the American Society for the Advancement of Science.

Polychrome Corp. has appointed **Gerald Feig** to the position of Manager of its Specialty Resins Div. in Yonkers, N.Y. Dr. Feig is a member of the American Chemical Society.

Ian Martin has been appointed Manager of the Technical Div., of California Redwood Assoc., based in San Francisco, Calif. His responsibilities will include work with government and industry researchers in developing technical data on finishing and installing redwood products.

The Armstrong Products Co., Warsaw, Ind., has named **Robert J. Henning** Manager—Marketing. In his new position, he will be responsible for sales, technical service, customer service, and new market development functions.

Lawter Chemicals, Inc., Northbrook, Ill., has appointed **Gene Cassidy** as a Technical Sales Representative for New England and portions of New York and New Jersey.

Obituary

John C. Moore, Past-President of the Federation (1946-47), and FSCT Honorary Member, died December 9, 1978. He was 79-years-old. During his business career, Mr. Moore was associated with Sinclair Refining Co., was Technical Director of the National Paint, Varnish and Lacquer Association, and was Technical Director of the Coatings Research Group, Inc.

He also served as President (1940) of the Philadelphia Society, and was the recipient of that Society's Liberty Bell Award in 1961.

Walter J. Harland, Consultant to Lanson Chemical Co., E. St. Louis, Mo., and a member of the Federation's Editorial Review Board, died November 24, 1978. Prior to his retirement, Dr. Harland was associated with Rohm and Haas Co. He was an active member of the St. Louis Society.

Literature

Crosslinking Agents

Four new crosslinking agents are described in literature now available. Samples and literature on acrylamidoglycolic acid and diacrylamido-acetic acid, for vinylic and acrylic coploymers; glyoxal bisacrylamide, for textile finishing, acrylic polymers, and gelatins; tetrallyloxyethane, for emulsion polymerization of acrylic and vinylic monomers are available by writing to American Hoechst Corp., Chemical Dept., Industrial Chemicals Div., Route 202-206 North, Somerville, N.J. 08876.

Flourescent Whitener

A fluorescent whitener for thermoplastics, coatings, printing inks, and synthetic fibers is discussed in a new booklet. The product's effectiveness in reducing the inherent yellowish tint of most polymers, including those containing white pigments, is described. To obtain a copy of the Unitex® OB booklet, write Additives Dept., Plastics and Additives Div., CIBA-GEIGY Corp., Ardsley, N.Y. 10502.

Piping System

A lightweight, easy to join piping system, designed for conveying corrosive liquids, is the subject of a new edition of a technical book now available. Pertinent technical data includes information about readily available sizes and dimensions of process pipe, drainpipe, and fittings and ease of installation; a comprehensive chart, listing the range of chemical environments in which the system is serviceable; and physical properties and design data. Copies of the book, "Chemtite Piping Systems," may be obtained by writing to Advertising & Public Relations Dept., Hercules Incorporated, Room 415, 910 Market St., Wilmington, Del. 19899.

Color Sensor Analyzer

Information is now available on a new preprogrammed microprocessor-based color analyzer. In addition to three standard illuminants, the system may store up to three additional user specified illuminants. Color analyses areas include opaque materials and transparent liquids. For further information on the IBM 7410, contact IBM Instrument Systems, 1000 Westchester Ave., White Plains, N.Y. 10604.

Malononitrile Review

A 118-page reprint reviewing "New Applications of Malononitrile in Organic Chemistry" is available. Written in two parts by Alexander J. Fatiadi of the Institute for Materials Research, the review includes an overview of the chemistry of substituted malononitriles. It includes items on methods of preparation, physical and spectral properties, chemical reactivity, various syntheses via different reactions, reaction of cyclooctatrienone with malononitrile, and miscellaneous reactions such as those with carbohydrates. For a copy of the review, write Lonza, Inc., 22-10 Route 208, Fair Lawn, N.J. 07410.

Polyester Polyols

A new brochure and data sheets describing Lexorez™ series of polyester polyols is now available. The brochure lists the properties of various polyols in urethane coatings and includes a detailed chart showing the properties of the series. Information on applications, packaging and availability are also included. The brochure may be obtained by writing Lexorez™, Inoles Corp., subsidiary of American Co., Jackson and Swanson Sts., Phila., Pa. 19148.

