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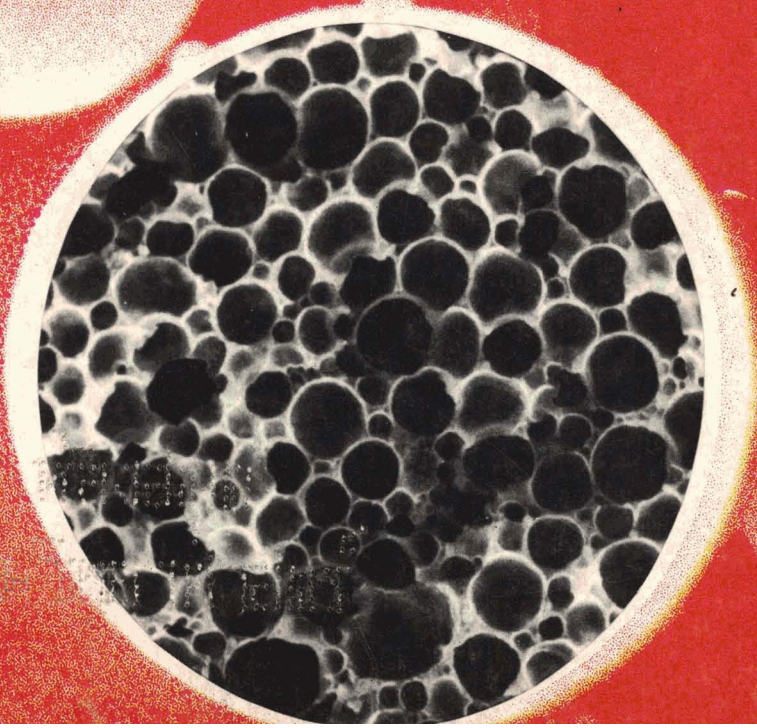
JOURNAL OF COATINGS TECHNOLOGY

JULY 1978

Microvoid Coatings: Pigmented, Vesiculated Beads in Flat Latex Paints



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INDUSTRIAL MINERALS AND CHEMICALS

JULY 1978

JOURNAL OF COATINGS TECHNOLOGY

Volume 50 Number 642

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JOURNAL OF COATINGS OLOGY is published monthly by eration of Societies for Coatings ology at Cresent & Mulberry Harrisburg, Pa. 17104. Editorial ecutive offices are located at 1315 St., Philadelphia, Pa. 19107. (215) 545-1507.
nd class postage paid at Philadel- a. and at additional mailing of-

scriptions U.S. and Canada—1 20; 2 years $37; 3 years, $52. (Air Mail)—1 year, $30; 2 years; years, $72. Other Countries—1 26; 2 years, $48; 3 years, $68.

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

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$20.00	$30.00	$26.00
2 Years	$37.00	$52.00	$48.00
3 Years	$52.00	$72.00	$68.00

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

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

A Guide for Authors is published in each January issue.

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

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

Comment

A Meeting of the Minds at Kent State

One hundred leaders from academia and industry were invited to Kent State University last month to take part in a Workshop on the Science of Organic Coatings. The unique three-day program, held June 20-22, was conceived by Dr. John Gardon, of M&T Chemicals, Inc. and a Trustee of the Federation's Paint Research Institute, and was jointly sponsored by PRI, National Science Foundation, National Paint and Coatings Association, and the Organic Coatings and Plastics Chemistry Div. of the American Chemical Society.

The workshop objectives were to:

- Define the non-proprietary basic research needs of the coatings industry relative to fast-changing technologies satisfying ecological, energy-savings, and safety requirements.
- Establish an intimate contact between leading academic and industrial scientists, to bring coatings-related research opoortunities to the attention of the academic community, and to acquaint industrial scientists with the thinking of academicians.
- Provide a blueprint for basic research which should influence various governmental and industry funding agencies supporting academic research, and guide research policies of universities and industrial organizations.

The daily format consisted of a keynote speech and plenary lectures on such topics as analytical techniques, crosslinking mechanisms, gaps in the state-of-the-art of coatings, material science opportunities, corrosion, inorganic polymers, and industry/government interface. In addition, four task forces met each day to address the topics of the plenary lectures.

The result of the meeting at Kent State should be significant, for this was an occasion when representatives from industry and academia convened to discuss critical needs in a planned manner. Lively discussions at the task force meetings accentuated the bonds as well as the gaps that exist between coatings scientists and academicians in a number of areas. Implementation, however, will depend upon the initiative of the attendees and those who read the published proceedings.

Meanwhile, congratulations are in order for Drs. John Gardon and Raymond Myers, PRI Research Director, for their efforts in arranging the meeting, as well as to all who contributed to the success of this special event.—TJM, *Technical Editor.*

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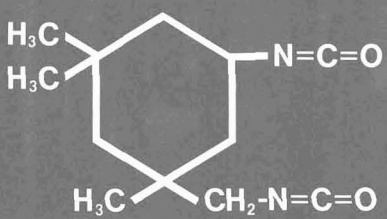

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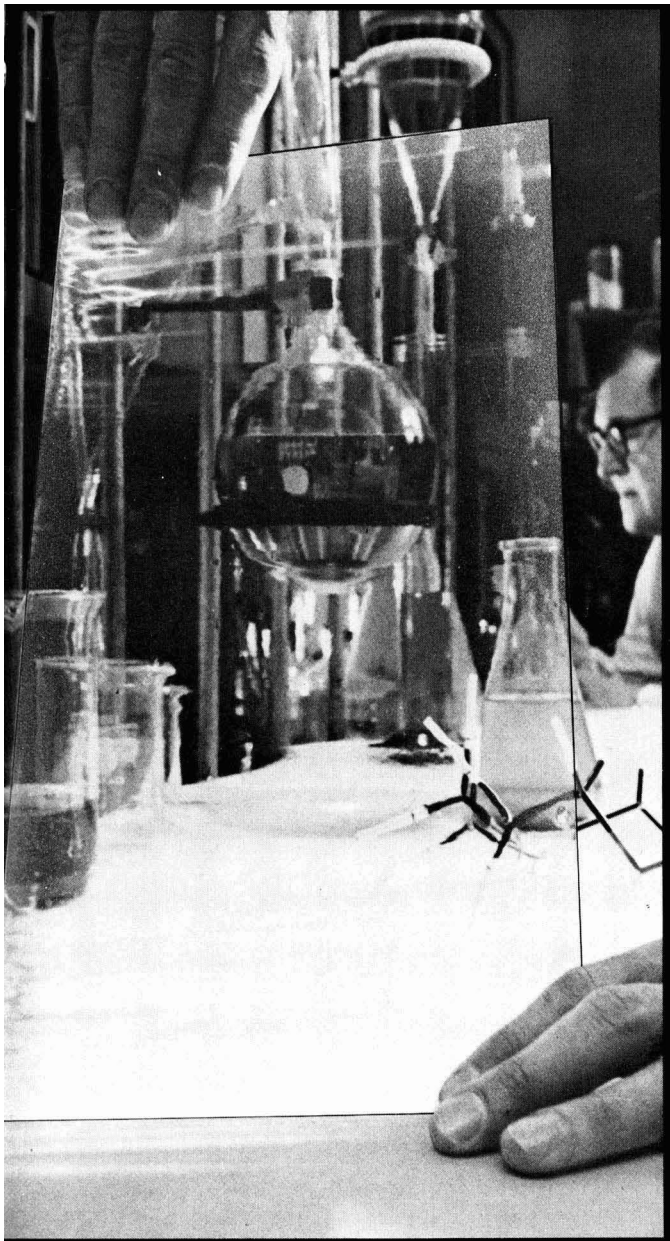

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Abstracts of Papers in This Issue

MICROVOID COATINGS: PIGMENTED, VESICULATED BEADS IN FLAT LATEX PAINTS—R.W. Hislop and P.L. McGinley

Journal of Coatings Technology, 50, No. 642, 69 (July 1978)

Synthetic opaque polymeric beads are useful flatting and opacifying agents for low gloss paints. The properties of paints containing different types of beads are related to the structure of the film and the properties of the beads. Beads containing microvoids introduce a synergistic effect which makes a significant contribution to the total light scattering. Comparisons are made between commercial paints formulated with beads containing microvoids and TiO_2, and conventional mineral extenders. Beads can be used to produce lower cost latex paints without sacrificing the physical or optical properties of the film, as well as flat latex paints with exceptional burnish resistance.

PIGMENT VOLUME CONCENTRATION EFFECTS IN COLOR PREDICTION AND PRACTICE—R.T. Marcus and J. Welker

Journal of Coatings Technology, 50, No. 642, 78 (July 1978)

Color control technology, using digital computers, has advanced sufficiently to allow paint batches to be manufactured without physically matching the color standard in the laboratory. Generally, it is assumed that a color match, predicted with pigments characterized at a single pigment volume concentration (PVC), will not be affected when the loading is varied providing that the ratio of colored pigments to the titanium dioxide remains constant. This study explores why a gray industrial enamel violated that assumption and attempts to quantify the color change in order to achieve more usable color predictions.

OPTICAL BRIGHTENERS—THEIR EFFECT ON THE YELLOW APPEARANCE OF LINSEED OIL PAINT—H. Rakoff and L.E. Gast

Journal of Coatings Technology, 50, No. 642, 84 (July 1978)

Three optical brighteners were incorporated into separate samples of a commercial linseed oil paint and, after storage in the dark, panels coated with these paints were evaluated spectrophotometrically and visually. The samples containing the optical brighteners achieved a smaller yellowness index than did the paint without optical brightener; in addition, each of these samples appeared less yellow to the human eye than did a paint with the same yellowness index but not containing an optical brightener.

INTERRELATIONSHIP BETWEEN STEEL SURFACES, PHOSPHATABILITY, AND CORROSION RESISTANCE—J.J. Wojtkowiak and H.S. Bender

Journal of Coatings Technology, 50, No. 642, 86 (July 1978)

The phosphatability of a steel surface and, hence, the corrosion protection achieved is related to the quality of that steel surface. It is the intent of this paper to determine what parameters of the steel surface influence phosphatability. This was done by examining the influence of steel surface roughness and contamination on zinc phosphate coating quality, and by determining the relationship of phosphate coating weight and density to the corrosion resistance of painted steel.