Vacuum Metallizing Guide

A 24-page, pocket-size guide is now being offered to the industry. Chapters cover product selection, trouble shooting procedures, technical data, and a state of the art dissertation. Problem, possible cause, and probable solution is the format for this guide which also outlines many definitions and potential problems. For a copy of "What You Should Know About Vacuum Metallizing," contact Bee Chemical Co., 2700 E. 170th St., Lansing, Ill. 60438.

Zinc Dust

Data sheets on four grades of zinc dust are now available. Each data sheet gives a brief, basic description, recommended uses, representative physical and chemical properties, a scanning electron photomicrograph, and a graph showing particle size distribution as measured on Micromeritics Sedigraph. Copies can be obtained from St. Joe Zinc Co., Chemical Sales, Two Oliver Plaza, Pittsburgh, Pa. 15222.

Silicone Fluids

A 76-page booklet describing silicone fluids for a wide range of applications is now available. Among the types of material covered are dimethyl fluids, organo-modified fluids, specialty products, emulsions, antifoams, and monomers. An application guide matches each type of silicone fluid with its end uses. Applications include textiles, household and institutional specialties, food and drugs, coatings, paper and printing, and petroleum and related products. Copies of bulletin F-46182 can be obtained from Union Carbide Corp., Silicones, Dept. JSW, 19th floor, 270 Park Ave., N.Y., N.Y. 10017.

Latexes

Two new latexes for water-based pressure-sensitive adhesives are described in newly released data sheets. The first, a vinyl acrylic copolymer, is recommended for adhesives used on removable tapes and labels, and the second, an acrylic copolymer, finds general application in the bonding of a variety of substrates. While both are designed to be used as received, each can be formulated for specific applications. Further information on Ucar Latexes 172 and 173 is available from Union Carbide Corp., Adhesives and Sealants Materials, Dept. RAM, 19th Floor, 270 Park Ave., N.Y., N.Y. 10017.

Fiber Reinforced Plastics

Methods for making fiber reinforced plastics (FRP) are presented in new technical literature. The bulletin is designed to help workers in the FRP industry make quality structures, economically and efficiently. The heart of the literature, the fabricating tips section, provides a discussion of methods, including minimizing air bubbles, effects of thixotropic additives, mold release agents, making a test laminate, and fabricating for FDA compliance. A special feature of the bulletin is an inside back cover pocket containing separate sheets for ready reference information such as the guide for making a test laminate, conversion factors, master batch formulation, and typical gel times. To obtain a copy of "Fabricating Tips—Fabricating FRP Structures with Derakane Vinyl Ester Resins," write Dow Chemical U.S.A., Plastics Dept., 2040 Dow Center, Midland, Mich. 48640.

Viscosity Technical Papers

Sixty-eight reprints of articles written by independent authorities in their fields are now available. The papers cover a complete spectrum of rheological studies in viscosity measurement and control. Readers are advised to write for the updated listing by titles and summaries published in Data Sheet 091-B, "Technical Papers on Viscosity Measurement and Control," which also contains a suggested book list for technical libraries. The data sheet is available from Brookfield Engineering Laboratories, Inc., Dept. NR 29, 240 Cushing St., Stoughton, Mass. 02072.

Color Control

A newly published brochure features general description, technical data, and specifications on this complete color control system. The system utilizes proven design concepts and incorporates new computer and solid state technology. To obtain a copy of the Match-Scan brochure, write Diano Corp., 8 Commonwealth Ave., Woburn, Mass. 01801.

Paint Pail

Literature is now available which introduces a new concept in one-gallon and four-liter containers for latex paints. These reusable pails are made of polypropylene plastic, have no rim at top to trap paint or dirt, and have an inside and outside seal which provides for a strong and leakproof lid. For additional information, write W.G. Holt, Hercules Incorporated, Taunton, Mass. 02780.

Computer Programming

A new integrated computer program package for coatings formula design, batch ticketing, inventory control, and general business/accounting purposes is described in literature now available. Among the benefits claimed for this program package is the ability to rapidly and conveniently determine up to the minute product cost information. To obtain more information, write Applied Color Systems, U.S. Highway One, P.O. Box 5800, Princeton, N.J. 08540.

Experimental Emulsion

A four-page technical bulletin describes a new acrylic emulsion polymer designed specifically for light duty industrial topcoats and trade sales consumer product finishes on metal. The literature provides information on typical physical properties, flash and early rust test results, and suggests starting formulation. Copies of the Experimental Emulsion E-1566 bulletin may be obtained by writing to Marketing Services, Rohm and Haas Co., Independence Mall West, Phila., Pa. 19105.

Colorants

A complete line of colorants developed expressly for polyester molding and coating applications is described in literature recently published. The colorants are contained in a proprietary, 100% solids, unsaturated polyester vehicle, and are dispersions of high quality organic and inorganic pigments. For more information, contact Mr. William J. Stewart, Tenneco Chemicals, Turner Place, P.O. Box 365, Piscataway, N.J. 08854.

Book Review

PAINT ADDITIVES
Recent Developments

Edited by
G.B. Rothenberg
Noyes Data Corp.
Park Ridge, N.J.
1978 (262 pages)
$36.00

Reviewed by
Paul R. Guevin
Hughson Chemicals
Erie, Pa.

"Paint Additives—Recent Developments," by G.B. Rothenberg, is a recent offering from Noyes Data Corp. (NDC) in their Review Series, Chemical Technology Review No. 115. This same publishing company offers another book "Paint Additives" by Harold P. Preuss. Although publisher and title are nearly the same, the content of the books is entirely different. The Harold Preuss volume, dated 1970, is a technical review of the state-of-the art, a good textbook in this field. G.B. Rothenberg's offering is a collection of 158 selected patents dating from January 7, 1975 to March 28, 1978. This patent review represents essentially the patent situation on the latest state-of-the-art in the paint additives field.

Mr. Rothenberg divides the text into eight major categories: Thickeners and Gelling Agents; Biocides, Bacteriacides, Fungicides; Dispersion Aids; Gloss and Hiding Improvers; UV Absorbers and Flame Retardants; Corrosion Inhibitors; Antifouling Agents; and Miscellaneous Additives. The index is conveniently separated into listing of patents by company, inventor, and U.S. patent number. The table of contents is divided into subheadings which act as the subject index.

The format of this book is the same as previous NDC books. The selected patents are abstracted and rewritten into a well organized, approach to the subjects. This is an excellent reference for recent patented changes in the United States.

Coming Events

FEDERATION MEETINGS

(May 17-19)—Federation Spring Meetings. Third-ranking Society Officers—17th; Board of Directors—18th; Executive Committee—19th. Hilton Hotel, New Orleans, La. (FSCT, Suite 832, 1315 Walnut St., Philadelphia, Pa. 19107).

(Oct. 3-5)—57th Annual Meeting and 44th Paint Industries' Show. St. Louis Convention Center, St. Louis, Mo. (FSCT, Suite 830, 1315 Walnut St., Philadelphia, Pa. 19107).

PAINT RESEARCH INSTITUTE MEETING

(May 1-2)—Paint Research Institute Symposium on Analytical Methods Used to Monitor Product Compliance With Regulations. Battelle Institute, Columbus, Ohio. (Dr. Raymond R. Myers, Chemistry Dept., Kent State University, Kent, Ohio 44242).

SPECIAL SOCIETY MEETINGS

(Feb. 12-14)—Sixth Annual Water-Borne and Higher-Solids Coatings Symposium. Hyatt Regency Hotel, New Orleans, La. Sponsored by Southern Society and University of Southern Mississippi. (Dr. B. George Bufkin, Dept. of Polymer Science, University of Southern Mississippi, Southern Station, Box 276, Hattiesburg, Miss. 39401).

(Feb. 28-Mar. 2)—Western Coatings Societies' Symposium and Show, Spectrum '79. Fairmont Hotel, San Francisco, Calif. (Ed Kevin, The O'Brien Corp., 450 E. Grand Ave., South San Francisco, Calif. 94080).