A high correlation was found between the amount of corrosion creepback of phosphatized and painted steel substrates and the amount of organic carbon present on the surface of the steel. The carbon, analyzed by Auger Electron Spectroscopy, averages approximately 50Å in depth and is not removed by phosphate precleaning operations. The carbon inhibits the formation and development of phosphate coatings which are required to provide satisfactory corrosion resistance.

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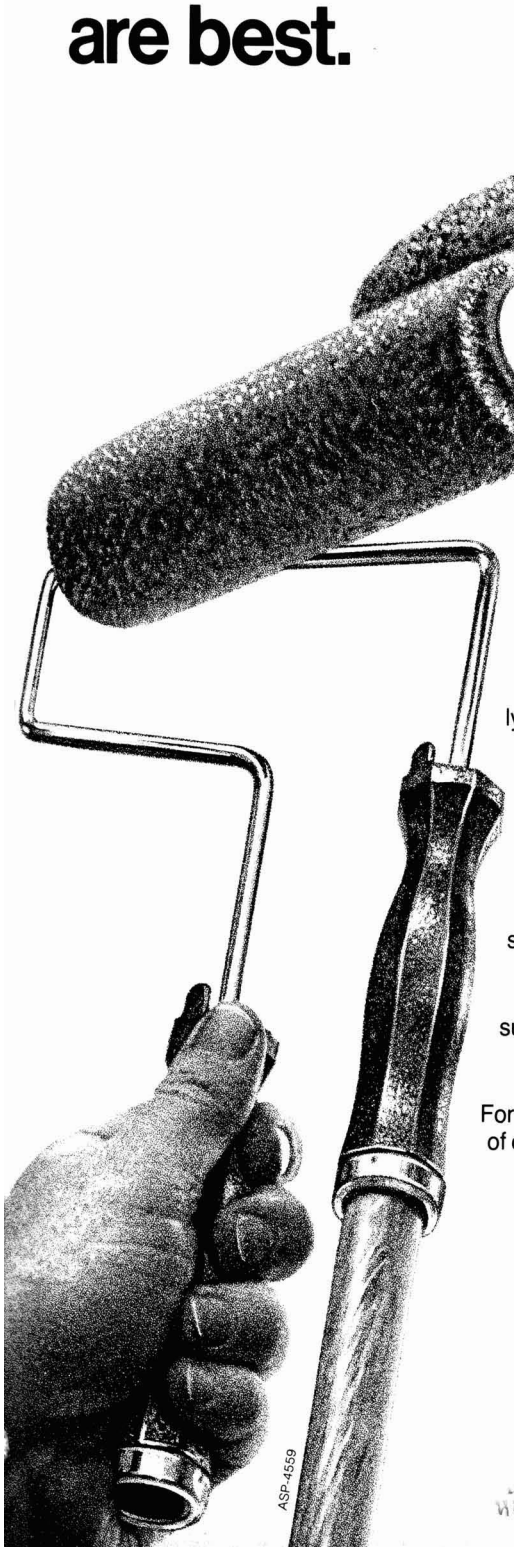

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Dr. Mario G. Salvadori, Engineer and Educator To Deliver Annual Meeting Keynote Address

The Federation of Societies for Coatings Technology is pleased to announce that Dr. Mario G. Salvadori, Engineering Consultant and Professor of Engineering and Architecture at Columbia University, will present the E.W. Fasig Keynote Address at the 56th Annual Meeting of the Federation, to be held November 1-3 at the Conrad Hilton Hotel, Chicago, Ill.

His address, "Technology, Ethics, and Society," will be delivered on Wednesday, November 1.

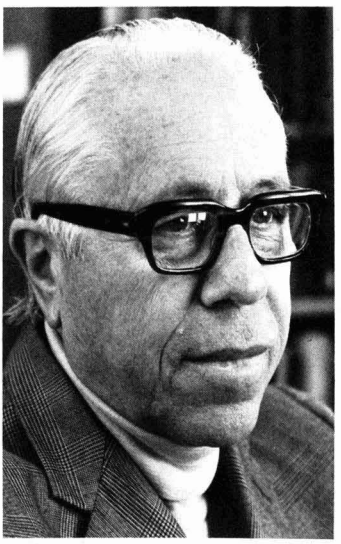
Dr. Salvadori, a native of Rome, Italy, has had a long and distinguished career in both industry and academia. He attended the University of Rome, where he received degrees as Doctor in Civil Engineering (1930) and Doctor in Pure Mathematics (1932). He then served on the faculty there from 1932 to 1938 as Instructor in Theory of Structures, School of Engineering and School of Architecture. During this same period he also served as Consultant to the Italian National Mathematical Laboratory, National Research Council.

He came to the U.S. in 1938 and joined The Lionel Corp. as a Time-and-Motion-Study Engineer. In 1940 he joined Industrial Products Trading Corp., where he became Vice-President, then served as Consultant on the Manhattan Project from 1942 to 1945. He is currently a partner in the consulting engineering firm of Weidlinger Associates, New York, which he joined in 1954 as a Consultant.

Dr. Salvadori began his academic career in this country in 1941 as an Instructor in Civil Engineering at Columbia University, where he subsequently became Professor Emeritus in both Civil Engineering and Architecture. From 1954 to 1959 he lectured at Princeton University with the rank of Professor of Architecture.

He is the author of five books on applied mathematics and four on architectural structures, has written more than 100 papers on applied mathematics, structures, and applied mechanics, and has lectured on these topics throughout the U.S., Europe, South America, and Asia.

Dr. Salvadori is a Fellow of American Society of Civil Engineers, as well as American Society of Mechanical Engineers, American Concrete Institute, and New York Academy of Sciences. Other professional memberships include International Association for Shell Structures, International Association for Bridge and Structural Engineering, Sigma Xi Honorary Society, and Faculty House of Columbia University.



Among his honors are: Best Teacher Award, Columbia University (1962); Honorary Professor, University of Minas Gerais, Brazil (1954); Sigma Xi (1950); Tau Beta Pi Engineering Honor Society (1960); 1978 Engineering Award of the Federation of Engineering of Science Societies, Drexel University.

Program Highlights

The Annual Meeting program, with the theme, "Coatings: The Search for Opportunities," will open on Wednesday, November 1.

Program Chairman Fred G. Schwab, of Coatings Research Group, Inc., Cleveland, Ohio, has announced the following papers selected for presentation:

"Solar Collector Performance: A Dependence Upon Coatings" — Dr. Richard E. Wolf, of DeSoto, Inc.

"Opportunities in Air Force Coatings Research and Development" — Daniel E. Prince, of Air Force Materials Laboratory, Wright-Patterson Air Force Base.

"Cementitious Coatings" — Joseph Lavelle, of Rohm and Haas Co.

"New Concepts in the Formulation of Gloss Latex Paints" — John Bax, of Scott Bader Co. Limited.

"Polyesteramide Modified Water-Dispersible Resins" — Wilma J. Schneider, of Northern Regional Research Center, U.S. Department of Agriculture.

"Coatings as Vapor Barriers in House Insulation and Their Effect on Heat Transmission" — Douglas M. Burch, of National Bureau of Standards.

"New Coatings from Monomers That Cure without Shrinking" — William J. Bailey, of University of Maryland.

"Latex Based Universal Primer" — Andrew Mercurio, of Rohm and Haas Co.

"Information — A Vital Paint Raw Material" — D. Dasgupta, of British Paint Research Association.

"APS — A New Coatings System" — Edward G. Bozzi, of CIBA-GEIGY Corp.

"Today's Coatings and Our Needs in the Future" — Members of Painting and Decorating Contractors of America.

"Formulating in Response to Legislation" — Panel discussion.

Also featured will be the Mattiello Lecture by Dr. Kenneth L. Hoy, of Union Carbide Corp.: "The Effect of Reaction Pathway on Emulsion Polymer Structure," and a session sponsored by the Federation's Manufacturing Committee on "Disposal of Water-Thinned Solids."

Other planned program presentations include:

- Constituent Society papers
- Roon Award papers
- Paint Research Institute Seminar
- Education Seminar
- Technical Information Systems Workshop

Paint Industries' Show

To be held concurrently with the Annual Meeting in the Conrad Hilton, the Paint Show is the only national exhibit of raw materials and equipment used in the formulation, testing and manufacture of paint and related coatings.

All available booth space has been reserved for the 1978 event, which will be the largest in Paint Show history.

Show hours will be 12:30 to 6:00 pm on Wednesday, November 1; 10:00 am to 6:00 pm on Thursday, November 2; and 10:00 am to 4:00 pm on Friday, November 3.

Harry Poth, of C-D-I-C; William Ellis, of Los Angeles, Nominated to Federation Officer Positions

Harry Poth, of The Dean & Barry Co., Columbus, Ohio, has been nominated to be President-Elect of the Federation of Societies for Coatings Technology. Mr. Poth, currently Treasurer, is a Past-President of the C-D-I-C Society and has served as Council Representative and as a member of the Technical Committee. He has also been Chairman of the Federation's By-Laws and Annual Meeting Program Committees.

William H. Ellis, of Chevron Research Co., El Segundo, Calif., has been nominated to the post of Treasurer. Mr. Ellis is a Past-President of the Los Angeles Society and is currently Council Representative. He was General Chairman of the 1972 West Coast Societies Symposium and has served on numerous Society committees, including Education, Environmental, Membership, Program, and Publicity. At the Federation level, he has served on the Board of Directors, and was a member of several committees, including Program, and the Ad Hoc Committees on Education and Restructuring of the Federation.

The Nominating Committee also submitted to the Spring Council Meeting, on May 19, two slates of candidates for Board of Directors/Executive Committee positions. One applies to the present organization, the other to the reorganized Federation, proposals for which will be presented for possible adoption by Council at its Fall meeting, October 31:

Present Organization

Board of Directors as Members-at-Large — (Four Nominees for Two 3-Year Terms):

JOHN C. BALLARD, Vice President and Technical Director of Kurfees Coatings, Inc., Louisville, Ky. He is a Past-President of the Louisville Society and a member of the Scientific Committee of NPCA. He is a current member of the Federation's Finance and Roon Awards Committee.

JOHN J. KENNEY, Technical Sales Representative with Reliance Universal, Inc., Clinton, Miss. He is a Past-President of the Southern Society and has chaired its Membership Committee for four years. He is in his sixth year as a member of the Federation's Membership Committee.

THOMAS J. MIRANDA, Staff Scientist with Whirlpool Corp., Benton Harbor, Mich. He has served as Technical Editor of Journal of Coatings Technology and Chairman of the Publications Committee for the past five years. He is a Past-President of the Chicago Society and received that Society's Outstanding Service Award in 1977.

T.J. Miranda

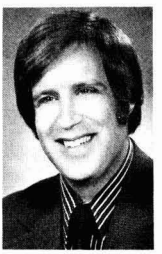
K.F. Weitz

H. Jerome

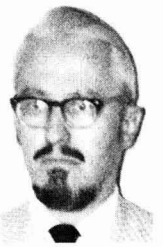
A.G. Rook

H. Poth

W. H. Ellis



J.C. Ballard



J.J. Kenney

KURT F. WEITZ, Product Manager, Fillers & Extenders, of Indusmin Ltd., Don Mills, Ontario, Canada. He is a Past-President of the Toronto Society. He is a current member of the Federation's Finance, Roon Awards, and Technical Advisory Committees.

Proposed New Organization

Board of Directors as Members-at-Large — (Four Nominees for Two 2-Year Terms): Same as above, Messrs. Ballard, Kenney, Miranda, and Weitz.

Board of Directors as Past-President Member: NEIL S. ESTRADA, of Reichhold Chemicals, Inc., S. San Francisco, Calif. He is the Immediate Past-President of the Federation.

Executive Committee as Society Representative Member — (Two Nominees for One 3-Year Term):

HOWARD JEROME, of Vane-Calvert Paint Co., St. Louis, Mo. He is the present Council Representative of the St. Louis Society and a Past-President and Honorary Member of the New England Society. He is Chairman of the Federation's By-Laws Committee.

A. GORDON ROOK, of Napko Corp., Fremont, Calif. He is the current Council Representative of the Golden Gate Society and a Past-President of that group. He was President of the Federation in 1973.

Elections will be held October 31, during the Federation Council Meeting at the Conrad Hilton Hotel, Chicago, Ill.

AM NOTES (continued)

Registration Fees

Regular "on-site" registration fees will be $40 for Federation members and $55 for non-members. Advance registration will be available for $35 for members and $50 for non-members.

There will again be a special $15 advance registration fee for retired Federation members.

An advance registration form is included in this issue (see pages 19 and 20), and will also be mailed to Federation members in August.

Luncheon

An Awards Luncheon will be held on Friday, November 3, at the Conrad Hilton.

Presentations will be made to recipients of the George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation) and the Flynn Awards (firms judged to have the best exhibit booths in the 1978 Paint Industries' Show).

Mark Russell, nationally-known political satirist, will be the guest speaker.

The luncheon, which will be open to all registrants, is being held in place of the traditional banquet.

1978 Annual Meeting and Paint Industries' Show

COATINGS: The Search for Opportunities

● Three days of technical sessions ● Exhibits of 126 supplier companies, whose top technical people will be on hand to discuss latest developments ● Opportunity for one-on-one interchange with Executives, Purchasing Agents, Chemists, Engineers, and Research, Development, and Production Personnel of the Coatings Industry ● All under one roof.

● Plan NOW to attend this Major Coatings Event ● Save time and money by registering in advance ● Copies of registration and housing forms available from FSCT headquarters.

CONRAD HILTON HOTEL
CHICAGO, ILLINOIS
NOVEMBER 1, 2, 3

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1315 Walnut Street • Philadelphia, Pa. 19107 • 215/545-1506

SAVE TIME AND $$$, TOO!!

REGISTER NOW

Annual Meeting and Paint Show

November 1-3, 1978

Chicago, Illinois

USE ADVANCE REGISTRATION FORM ON REVERSE SIDE OF THIS PAGE

You can pre-register for the 1978 Annual Meeting and Paint Show by completing this advance registration form and mail with your check to FSCT headquarters. Your registration badge can be picked up at the Advance Registration desk in the Conrad Hilton Hotel, North Hall.

REGISTRATION FEES

	Member	Non-Member	Ladies' Activities
Advance*	$35	$50	$20
On-Site (Full-Time)	$40	$55	$25
On-Site (One-Day)	$20	$30	—

Note: You save $5.00 by registering in advance.

***Special registration for Retired Federation Members $15.00 in advance only.**

SAVE TIME AND $$$, TOO!!

To register in advance for the 1978 Annual Meeting and Paint Show, please fill in the adjacent form and return with your remittance, to:

Federation of Societies for Coatings Technology
Suite 832
1315 Walnut Street
Philadelphia, Pa. 19107

Forms must be received by October 13.

Federation Awards Luncheon
Friday, November 3
Conrad Hilton Hotel

Purchase of Luncheon tickets is optional, and is not part of Advance Registration fee. If you wish to attend, please check square below and include additional $10 with your registration payment.

Luncheon
($10 per person)

Note: Luncheon is open to all registrants, and will be held in place of the traditional banquet. Political humorist Mark Russell will be guest speaker.
Price of Luncheon is included in Spouses' Registration fee.

Spouses Activities $20.00

ADVANCE REGISTRATION

PLEASE PRINT EXACTLY as you wish registration badge prepared

NAME

ADDRESS

CITY STATE

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

PLEASE PRINT EXACTLY as you wish registration badge prepared

FIRST NAME LAST NAME

BUSINESS AFFILIATION

STREET

CITY STATE *(U.S. only)*

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

Your title or position _____

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

Hotel at which you are staying _____

ADVANCE REGISTRATION

Federation Member	CONRAD HILTON HOTEL CHICAGO, ILLINOIS NOVEMBER 1, 2, 3	NON-Member
$35.00		**$50.00**

YOUR COMPANY *(Check One):*

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

YOUR POSITION *(Check One):*

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

FSCT Annual Meeting and Paint Show

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1978 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW

CONRAD HILTON HOTEL, CHICAGO, ILLINOIS

NOVEMBER 1, 2, 3, 1978

"COATINGS: SEARCH FOR OPPORTUNITIES"

MAIL TO: Coatings Federation Housing Bureau
Conrad Hilton Hotel
720 South Michigan Ave.
Chicago, Ill. 60605

APPLICATION FOR ACCOMMODATIONS

RESERVATION: Please reserve the following accommodations: See reverse side for room rates. Room reservations cannot be guaranteed unless this form is received by Oct. 3, 1978. Reservations accepted only on official housing form.

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

CHOICE OF HOTELS:

1st choice _____

2nd choice _____

ARRIVAL AND DEPARTURE: Arrival: Date _____ Hour _____

Departure: Date _____ Hour _____

Reservations held only until 6 p.m. unless later arrival is indicated.

NAMES AND ADDRESS OF ALL OCCUPANTS OF ROOMS (Please "bracket" those rooming together). Incomplete information **WILL DELAY** assignment of room. Type additional names on a separate sheet, or on reverse side.

NAME(S) ADDRESS(ES)

_____

_____

_____

_____

_____

_____

_____

SEND CONFIRMATION TO:

PLEASE PRINT OR TYPE

NAME _____

FIRM _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

LIST ADDITIONAL NAMES BELOW

HOTEL INFORMATION AND RATES

The Conrad Hilton and Pick-Congress Hotels have reserved blocks of rooms specifically for the 1978 Annual Meeting and Paint Industries' Show of the Federation of Societies for Coatings Technology, November 1, 2, 3, 1978, at the Conrad Hilton.

The Pick-Congress is located two blocks from the Conrad Hilton.

All room rates are subject to additional 6.1% charge to cover Illinois Hotel Operators' Occupation Tax and the Chicago Hotel Operators' Tax, as well as a 2% Chicago Hotel Accommodations Tax imposed by the City of Chicago.

You will receive confirmation from the hotel to which you have been assigned. If you wish to cancel or change the date of your reservation, contact that hotel directly. If the rate requested is not available, the next available rate will be confirmed.

	Conrad Hilton Hotel 720 S. Michigan Ave. Chicago, Ill. 60605 312-922-4400	**Conrad Hilton Towers**	**Pick-Congress Hotel** 520 S. Michigan Ave. Chicago, Ill. 60605 312-431-1102
Singles	$35 41 44 47 62*	$44 67*	$29 34 39
Doubles	$47 53 56 59	$56	$41 46 51
Twins	$47 53 56 59 62*	$47 56 67*	$41 46 51
Suite (P&1)	From $67 to $285	From $70 to $255	From $65 to $150
Suite (P&2)	From $185 to $650	From $190 to $400	From $105 to $250

*Deluxe Twins

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Spring 1978 Council Meeting

Forty-three members of the Federation Council attended the Spring Council Meeting of the Federation of Societies for Coatings Technology on May 19, 1978, in Kansas City, Mo.

The following were present:

Officers

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

Society Representatives

Baltimore ..... Alex Chasan
Chicago ..... Victor M. Willis
C-D-I-C ..... William Mirick
Cleveland ..... Fred Schwab
Dallas ..... Carlos E. Dorris
Detroit ..... Harry Majcher
Golden Gate ..... A. Gordon Rook
Houston ..... Willy C.P. Busch
Kansas City ..... Terryl F. Johnson
Los Angeles ..... William H. Ellis
Louisville ..... Joseph A. Bauer
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

William Dunn
Neil S. Estrada
Herbert L. Fenburr
Donald J. Fritz
James Hanson
Philip Heiberger
Elder C. Larson
Michael W. Malaga
Robert W. Matlack
Raymond R. Myers
Carroll M. Scholle
Raymond D. Stevens, Jr.
Jean P. Teas
Joseph W. Tomecko
Willard W. Vasterling

Mr. Stevens is the President of the National Paint and Coatings Association. Mr. Hanson is the President of the Canadian Paint Manufacturers Association.