(Mar. 14-17)—Southern Society Annual Meeting. Dutch Inn, Buene Vista, Fla.

(Mar. 20-21)—22nd Symposium of the Cleveland Society, "Advances in Coatings Technology." Baldwin-Wallace College, Berea, Ohio. (George Pilcher, Sherwin-Williams Co., P.O. Box 6027, Cleveland, Ohio 44101).

(Mar. 20-21)—Chicago Society SYMCO '79, "Pigments and Color." Fountain Blue Restaurant, Des Plaines, Ill. (Daryl Luxmore, 9 S 684 Highland Ave., Hinsdale, Ill. 60521).

(Apr. 5-7)—Dallas and Houston Societies. Southwestern Paint Convention. Shamrock Hilton Hotel, Houston, Tex. (Don Webb, Jones-Blair Co., P.O. Box 35286, Dallas, Tex. 75235).

(May 3)—Detroit Society FOCUS Seminar, "Recent Advances in Automotive Coatings." Michigan Inn, Detroit, Mich.

(May 3-5)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C., Canada.

(June)—Golden Gate Society Manufacturing Seminar, "Mixing Time '79."

OTHER ORGANIZATIONS

(Jan. 21-Feb.2)—National Association of Corrosion Engineers Courses, "Basic Corrosion," "Corrosion Prevention by Cathodic Protection," and "Corrosion Prevention by Coatings,"—Jan. 21-26, Amarillo, Tex.—Jan. 28-Feb. 2, Chicago, Ill. (NACE, P.O. Box 986, Katy, Tex. 77450).

(Jan. 31-Feb. 2)—Society of Plastics Engineers, Western Sections RETEC, "Plastics Technology—Recent Developments and Trends." South Coast Plaza Hotel, Costa Mesa, Calif. (John C. Moricoli, West Coast Plastics Equipment, Inc., 7571 Alpine Way, Tujunga, Calif. 91042).

(Feb. 5-9)—Third Annual Gulf Coast Corrosion Seminar. Dunfey's Royal Coach Inn, Houston, Tex. (NACE, 1440 South Creek, Houston, Tex. 77084).

(Feb. 7-8)—Minicomputers and Microprocessors Conference. Battelle, Columbus Div. (Susan R. Armstrong, Battelle Columbus Div., 505 King Ave., Columbus, Ohio 43201).

(Feb. 11-14)—"Judd Memorial Conference on Color Metrics," sponsored by Inter-Society Color Council. Williamsburg Lodge, Williamsburg, Va. (S. Leonard Davidson, c/o N L Industries, P.O. Box 700, Hightstown, N.J. 08520).

(Feb. 13-16)—Conference on "Control of Specific (Toxic) Pollutants," sponsored by the Air Pollution Control Association. Hilton Hotel, Gainesville, Fla. (Leo Weitzman, IERL, EPA, Cincinnati, Ohio 45268).

(Feb. 26-Apr. 27)—Paint Short Courses at University of Missouri—Rolla. For Painting Contractors and Maintenance Engineers—Feb. 26-Mar. 2; Composition of Paints and Coatings—Mar. 5-9; For Paint Inspectors and Quality Controllers—Mar. 26-30; Tinting, Shading, and Matching of Colored Paints—Apr. 2-6; Advanced Coatings Workshop—Apr. 23-27. (Norma Fleming, Extension Div., University of Missouri—Rolla, 501 W. 11th St., Rolla, Mo. 65401).

(Mar. 5-9)—30th Pittsburgh Conference on "Analytical Chemistry and Applied Spectroscopy," Pittsburgh Section, Analytical Group, et al., Convention Center, Cleveland, Ohio, (PCAC & AS, P.O. Box 2128, Lower Barrell, Pa. 15068).

(Mar. 12-13)—Conference on "Quality Assurance in Air Pollution Measurement," sponsored by the Air Pollution Control Association. Grand Hotel, New Orleans, La. (Gus Von Bodungen, Air Quality Section, Louisiana Air Control Commission, P.O. Box 60630, New Orleans, La. 70160).