Guests

Walter B. Clyde
Thomas Cochran
José M. Castellanos
Fred Croad
John S. Dahl
Martin L. Davis
William Fitzpatrick
John W. Folkerts
Carl W. Fuller
Gary W. Gardner
John A. Gordon, Jr.
Michael Griffin
Arthur Hagopian
John V. Hajnos
Alfred L. Hendry
Paul J. Houck
Joseph B. Lococo
Eugenio Macouzet
Hugo R. Manco
Robert Marcus
George Mulvey
Sandy Palleschi
Ken G. Probst
Herbert Rosenblatt
Lothar Sander
Harry Schwartz
William A. Smith IV
Robert Snyder
Glenn Sorensen
Helmut Zapfe

Twenty-seven of the above guests are Society second and third ranking officers who attended a special orientation meeting arranged for them by the Federation the previous day.

Mr. Macouzet is the President of the Mexican Paint and Ink Manufacturers Association.

Staff

Frank J. Borrelle
Thomas A. Kocis
Rosemary Falvey

Executive Vice-President Frank J. Borrelle called the roll of members and reported a quorum present. The report of the Fall 1977 Council Meeting was approved as published in the January 1978 JOURNAL OF COATINGS TECHNOLOGY.

Reports of Officers

PRESIDENT OATES

At the mid-term of my service as Federation President, but at a time when I have completed most of my visits to the Constituent Societies, I'd like to make a few personal observations on the status of the Federation.

If the function of the Federation is to satisfy the officers and Executive Committees of the Constituent Societies, then judged by the relative absence of criticism, and the favorable reaction to the services provided, your Federation is doing a good job indeed.

But, I submit, such criteria reflect a passive outlook at the local level. As long as the Federation puts on a successful Paint Show, publishes a good *Journal*, keeps the finances in order, and turns out new booklets now and then—O.K.

However, in my view, the Federation should have a more positive role in generating action at the local level, in getting things started in the local Education, Technical, and Manufacturing Committees. And in this area there is room for substantial improvement.

Educational efforts at the local level might be characterized as adequate, based on the number and variety of courses being given. Technical Committee effort, compared to past years, appears less than adequate. And local Manufacturing Committee activity, with one or two exceptions, is almost non-existent.

It's admitted, by all concerned, "that you don't get the interest in these areas that you used to." That's a general problem at the local level, and to help overcome this serious problem is the challenge at the Federation level—nothing less.

The annual committee meetings we are scheduling, bringing Constituent Society officers together, bringing Educational, Technical, and Manufacturing Committee chairmen together, etc., have as one of their aims the generation of new ideas and new enthusiasm in our membership. Our plan to study ways to improve programming at the local level has a similar aim. The appointment of Tom Kocis as Field Director is a positive step in more effective Federation/Society Communications. Efforts of this kind, plus other innovative ideas, should be encouraged.

We can take pride in our Federation and its accomplishments, and anyone who has seen our slide presentation can't fail to be impressed with the extent of the Federation programs and services available. But the availability and the value of these services have not been effectively communicated to the membership at large.

I sense that we are a long way from capturing the loyalty, enthusiasm, and involvement of a significant proportion of our members. If this is so, until we make more progress in this area, I caution against the too easy assumption that the Federation is in robust good health.

On the positive side, Federation officers, who met the previous day with the Constituent Society incoming officers, cannot help but be impressed with the enthusiasm and competence of this dedicated group.

The potential for robust health and significant growth is there. The challenge is to our leadership capabilities - and to all of us. Your Federation officers, the staff, and your Constituent Society Officers are determined to work hard to meet the challenge.

JOHN J. OATES
President

PRESIDENT-ELECT McCORMICK

Since the Fall Council Meeting, your President-Elect has been involved in a variety of meetings or visits on behalf of the Federation, including:

- Special PRI Meeting
- Ad Hoc Committee on Education and Motivation
- Visit to Baltimore Society
- Visit to Pittsburgh Society
- Visit to Philadelphia Society
- Visit to Northwestern Society
- JPICC Meeting
- NPCA Scientific Committee Meeting
- Visit to Detroit Society

Routinely, one of the duties of the President-Elect is to appoint committee chairmen and various delegates to other organizations. This task will be completed soon.

One major activity of your President-Elect, not normally connected with usual duties, has been to act as Chairman of the Ad Hoc Committee on Education and Motivation. This committee completed its deliberations and a complete report was submitted to the January Board Meeting. Four major items under consideration were: Education for members; Motivation of members to participate; Motivation of members management; and How to attract "new blood".

This year has been an interesting and helpful period to develop helpful hints, comments and suggestions. Using the officer and staff visitations to encourage member participation in the evening's program, a number of interesting discussions resulted. Many of the suggestions and comments have already reached the Executive Committee.

The new year is rapidly approaching. As usual, much of the planning necessary for the successful operation of the Federation is completed. Rest assured 1979 will be a successful year.

JAMES MCCORMICK
President-Elect

TREASURER POTH

I am pleased to report that your Federation is in excellent financial condition. We are within budget and barring some unforeseen circumstances, should end the year with a small surplus.

I was privileged to spend an afternoon in the Federation office familiarizing myself with their procedures and bookkeeping methods. The staff is very methodical and precise in their methods. I was impressed and can report to you that our funds are in good hands.

I have had the good fortune to visit the Philadelphia and

Southern Societies. The reception at both was most cordial. I found a group of hard working, dedicated individuals making these Societies a great asset to the Federation. I have also found that some stimulation is in order for many of the newer members.

I attended the Symposium on Color and Appearance Instrumentation in Cleveland. It was an excellent undertaking sponsored by your Federation in conjunction with ISCC and MCCA. Special recognition should be given to Tom Kocis, of the Federation staff, and Ruth Johnston-Feller, Chairperson of the Inter-Society Color Council, for their flawless handling of both program and arrangements.

I have also attended to my duties as a member of the Board of Trustees and Treasurer of PRI.

HARRY POTH
Treasurer

EXECUTIVE VICE-PRESIDENT BORRELLE

As indicated in the February JOURNAL OF COATINGS TECHNOLOGY Comment Page, 1978 will be a banner year for the Federation. This report will reflect some of the activities contributing to this very sound state of affairs.

Four of the items mentioned (Dictionary, Pictorial Standards Manual, Audio/Visual, and Color Symposium) will be discussed in more detail by Tom Kocis, Director of Field Services, in a separate report.

PUBLICATIONS

JCT: Availability of editorial matter continues to be good. Advertising page sales in 1977 were over 1976, and we look for further increases in 1978.

Year Book: The 1978 edition (288 pages) was released on April 11. It includes the names of 6,424 members—a growth of 70 Active and 82 Associate members. Advertising sales matched 1977.

Federation Series: #26 on "Corrosion and the Preparation of Metallic Surfaces for Painting" was published in March. Coming later will be #27 on "Anti-Corrosive Barrier and Inhibitive Primers." Both were authored by Clive Hare.

Newsletter: Four editions (#70 to #73) were published since January. A special bulk distribution of the Newsletter was offered to the Societies. The response was good and we are now shipping 2,000 extra copies to 15 Societies.

Dictionary: This long-awaited monumental volume will be published in late summer. The Board of Directors has already approved the selling price of $30 to individual members, $50 to others.

Pictorial Standards of Coatings Defects: This publication is also due later this year.

ANNUAL MEETING AND PAINT SHOW

Registered attendance at the 1977 Annual Meeting and Paint Show was 4,396. Paid exhibit space totalled 26,900 net square feet, the largest ever.

For the first time, Show attendance was audited by Exposition Audit, a new service welcomed by exhibitors.

The 1978 Paint Show in Chicago has been sold out and with 29,000 net square feet of paid space, it sets a new record.

Fred Schwab and his Program Committee are lining up a very interesting program geared to the theme—"Coatings - Search for Opportunities."

Because of declining attendance, the dinner-dance will not be held this year. Instead, the Federation will sponsor a Friday luncheon.

MEMBERSHIP

A new and improved membership application form is being prepared and will be distributed to the Societies in time for the new administrative year.

COLOR-MATCHING APTITUDE TEST

Production work on the CAT sets is nearly completed and sets are now available for purchase. Thanks are extended to Ruth Johnston-Feller, Chairman of the Federation's Inter-Society Color Council Committee, for her counsel and assistance in preparing the 1978 edition.

OFFICERS/STAFF VISITS TO SOCIETIES

The Executive Committee has approved a modification to the Officers/Staff Society Visitation Policy announced last year.

Visitations will continue to most Societies every other year and also to each of the annual (or biennial) special meetings. In addition, beginning September, we will schedule visits to monthly meetings of the Societies in which the annuals (biennials) *will not* be held. And further, visits to the sections of the Northwestern, Pacific Northwest, and Southern Societies will be planned every two or three years.

Reason for this change is that a good cross-section of members is not generally present at the annuals. The added visit will provide more adequate Federation coverage in those areas.

A letter from staff about the 1978-79 schedule will be sent to Societies this summer.

FIELD DIRECTOR

Tom Kocis has begun his additional duties as Director of Field Services. In this capacity, he will work very closely with the Educational, Manufacturing, and Technical Committees and will coordinate the activities of both the Federation and Society groups. The services of the Field Director are available to any Society. Tom will be pleased to meet with the three committees for the purpose of offering both staff and national committee assistance in problem areas. Please write Tom if you want him to meet with your Society committees. He also plans visits to a few Societies each year, exclusive of those in the regular Officers/Staff schedule.

COOPERATION BETWEEN NEIGHBORING SOCIETIES

We are both pleased and encouraged at the growing spirit of cooperation and partnership among neighboring Societies. This close relationship has existed for a long time in areas such as: Dallas/Houston; Golden Gate/Los Angeles; Kansas City/St. Louis; and Montreal/Toronto.

The Executive Committees of the four West Coast Societies meet every summer for the purpose of coordinating their monthly meeting programs and other activities for the coming year.

The officers of the Toronto and Western New York Societies exchange visits twice annually.

When announced last year that Federation officers/staff visits to most Societies would be on an alternate year basis, we suggested that the President of the neighboring Society attend the meeting of the "sister" Society at which the Fed-

eration visitors would be present. This was one means, we said, of "staying in touch" with Societies not in the travel schedule that year.

A few Societies did follow through on this idea. Toronto officers were at Western New York; the President of C-D-I-C was in Louisville; and the President of Cleveland would have been in Pittsburgh were it not for very bad weather. Our thanks to them.

The newest joint activity is the May 1-2 "Coatings Symposium" sponsored by the New York and Philadelphia Societies at a location midway between the two cities. Joining forces in this manner eliminates the competitive aspects of separate symposia, contributes to a more effective program with good attendance, and saves the interested membership time and expense. We understand that C-D-I-C/Louisville are thinking along these lines, too.

All of the examples cited above illustrate that joint cooperation does work to the advantage of the Societies, their membership, and the coatings industry.

Society Officers Meeting

A lot of preparation has gone into the meeting with Society Officers held on May 18. A special package of reference material was distributed. This year only, the meeting was for the Second and Third Ranking Officers. In future years, it will be for Third-Ranking officers only.

Audio/Visual Programs

A volume II has been added to the Federation's "Training Series on Test Methods." It includes one program by the Philadelphia Society and two by Golden Gate.

Color Symposium

In cooperation with the Inter-Society Color Council and the Manufacturers Council on Color and Appearance, the Federation sponsored a Symposium on Color and Appearance Instrumentation (SCAI) in Cleveland, March 13-15. The Symposium attracted a registration of 201 and was a great success. Programming was provided by ISCC and MCCS handled the workshops and instrument displays. The Federation staff, under the direction of Tom Kocis, was responsible for all other arrangements. This marked the Federation's first involvement in any special spring activity. The success of SCAI proves it can be done.

JPICC

Since 1972, the Federation has been a member of the Joint Paint Industry Coordinating Committee, composed of the officers and staff of the: Federation, National Decorating Products Association, National Paint and Coatings Association, and Painting and Decorating Contractors of America. At each semiannual meeting of JPICC, the member groups present an update of activities in their segment of the coatings industry. The Federation hosted the March meeting in Philadelphia.

Staff

I extend my thanks to these staff members for their dedication and good work: Tom Kocis, Rosemary Falvey, Dick Gross, Dolores Giovanetti, Ronna Righter, Kate Ferko, Bob Ziegler, Elena Comi, Lorraine Ledford, and Mary Sorbello. Ronna, the Federation's familiar telephone voice, will be leaving in July to raise a family.

FRANK J. BORRELLE
Executive Vice-President

DIRECTOR OF FIELD SERVICES KOCIS

This report covers the major areas of involvement since the Annual Meeting, specifically those relating to the new duties as approved by the Board at its October 29, 1977 meeting.

Committee liaison has included arranging for and attending meetings of the Program, Manufacturing, and Educational Steering Committees, as well as writing and distributing minutes for them.

Symposium on Color and Appearance Instrumentation

This event, held March 14-16 in Cleveland, was sponsored by the Federation in conjunction with the Inter-Society Color Council and the Manufacturers Council on Color and Appearance, in response to the numerous recent developments in color matching programs and instrumentation for the coatings industry. It had been proposed by Ruth Johnston-Feller, who chairs Federation's ISCC Committee, and approved by the FSCT Board of Directors at its January 22, 1977 meeting.

Format for the Symposium was morning and afternoon general sessions on the first two days, followed by four concurrent workshops which featured newly developed instrumentation equipment of nine supplier firms. Each general session focused on one of four topics (Gloss and Appearance, Colorant Formulation, Spectrophotometry, and Color Difference), and each workshop was devoted to discussions of one of these topics. Registrants rotated in attending the workshops until all four had been covered.

A total of 201 registrants took part. Attendees came from all parts of the U.S., as well as from Canada, Mexico, Argentina, and France, and the calibre of the registrants was very high—management was represented as well as competent technical people.

The number of registrants was about what had been anticipated, so income was close to budget; expenses, however, were below expectations, so the event was financially more rewarding than projected. The surplus accrues to the Federation for its efforts in providing seed money to initiate preliminary work for the Symposium, as well as for attending to the planning, promotion, and registration needs, all of which were handled by staff.

Mrs. Johnston-Feller was in charge of the general programming and she and her committee arranged for all the paper presentations. The workshops and instrumentation exhibits were handled by the Manufacturers Council on Color and Appearance. Both groups did an outstanding job and the success of the Symposium reflects their excellent efforts.

Throughout, interest was high, the sessions and workshops were crowded, and the exhibit people were sufficiently enthusiastic to express interest in another jointly sponsored Symposium some three or four years hence.

Publications

"Paint/Coatings Dictionary"—Work on this long-awaited publication is winding down. Corrected copy of final draft was delivered to typesetter in February, and material has been assembled in page format for final proofing and has been distributed to the Definitions Committee for checking. Proof copy is to be returned to Federation headquarters by June 10 to implement corrections for initiation of printing production work aimed at published book by mid-September.

Meanwhile, publicity and promotion planning is underway

for promoting the marketing and sales of the "Dictionary," and copies will be on display at the Federation booth in Chicago, where orders will be taken for the book.

"Pictorial Standards of Coatings Defects"—Manual is currently nearing completion. All photographic work has been finished, and text is undergoing final editing prior to typesetting. Publication is anticipated this summer.

Audio/Visual Programs

Volume II of the "Federation Training Series on Test Methods" has been completed and copies are now available ($50). The three programs included in the new volume contain a total of 79 slides and represent the work of the Philadelphia Society ("A Simple Method to Determine Microbiological Activity") and the Golden Gate Society ("Wet Film Thickness Gages" and "A Salt Spray (Fog) Testing Cabinet").

Review has been completed of a script submitted by the Birmingham Club for a presentation on "Setaflash" and one by the Cleveland Society on "Tinting Strength." Currently being reviewed is a script submitted by the Western New York Society on "Impact."

PRI Liaison

Made arrangements for, and attended, November and March meetings of PRI Trustees.

Continue to assist in preparation of literature and slides and to coordinate their distribution for use in presentation of "PRI Night" at various Societies.

Committee Liaison

Manufacturing—Initial joint meeting of the Federation Manufacturing Committee with Society Manufacturing Committee Chairmen was held January 26 in Louisville to discuss ways and means of coordinating and strengthening manufacturing programs at both the national and local level.

Severely adverse weather conditions limited attendance (5 members of the Federation Manufacturing Committee and 9 Society representatives were present), but those who made it to Louisville made good use of their time to pursue discussions.

The Society Chairmen were briefed on current Federation Manufacturing Committee programs and projects, and then joined in deliberations on proposed Task Force assignments.

There was general consensus that prime effort was needed to accomplish meaningful goals and that at the local level, some Societies were in need of continued input from the Federation and other Societies to help them develop and maintain ongoing manufacturing efforts. To this end there was agreement that a regular communique should be issued by Federation headquarters in the form of a "Newsletter" to each Society Manufacturing Committee Chairman, and that the first issue should include a list of suggested guidelines for developing successful Society committee activity. It was acknowledged that the Newsletter would be dependent in large measure on the contributions from each Society and the Chairmen agreed to submit information on their activities to the headquarters office. The initial issue of "Manufacturing Committee News" was recently compiled and distributed, and subsequent issues are planned on a regular basis.

Educational—The Educational Steering Committee met March 17 in St. Louis *(see Chairman's report)*. Prime topic of discussion was the proposed Correspondence Course, for which the Committee reiterated its support.

Other discussions focused on: need to update the Federation booklets on coatings technology—these were recently reviewed by Society Educational Committee personnel and their comments and suggestions will be considered in any revisions which the Publications Committee deems appropriate when the booklets are reprinted; Update of the "Guide to Coatings Courses," which is to be issued annually—latest edition was published last Fall, with next issue planned for late Summer, and request for current and revised information has been sent to Society Educational Committee Chairmen.

A topic that generated much discussion was providing assistance to help members respond better to needs of the industry. To this end, it was agreed that headquarters staff could help by distributing to Society Educational Committee Chairmen copies of important announcements (news releases, NPCA bulletins and alerts, etc.) that should be brought to the attention of the membership. It was felt that this is an effort that falls in the province of the Educational Committee Chairman and he should see that the information is disseminated to Society members. Staff is now screening material for pertinent items and will distribute copies of appropriate information as received.

The next meeting of the full Educational Committee (all Society Educational Committee Chairmen) is planned for mid-September, possibly in Kansas City.

Program—The 1978 Annual Meeting Program Steering Committee met in Chicago in December to select a theme and pursue contributions that would address that general topic. The committee agreed upon "Coatings: The Search for Opportunities" as the theme. Chairman Fred Schwab and his committee members have lined up approximately a dozen papers on various aspects of the theme and are enthusiastic about the response to the call for papers on this "upbeat" topic.

After committee has selected presentation and author has been so advised, staff follows through on subsequent communications and arrangements. This minimizes time and effort of committee members and frees them from unnecessary involvement in routine paper work.

Society Visits

In keeping with directive to visit Constituent Societies, I met with the Piedmont Society in my first solo venture as Field Director to discuss the Federation/Society relationship. I also attended meeting of the New England Society (accompanying President John Oates) and the Detroit Society (accompanying President-Elect Jim McCormick and Executive Vice-President Frank Borrelle).

On all three visits, meetings were held with Society Executive Committees to discuss activities at the local and national levels and to probe for areas in which staff support might be provided to assist local efforts, particularly in committee work. None of the Societies visited expressed the need for current staff assistance in their activities.

Additional visits are planned later this year, exclusive of the regular Officer/Staff schedule, and Societies are requested to encourage their committee chairmen to attend on these occasions to contribute their input to the discussions.