(Mar. 12-16)—National Association of Corrosion Engineers Annual Conference and Materials Performance and Corrosion Show, CORROSION/79. Atlanta Hilton, Atlanta, Ga. (NACE, P.O. Box 986, Katy, Tex. 77450).

(Mar. 20)—"Toxic Considerations in Fats and Oils Products and Derivatives," sponsored by Northeast Section of American Oil Chemists' Society. Sheraton Inn-Newark Airport, Elizabeth, N.J. (George Willhite, American Oil Chemists' Society, 508 S. Sixth St., Champaign, Il. 61820).

(Mar. 21-22)—Seventh Annual Air Pollution Control Association Seminar, "The Clean Air Act—What's Happening?" Mayflower Hotel, Washington, D.C. (Public Relations Dept., Air Pollution Control Association, P.O. Box 2861, Pittsburgh, Pa. 15230).

(Mar. 22-23)—Coatings - 79: International Symposium on Coatings. Carillon Hotel, Miami Beach, Fla. (V.M. Bhatnagar, Alena Enterprises of Canada, P.O. Box 1779, Cornwall, Ont., K6H 5V7, Canada).

(Mar. 28)—Annual Symposium of North Central Section of American Oil Chemists' Society. North Shore Hilton, Skokie, Ill. (George Willhite, American Oil Chemists' Society, 508 S. Sixth St., Champaign, Il. 61820).

(Mar. 27-29)—1979 Industrial Pollution Conference. Philadelphia, Pa. (Alan Krigman, ICON Inc., 211 S. 45th St., Philadelphia, Pa. 19104).

(Mar. 29-30)—International Conference on Spectroscopy. Konover Hotel, Miami Beach, Fla. (V.M. Bhatnagar, Alena Enterprises of Canada, P.O. Box 1779, Cornwall, Ont. K6H 5V7, Canada).

(Mar. 29-30)—"Control of Volatile Organic Compound Emissions," sponsored by the U.S. Environmental Protection Agency, National Paint and Coatings Association, Association of Finishing Processors of the Society of Manufacturing Engineers, and Air Pollution Control Association. Stouffer's Valley Forge Hotel, Valley Forge, Pa. (Mr. Michael R. Taylor, JACA Corp., 550 Pinetown Rd., Fort Washington, Pa. 19034).

(Apr. 1-6)—Pacific Chemical Conference: 1979. Honolulu, Hawaii. (A.T. Winstead, ACS, 1155 - 16th St., N.W., Washington, D.C. 20036).

(Apr. 2-6)—Div. of Organic Coatings and Plastics Chemistry Symposiums and Spring American Chemical Society Meeting. Hyatt Regency-Waikiki Hotel, Hawaii. (American Chemical Society, 1155 16th St., N.W. Washington, D.C. 20036).

Coming Events (Continued)

(Apr. 3-6)—OCCA-31. Oil and Colour Chemists' Association 31st Annual Technical Exhibition. Alexandra Palace, London, England. (The Director & Secretary, Oil and Colour Chemists' Association, Priory House, 967 Harrow Rd., Wembley, Middlesex, HAO 2SF, England).

(Apr. 4-5)—NPCA Marine Coatings Conference. Omni International Hotel, Norfolk, Va. (Georgene Savickas, National Paint and Coatings Association, 1500 Rhode Island Ave., N.W., Washington.

(Apr. 19-20)—Second Canadian Chromatography Conference. Hampton Court Hotel, Toronto, Canada. (V.M. Bhatnagar, Alena Enterprises of Canada, P.O. Box 1779, Cornwall, Ont. K6H 5V7, Canada).

(Apr. 9-10)—Washington Paint Technical Group 19th Annual Symposium, "Uncle Sam Wants Your Paint—$100 Million Opportunity. Marriott Twin Bridges Motel, Washington, D.C.

(Apr. 23-24)—Inter-Society Color Council. Annual meeting. Roosevelt Hotel, New York, N.Y.

(Apr. 25-26)—"Control of Volatile Organic Compound Emissions," sponsored by the U.S. Environmental Protection Agency, National Paint and Coatings Association, Association of Finishing Processors of the Society of Manufacturing Engineers, and Air Pollution Control Association. Holiday Inn Chicago City Centre, Chicago, Ill. (Mr. Michael R. Taylor, JACA Corp., 550 Pinetown Rd., Fort Washington, Pa. 19034).

(Apr. 25-May 3)—70th Annual Meeting of the American Oil Chemists' Society. Fairmont Hotel, San Francisco, Calif.

(Apr. 29-May 2)—National Coil Coaters Association Annual Meeting. Marco Beach Hotel and Villas, Marco Island, Fla. (Don White, National Coil Coaters Association, 1900 Arch St., Philadelphia, Pa. 19103).

(Apr. 29-May 3)—70th Annual Meeting, American Oil Chemists' Society. Fairmont Hotel, San Francisco, Calif. (James Lyon, Executive Director, American Oil Chemists' Society, 508 S. Sixth St., Champaign, Ill. 61820).

(May 7-10)—Society of Plastics Engineers, 37th Annual Technical Conference, "Plastics—Efficient Use of Resources." Hyatt Regency Hotel, New Orleans, La. (SPE, Eugene E. Wilson, 656 W. Putnam Ave., Greenwich, Conn. 06830).

(May 10-11)—"Control of Volatile Organic Compound Emissions," sponsored by the U.S. Environmental Protection Agency, National Paint and Coatings Association, Association of Finishing Processors of the Society of Manufacturing Engineers, and Air Pollution Control Association. New Otani Hotel, Los Angeles, Calif. (Mr. Michael R. Taylor, JACA Corp., 550 Pinetown Rd., Fort Washington, Pa. 19034).

(May 15-17)—Powder and Bulk Solids Conference and Exhibition. The Civic Center, Philadelphia, Pa. (Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, Ill. 60606).

(May 3-4)—International Symposium on "Flammability and Fire Retardants." Opryland Hotel, Nashville, Tenn. (V.M. Bhatnagar, Alena Enterprises of Canada, P.O. Box 1779, Cornwall, Ont. K6H 5V7, Canada).

(May 19-27)—GEC '79, International Exhibition of the Printing, Publishing, Paper and Paper Processing Industries, sponsored by Italian Association of Printing and Converting Machinery Manufacturers. International Fair Grounds, Milan, Italy. (Sim Robbins, U.S. and Canadian Representative, National Expositions Co., Inc., 14 W. 40th St., New York, N.Y. 10018).

(May 21-25)—"Colloids and Surfaces." Carnegie-Mellon University. (Mrs. Gerry Cohen, Course Coordinator, Post College Professional Education, Carnegie Institute of Technology, Carnegie-Mellon University, Schenley Park, Pittsburgh, Pa. 15213).

(June 10-13)—American Oil Chemists' Society short course on "Industrial Fatty Acids." Tamiment Resort, Tamiment, Pa. (James Lyon, Executive Director, American Oil Chemists' Society, 508 S. Sixth St., Champaign, Ill. 61820).

(June 10-13)—ASTM Committee D-1 on Paints and Related Coatings and Materials, Shoreham Hotel, Washington, D.C. (J.H. Bystrom, ASTM, 1916 Race St., Philadelphia, Pa. 19103.)