Thomas A. Kocis
Director of Field Services

Society Representatives Report

(1) Society Officers' Meeting

The Society Representatives discussed the practice, recently established by Board action, of scheduling annual meetings of Society Officers. Several Representatives expressed the desire to have their fourth-ranking officer attend so as to get the earliest possible exposure to the Federation. However, because of variations that exist in the make-up and responsibilities of the various Executive Committees, we simply chose to endorse the policy and recommend its continuation. Furthermore, the Representatives suggested that the local Society Executive Board be given some flexibility in selecting the officer, either third or fourth, that they choose to send.

(2) Year Book

The lateness of publication of the *Year Book* is of concern to us.

Though we appreciate the many problems involved in its publication, we also realize the value it offers to the entire membership. As a possible solution, we ask that the staff consider publishing the "*Year Book*" in two parts.

Part 1 - Would be available by November 15th and would contain: Constitution, By Laws, and Standing Rules; a listing of the Federation Officers, Committees and their Chairmen; and a listing of Society Officers, Committees and their Chairmen.

Part 2 - Would simply be the roster of our membership and should be available by February 1st.

(3) Associate Members

Rights offered to Associate Members at the local level were also discussed.

We conducted a poll to determine how many Societies offer Associate members voting rights equal to that of their Active Members and the right of the Associate member to hold local office. One year ago, seven Societies treated both Associate and Active members more or less as equals in both categories. Today that number has risen to nine with six more contemplating the change. The Society Representatives requested that the Federation's By Law Committee prepare a "model" By-Law change that could be used by Local Societies planning the change. Such a model could provide a strain of uniformity from Society to Society and ease compliance with a change in the Federation's By Laws which we feel is inevitable.

E. G. LeVea
Chairman

Paint Research Institute

The present Board of Trustees has now served for 1½ years. During this period every aspect of the PRI was considered and minutely examined. Our mission was to make the PRI a more vital and relevant part of the paint industry. In carrying out this task, many possible approaches were considered including such extreme options as liquidation as one possibility and gross expansion as another.

By virtue of these exercises, we have evolved a useful structure appropriate for the times and relevant to the Paint Industry. This has been accomplished without changing our essential character, objectives, or mode of operation.

Interdisciplinary Research

Historically, PRI was primarily a supporter of multidisciplinary research. The objectives were not only to provide new information, but to educate scholars and to develop students. In practice, this meant that our programs were fragmented and focused only on single aspects of a given problem. As a consequence, we did not confine ourselves to a few well integrated programs but superficially supported a wide range of activities, e.g., rheology, corrosion, color physics, synthesis, catalysis, film formation, latex development, microbiology, etc. The key to selection was a qualified investigator, a good concept, and relevancy to the paint industry.

True, there are still some who believe that this should remain PRI's objectives. But many, including the PRI's Board of Trustees, believe that the PRI should direct their efforts to fewer problems, but very relevant ones and in greater depth. In other words, we should emphasize a strong interdisciplinary approach.

MIDOC Consortium

At the March 1-2 meeting of the PRI Board of Trustees, we took the "bull by the horns" and firmly committed the PRI to a formal interdisciplinary research mode. The MIDOC program was restructured into a consortium. As such, it will be managed and funded separately from the main stream programs.

The rationale behind this selection was the recognition that the PRI's mildew program is our most advanced interdisciplinary effort, and the one that also involves disciplines most removed from traditional paint technology. For these reasons the PRI Trustees authorized Dr. Ray Myers to engage a microbiologist project manager for the MIDOC program. Dr. Douglass E. Eveleigh, of Rutgers University's Department of Biochemistry and Microbiology, was engaged to fill the newly created position.

With Dr. Eveleigh's input, the Trustees and Dr. Myer restructured the MIDOC program to de-emphasize the "pure-fundamental" approach to emphasize an "applied-fundamental" approach. The new studies will fall into three broad categories: (1) apply fungicides efficiently to gain long term effectiveness; (2) continue the study of the intrinsic factors that impart resistance on a paint to mold growth; and (3) explore the use of inhibitors of unique biochemical pathways.

This program will be structured as a consortium and industry will be solicited for funding. The technical component of this program will be managed by Dr. Eveleigh.

As project manager, Dr. Eveleigh will be responsible for deciding what combination of research disciplines and which research agencies should be used in attacking the problem. It will also be his job to work with the various research groups, to set up tight, sharply focused programs with stated, goal-dated objectives. As the work progresses he will periodically with the aid of a special advisory committee review the various programs, correlate the input of the various disciplines, institute changes as necessary, and report progress to the PRI Research Director.

Through this change, we expect to make this part of the PRI

research activity more attractive to industry and to potential supports. This undertaking is in the nature of an experiment, and will be used both as a learning experience and, if successful, as a model for future changes. In other words we are trying to restructure the management of the PRI so that we can respond rapidly and adequately to the wants and needs of the paint industry.

Official sanction for this action was the following motion approved by the PRI Trustees on March 2: "The MIDOC program be packaged as a single project and supported by sponsors as a consortium. The minimum number of sponsors must be five and each will be asked to contribute a minimum of $5,000 a year for two years. Each sponsor will be invited to select one representative for appointment to the Advisory committee of the Program."

Rearrange Multi-Disciplines Programs Into Interdisciplinary Mode

The Trustees also requested that several of the multi-disciplinary programs be refocused. This may provide the nucleus of another important interdisciplinary program. The tentative title is "Physical Chemistry of Aqueous Coatings." PRI investigators Myers and Krieger will form the nucleus of a new team. They will try to understand how aqueous coatings behave during application and during film formation. Initially, one of the investigators will serve as coordinator and a single advisory committee will be formed. As the program develops and the objectives refined, a program coordinator may be appointed and special funding may be sought. At present, these programs are being carried out under existing procedures. The cooperative effort is in lieu of the earlier fragmented and independent projects.

Note that we are still supporting two exploratory programs in the multi-disciplined mode—a corrosion study at Carnegie-Mellon University and a UV study at NDSU. The corrosion program is designed to learn how little zinc we can get away with on steel and still retain sacrificial protection. The practical objective of the NDSU program is to effect rapid and complete cure of pigmented films by UV radiation.

Tutorial Symposia

We will continue to limit our educational activities to a spring tutorial symposia and to an Annual Meeting seminar. These will serve to expose PRI work to the scientific public and will include a blend of review and current work.

The May 1 and 2 symposia on "Photochemical Processes in Film Curing and Degradation" was held at the Battelle Laboratories in Columbus, Ohio. Over 50 people attended and the meeting was both technically and financially rewarding.

Dr. Myers is preparing an excellent program for the Annual Meeting in Chicago. This one will feature several PRI technical highlights.

PRI Nights

We are continuing to provide material for PRI nights and several Societies have already scheduled round two. The PRI nights are usually presented by a Trustee or a retired Trustee to feature a nontechnical review of current PRI activities. For those Societies desiring an in-depth discussion of any specific topic, individual arrangements can be made as usual with Dr. Myers or with any principal PRI investigator.

PRI's Objectives

Until recently, PRI's official objectives were tied fairly strictly to academic research and to the furtherment of education. The Trustees preferred a less restrictive objective. At the November 18, 1977 meeting, the PRI Trustees adopted the following single objective - "*To advance the knowledge and applications of science to the technology of coatings by supporting research and education.*" This change is subject to approval by the Federation's Board of Directors.

Summary

In conclusion, it is evident that the PRI is meeting critical issues headon. We have established a new format, a new approach to problem solving, and a greater involvement with our membership. We are awaiting the verdict from the paint industry. We are now soliciting funds for general support and separate funds for the mildew consortium. Trustee Jack Lynch is heading our general campaign and former PRI President Milt Glaser will head our special campaign for the consortium. Herb Lowell, our communications consultant, is continuing to support our effort to supply clear and readable reports and Dr. Myers is continuing to provide the scholarship and day-by-day direction so needed by the Institute.

We are all optimistic and we all look foward to a stronger and more effective PRI.

Philip Heiberger
President

During the meeting, the Montreal and C-D-I-C Societies presented contributions of $300 and $250, respectively, to the Paint Research Institute. They were accepted with thanks by Dr. Heiberger.

Committee Reports

BY-LAWS

The proposals to amend the Constitution and By-Laws—as per the Dec. 9, 1977 report of this committee which was distributed on Feb. 10, 1978 and published in the Feb. 1978 JCT—were offered for first reading at the Spring Council Meeting and were approved.

The Philadelphia Society presented a motion (seconded by C-D-I-C) which would have amended proposed By-Laws Article III so as to extend certain election voting rights to only the Society Representative members of the Board of Directors. The motion was defeated.

After minor editorial changes to the Constitution and By-Laws, they were approved for first reading.

The complete proposals to amend the Constitution, By-Laws, and Standing Rules are included elsewhere within this Council Report.

Those to amend the Constitution and By-Laws are now scheduled to be presented for adoption at the Fall Council Meeting in Chicago on October 31, 1978.

If approved at that time, they will become effective following the adjournment of the Council Meeting. The Board of Directors will then take action on the Standing Rules according to the By-Laws, Section X, paragraph B.

Howard Jerome,
Chairman

CORROSION

The Corrosion Committee met at the 1977 Annual Meeting. A report of activities within the committee included a review of projects which are continuing at the Steel Structures Painting Council.

The Federation is sponsoring three projects. This year $3,000 has been allotted for this work at SSPC.

PACE—Performance of Alternate Coating Systems in the Environment

This program is a continuing effort to test all types of generic coatings, basically to get the lead out, but Rule 66, CARB regulations, and water-based systems are a part of this panel test program. Some of these panels have been exposed as long as two years. Salt fog results and other evaluations are expected. Using special instruments it is hoped we might be able to identify polymer or chemical degradation, as well as identify total performance of replacement products for the old standards.

Topcoating Zinc Rich Primers

Performance of topcoats over various zinc rich primers is being evaluated. Considerable lab data have been generated regarding topcoat adhesion with and without a tie coat. Panels have been exposed at various sites. Instrumental examination of the topcoat-primer interface will be studied.

Minimum Film Thickness

This is one of the most extensive studies ever done utilizing multi-panel exposures of various generic coatings over various surface preparations of steel at different film thickness. This was reported in 1968. All panels were removed, however, in 1977 and 30 panels with a 9+ rating were sent back out for continued exposure. A report evaluating the performance of these paints will be issued.

The annual grant of $800 was also made by the Federation to SSPC for 1978.

Dean M. Berger
Chairman

DEFINITIONS

Final proof pages of the "Paint/Coatings Dictionary" were received for proofreading. These were sent to our very critical reviewers with a specified deadline.

Our second section, the Thesaurus, has been completed, proofread, and is ready for publication.

Our comprehensive Bibliography section is almost finished and will be ready by the deadline.

The Preface is being updated and will wind up our work. We are confident that we will have bound copies ready for sale by mid-September.

Stanley LeSota
Chairman

EDUCATIONAL

In January 1978, discussions were held with Drs. Thames, Wildman, and Bufkin at the University of Southern Mississippi, regarding the proposal to develop and administer a Correspondence Course in Coatings Technology for persons who find it impossible to avail themselves of other opportunities to increase their knowledge of coatings. The results of these discussions were presented at the January 1978 meeting of the Federation Board of Directors. The Board directed the committee to review the proposal, clarify the conditions, and submit the results to the May 1978 meeting of the Board.

A meeting of the Steering Committee of the Education Committee was held in St. Louis, March 17, 1978. At this meeting, one of the main topics of discussion was the status of the proposed Correspondence Course. At that time it was decided that:

(1) The course would be a definite benefit to the industry.
(2) An Industrial Advisory Committee should be appointed by the Federation Board of Directors.
(3) We need a more logical explanation of the finances.
(4) Perhaps we should have the option to take parts of the program elsewhere.
(5) We should discuss actual payment and cost recovery schedules.

The requests of the Steering Committee were followed. As late as April 25, Dr. Bufkin was in agreement that one more presentation be made to the Federation Board of Directors. However, on April 27 we were informed that Drs. Thames, Wildman, and Bufkin had reviewed their work load with their Industry Advisory Committee and felt that they must withdraw their proposal. This is the result of increased research and industry-centered projects that have been accepted since the original proposal was submitted. They would like to do the job but, in honesty, cannot see where they will have the time to do it properly, and they do not want to do anything halfway.

The action of the Polymer Science group at USM leaves the Education Committee without contingency plans. We still believe that a good correspondence course would be a real benefit to the Coatings Industry. This is especially true at the present time, when the pressures of new government regulations are causing many changes in a compressed time span. Earlier contacts with coatings oriented universities failed to bring to light any with the capability to develop and administer such a correspondence course. There is an ACS course on Organic Coatings that might be modified or adapted to the needs of the Coatings Industry.

The Education Committee would like some guidance from the Federation Board of Directors. Should we look for a means of providing an adequate correspondence course? Should we contact the ACS to see what we can work out with them on their Organic Coatings Course? Do you have any other suggestions?

Other business from the meeting of the Steering Committee includes:

(1) It was suggested that the Federation consider the updating of the film made in 1964.
(2) Individual Societies are to be encouraged to complete the slide-tape programs they have in progress.
(3) Efforts should be made to tap the talents of retired members.
(4) Existing programs concerning our response or reaction to new restrictive regulations should be expanded and updated.
(5) The Education Committee should accept a part of the 1978 Annual Meeting Program.

Local Societies' Education Committee Chairmen are asked to keep Tom Kocis, FSCT Field Director, posted regarding plans and dates for special symposia, technical meetings, schools, educational offerings, and courses in local schools and universities which would benefit technical people in the Coatings Industry. We hope, by this means, to avoid overlap-

ping of dates, wherever possible, and to allow better promotion and publicity for such offerings. We also want to provide a list of such activities to all FSCT members.

This year the Federation is contributing a total of $12,000 scholarship money to the following schools: North Dakota State University ($4,000); University of Southern Mississippi (4,000); University of Detroit (2,000); Kent State University (1,000); and University of Missouri-Rolla (1,000).

We believe that this scholarship money will come back to the industry in the form of better trained graduates who can help solve the complex new problems facing us. Each local Society can help the program by encouraging students to go to schools with special coatings courses.

One such program that should help is the High School Teachers Night sponsored by the Education Committee of the St. Louis Society. Another is the Science Fair involvement of the Kansas City Society. A project of the FSCT Education Committee is the development of a comprehensive work-study program involving students in Coating Science Courses with actual industry jobs for summers and vacation times. Everyone can help in some way.

JOHN A. GORDON, JR.
Chairman

FINANCE

The Finance Committee met just prior to the Board of Directors Meeting in January. A budget was developed after careful and prolonged consideration of all necessary details. This budget was adopted by the Board.

Two especially difficult items faced the committee: the first was with respect to the effect the funding of the new Dictionary and the Color-matching Aptitude Test would have on presenting a balanced budget. It was the committee's intent to develop a balanced budget, including these major expenditures, without drawing on the Federation's reserve assets. Because of the funds in cash, bank account, and short-term investments (due in large part to the surplus developed in 1977), it was felt that funding of these two items could be handled without borrowing from the Federation's Investment Fund. The budget was presented to the Board in a manner that indicated it would be in balance through the use of cash flow during 1978. The budget has been rewritten in accordance with the Federation's accountant's advice and shows an apparent deficit of $70,300. The Federation has more than this amount in short-term commercial paper. Given the rather skewed income-expense pattern of Federation finances, it was the opinion of Finance Committee that it would be possible to manage in 1978 without drawing on the Investment Fund. It was understood that funding for CAT and the Dictionary could come from the Investment Fund, if necessary, with the proviso that the loan be replaced from the earnings as these items were sold.

The second item of concern was due to the Paint Research Institute budget, as presented, being contingent upon the Board of Directors approving a very major change in the organization of the PRI. Since the Finance Committee could not assume the plan would be approved, it took a conservative view and provided only the funding that appeared necessary to carry out the projects that were presented in the PRI budget. The Board did not approve the PRI organizational change and it appeared evident that further funding would have to be provided, based on continuation of the usual PRI activities. It was decided to adopt the budget with the amount suggested by the Finance Committee for PRI, with the understanding that the PRI would present a revised budget for consideration by the Board at the Spring Council and Board Meetings. Depending on what action is taken by the Board, it may or may not be necessary to utilize some of the Federation's assets to fund operations during 1978.

NEIL ESTRADA
Chairman

ISCC

The Annual Meeting of the Inter-Society Color Council was held April 16-18 in Washington, D.C. Monday's program included meetings of the Problem Subcommittees and, in the evening, five workshop sessions. Subcommittees of interest to the FSCT members include the following problems: 10, Color Aptitude Test; 22, Procedures and Material Standards for Accurate Color Measurement; 25P, Determination of the Strength of Pigments; 27, Indices of Metamerism; 30, Color in the Building Industry; 33, Human Response to Color; 34, Color-Difference Problems; 36, Color Acceptability Standards. Summaries of the activities of each of the Problems Subcommittees will be published in the next issue of the *ISCC Newsletter*. If the work of any Subcommittee is of particular interest to any FSCT member, details of the activities may be obtained from any ISCC Committee member.

Of major importance is the Color-matching Aptitude Test which will be on sale from the Federation Office very soon. New instruction sheets and brochures were written jointly by the ISCC Committee Chairman of the Federation and the Chairman of the ISCC Subcommittee for Problem 10, Ms. Bonnie Swenholt. At the meeting of the Subcommittee held April 15, it was agreed that a questionnaire will be prepared by these same persons for inclusion with the test. The completed questionnaires will be returned to the ISCC Subcommittee for analysis.

On the second day of the annual meeting, a Symposium on Color and Illumination was held. During the luncheon held on the second day, the Macbeth Award was presented to Prof. F. W. Billmeyer, Jr., of Rensselaer Polytechnic Institute.

During both days an interesting art exhibit, "Where Art Meets Science and Technology," was held.

During the ISCC Meeting, the Federation's Delegation to the ISCC (i.e., the Federation's ISCC Committee) met. It was decided the committee would not recommend that the Federation contribute to the Munsell Foundation Fund at this time. The major topic for discussion was a review of SCAI (Symposium on Color and Appearance Instrumentation) held March 14-16 in Cleveland. Everyone reported that all comments received were equally enthusiastic. Of major concern now is the publication of the papers in *JCT*. It was agreed that each moderator would be responsible for contacting the speakers in his or her session. Joyce Davenport kindly consented to write a review for the *ISCC Newsletter* and for *JCT*.

The galley proof for the Federation's Dictionary has been received by the Chairman for proof-reading of the color and optics words. This task will be completed as soon as possible.

RUTH JOHNSTON-FELLER
Chairman

LIAISON

At the Liaison Committee meeting in Houston, it was decided:

(1) To maintain and strengthen our relationships with the working party on "Supported Polymer Films," (SPF), Macromolecular Division, International Union of Pure and Applied Chemistry (IUPAC). A detailed report of

the SPF/IUPAC work and the history of this group was published in the January 1978 JOURNAL OF COATINGS TECHNOLOGY.

(2) To express our interest in positive international action in cooperation with the International Activities Committee of The American Chemical Society. This decision was in response to Howard Gerhart's inquiry on the matter. Dr. Gerhart was a member of the IAC/ACS delegation to Cairo, Egypt. Regarding the activities of IAC/ACS, the April 10 *C & E News* reported that

"One area in which staff responsibilities have been expanded is that of international affairs which worked on a number of projects under the guidance of the joint board-council Committee on International Activities chaired by past-president Glenn T. Seaborg. One such project was the workshop held in Cairo in December, at which 20 U.S. chemists discussed possible cooperative research projects with 200 Egyptian research institute chemists, industrial organization managers, government officials, and university professors. Two dozen programs were selected, and at year's end proposals were being prepared for submission to U.S. government funding agencies to secure support.

"Meanwhile, discussions were started with leading chemists and government officials abroad and with U.S. agency officials looking toward initiation of similar exchange projects elsewhere in both developed and developing countries.

"Another event of international import was a reception and luncheon at ACS headquarters in April for an 11-member delegation of chemists from the People's Republic of China—"

(3) That future contacts with FATIPEC and other foreign technical societies would be only through the Federation President or someone he might delegate for a specific assignment.