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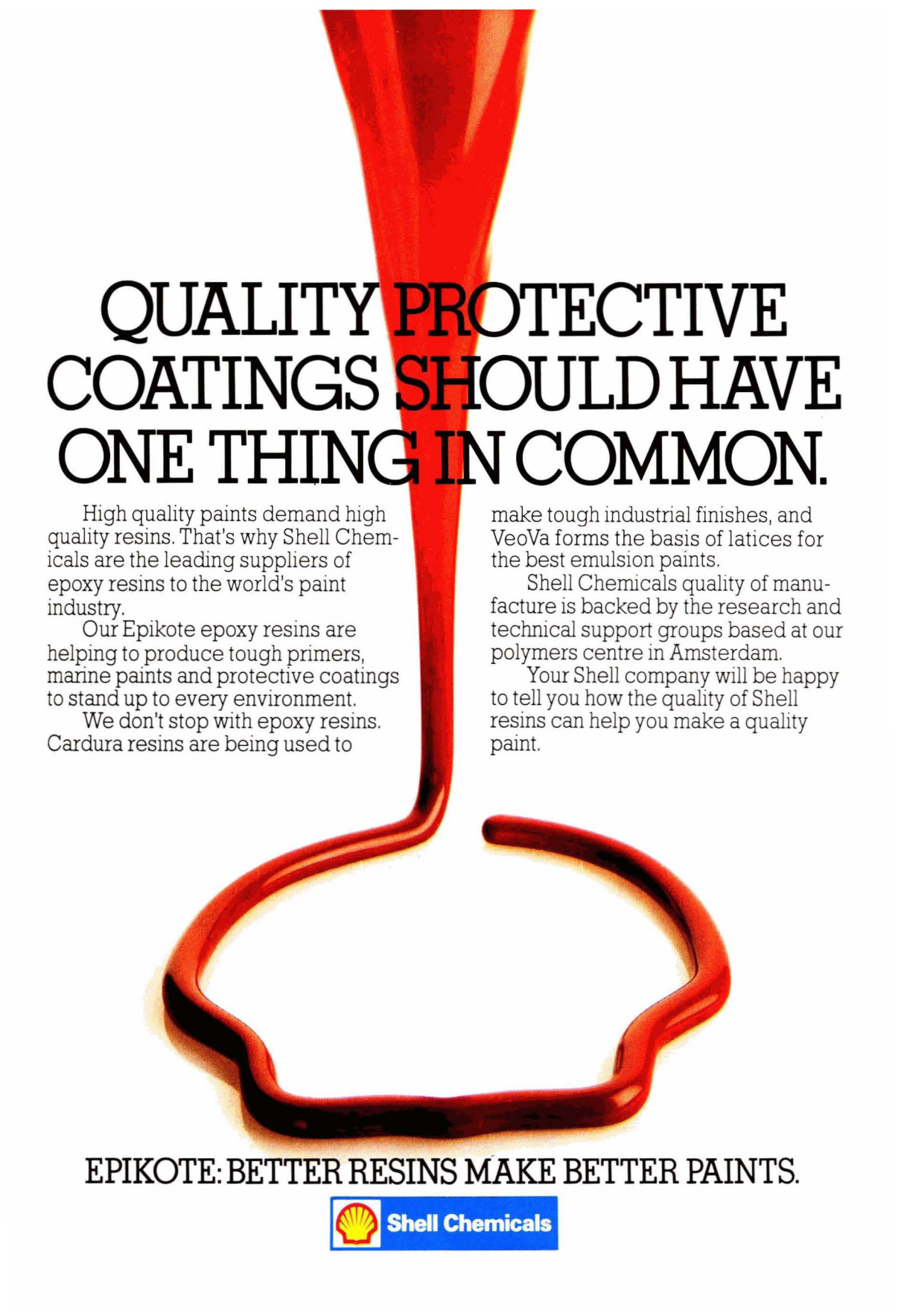

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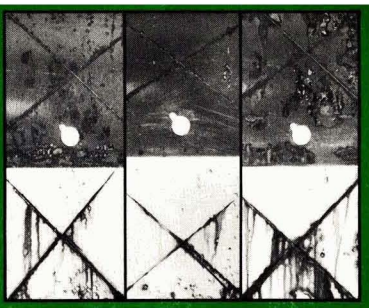

Comparison of Busan® 11-M1 (middle) with zinc phospho oxide (left) and calcium borosilicate (right) in latex emulsion primer. Each primer topcoated with two coats of latex emulsion paint without inhibitor. Panels exposed 200 hours in salt fog cabinet. Panels shown before and after paint was removed.

Comparison of Busan® 11-M1 with zinc chromate in an oil-alkyd primer. Primer on top panel contains 0.7 lb. Busan® 11-M1 per gal. Primer on bottom panel contains 0.7 lb. zinc chromate per gal. Both primers topcoated wth alkyd finish coat without inhibitor. Panels exposed for 10 years.

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