(4) That the Liaison, Program (and Publication) committees would, in the future, be the judges of the acceptability of foreign papers for presentation at the Annual Meeting and subsequent publication in the *JCT*. These papers should be solicited by the Federation President no later than December of the prior year, with such foreign papers being due by June 1.

(5) That future invitations for Federation participation in foreign meetings must be approved by the Federation Board of Directors before Federation committees, etc., could actively participate.

(6) At Federation Annual Meetings, a "Reception for Overseas Visitors" will be a Liaison Committee responsibility, to be carried out in consultation with the Federation officers.

(7) The 1978 meeting of FATIPEC will be held in Budapest, Hungary from June 4-9. Percy Pierce, of the Pittsburgh Society, will deliver a plenary lecture on "The Kinetics and Mechanism of Film Growth During Electrodeposition Process." Drs. Gerhart, Gott and Prieve will lecture on "Chemiphoresis," and Dr. Wu, of Philadelphia, will also deliver a lecture from the U.S.A. Other U.S. people planning to attend from the Liaison Committee are Messrs. Beckwith, Daniel, Gerhart, and Harris. President Oates and Executive Vice-President Borrelle also plan to represent the Federation.

(8) While in Europe, Messrs. Oates and Borrelle also plan to attend the Annual Business Meeting of the Oil and Colour Chemists Association and meet with the Birmingham Club.

M.A. GLASER
Chairman

MEMBERSHIP

A realistic look at the membership figures of the Constituent Societies based on the 1976-1977-1978 *Year Books* brings to light several important facts:

(1) With the exclusion of the recent addition of the Mexican Society, there has been no increase (0.2%) in the number of Active members in the Federation.
(2) By contrast the ranks of Associate members has been showing an annual growth of 10% for the last four years.
(3) Fortunately the decrease in some of the larger Societies, e.g., Chicago, New England, and Philadelphia, has been counterbalanced by the good increase in Los Angeles, Northwestern, Rocky Mountain, and Southern Societies.

It has long been the contention of this committee, and graphically depicted in a past letter to Society Membership Chairmen, that there is an important interrelationship between program, attendance, and membership. The recent appointment of an ad hoc committee by the Federation Executive to study the matter of programs of the Societies would seem to lend weight to this concept and its findings are eagerly awaited by the Membership Committee.

In addition to the geographical segregation of non-member registrants of the Annual Meetings by Federation staff and mailing same to respective Society Membership Chairmen for follow-up, this committee is also continuing to look into registrations of local symposia and paint technology courses for prospective members and credit here is due to Messrs. Kenney, Keene, and Probst.

To facilitate the processing of membership applications, the Executive Vice-President revised the present form for ease of legibility.

It now remains for the local Societies to develop new sources from the *users* of coatings such as highway commissions, utility firms, railways, engineering design companies, and pipeline operators, to name a few.

Finally, thanks to the Los Angeles (10%), Northwestern (11%), Rocky Mountain (20%), and Southern (5%) Societies for their membership increases and the Federation staff for their prompt and precise assistance.

HORACE S. PHILIPP
Chairman

METRIC SYSTEMS

A good deal of the work that this committee can do has already been done in previous years. Our activity was, therefore, somewhat less than accomplished previously. A survey of several Societies is being carried out to determine the degree of metric awareness and conversion preparedness. Not all the results are in yet. When they are, they will be reported in *JCT*. Contributions to *JCT's* Metric Corner have been continued. The Chairman gave a talk on metric conversion to the New England Society in January.

Liaison with NPCA's Metric Task Force and with CPMA's Metric Committee, as well as with the Canadian Metric Commission's Sector Committee 3:08, have been continued.

E.L. HUMBURGER
Chairman

NOMINATING

Because of the proposals to reorganize the Federation, the Nominating Committee is required to present two slates of candidates for 1978-79. One applies to the present organization; the other to the restructured Federation, final action for which will be taken at the Fall Council Meeting, October 31, in Chicago.

For purposes of information and clarification, this report will define the composition of the present Board of Directors and the proposed new Board of Directors and Executive Committee.

PRESENT ORGANIZATION

[*The present Board of Directors is composed of: three officers; three Society Representatives; six members-at-large; the immediate Past-President; two other Past-Presidents; and the President of the Paint Research Institute.*]

- For President-Elect: Harry Poth, of C-D-I-C Society (Dean & Barry Co.)

- For Treasurer: William H. Ellis, of Los Angeles Society (Chevron Research Co.).

- For Board of Directors (members-at-large); Four nominees for two 3-year terms: (1) John C. Ballard, of Louisville Society (Kurfees Coatings, Inc.); (2) John J. Kenney, of Southern Society (Reliance Universal, Inc.); (3) Thomas J. Miranda, of Chicago Society (Whirlpool Corp.); (4) Kurt F. Weitz, of Toronto Society (Indusmin Ltd.).

The appointment of one Society Representative, one Past-President, and the President of PRI will be announced at the October 31 meeting, if the restructuring is not approved.

The remaining members of the current Board of Directors are serving continuing terms of office.

PROPOSED NEW ORGANIZATION
BOARD OF DIRECTORS

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

- For President-Elect: Harry Poth.

- For Treasurer: William H. Ellis.

- For Board of Directors (members-at-large): Four nominees for two 2-year terms: (1) John C. Ballard; (2) John J. Kenney; (3) Thomas J. Miranda; (4) Kurt F. Weitz.

- For Past-President Member: Neil S. Estrada, of Golden Gate Society (Reichhold Chemicals, Inc.)

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

EXECUTIVE COMMITTEE

[*The proposed new Executive Committee will be 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: (1) Howard Jerome, of St. Louis Society (Vane Calvert Paint Co.); (2) A. Gordon Rook, of Golden Gate Society (Napko Corp.).

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

NEIL S. ESTRADA
Chairman

PROGRAM

Plans for the Annual Meeting Program are moving along in an orderly fashion. The theme is "Coatings—The Search For Opportunities."

The Program Committee believes that ours is a viable industry with a strong future and that we should accentuate the positive. We plan to show that new opportunities do exist. Theme presentations include the following:

- Air Force coatings developments and needs.
- Barrier coatings in house insulation—NBS.
- Solar collector coatings.
- Fire retardant coatings opportunities.
- A presentation by PDCA on painting contractors likes and dislikes in coatings and a prediction of future coatings requirements.
- Low cost cementitious-latex thick coatings having good durability.

The Manufacturing Committee will present a program on Liquid Waste Disposal. The Technical Information Systems and the Educational Committees will also make presentations.

General interest, Roon, and Society papers will round out the program which will also include a legislative update, raw material forecast, overseas papers, an industrial hygienist, and the Mattiello Lecture.

The earlier opening session was very successful last year and this time schedule is being repeated with the opening session beginning on Wednesday, November 1, at 10:30 a.m.

For the technical session on Friday afternoon, we are scheduling only one session instead of the usual concurrent programs. Although it has not been firmed-up, the subject will probably be "Low Energy Coatings."

FRED G. SCHWAB
Chairman

PROGRAM AWARDS

The committee is looking forward to its next activity at the Annual Meeting in Chicago.

Committee members are: Bill Ellis, of Los Angeles; John Gordon, of Los Angeles; Robert F. Hall, of Southern; Elmer Moerschel, of CDIC; Derick Pawsey, of Pacific N.W.; and A. Gordon Rook, of Golden Gate.

LOWELL CUMMINGS
Chairman

PUBLICATIONS

The memberships of the Publications Committee and the Editorial Review Board have been reviewed and necessary changes and additions made.

New Federation Series Booklets are being prepared and an effort is underway to upgrade and reissue those of earlier vintage. Manuscript supply is adequate but we have had some difficulty approving Society papers. Recommendations have been made to Society Technical Committees for improvement.

We are continuing to monitor meetings and symposia to seek out quality papers for the JCT. We have been able to

speed up the reviewing process so that a reasonable turnaround can be achieved. We have also expanded our book reviews and plan to continue this service.

THOMAS J. MIRANDA
Chairman

ROON AWARDS

The preliminary notifications indicate that nine papers are being prepared for this year's Roon Awards competition. Seven of the papers are from industry sources, and two from universities.

Although this is below the response at this time last year, all nine notifications look like good solid candidates. This indicates that the probability of having four quality award papers is very good. The Program Chairman will be informed of the number of presentation quality papers as soon as practicable.

BILL SHACKELFORD
Chairman

TECHNICAL ADVISORY

I think it is appropriate to begin this report with a quotation excerpted from the April 1978 ASTM *Standardization News*, an issue devoted to "A Look at Paint and Coatings:"

"[Committee] D-1, one of the more prolific developers of ASTM standards [on Paint and Related Coatings and Materials], in recent years has begun to suffer more frequently from a malady that afflicts many of today's organizations, that of maintaining a continuing supply of eager and conscientious active contributors of time and thought to its increasing agenda of problems. These problems are growing in complexity and require a greater sophistication and scientific intensity in the search for solutions . . ."

This is part of a statement by Harold M. Werner, Chairman of Subcommittee D01.08, the Federation-ASTM Joint Committee and D01.96, the ASTM Long-Range Planning Committee, in his introduction to a comprehensive review of the D-1 Committee's projects. Echoes of this combined challenge and depressing assessment can be found in the journals and proceedings of almost every voluntary professional organization in America.

Nearly three years ago—it's hard to believe that it was that long ago!—a letter that I wrote to the Federation's Technical Advisory Committee was printed as an editorial in the JOURNAL OF PAINT TECHNOLOGY (August 1975). It commented on the same apparent ebb in the willingness of individuals to devote time and effort to Technical Committee projects, and reflected on the possibility that some employers might be giving *negative* encouragement for this work.

In September 1976, we held the first national convocation of Society Technical Committee Chairmen, with 21 Societies represented. The reaction to this first get-acquainted meeting, was so good, and the organizational ideas and enthusiasm that were generated were so stimulating, that a second national meeting was scheduled for the following year.

The second meeting, on June 10, 1977, was attended by Technical Committee Chairmen or alternates from 17 Societies. A comprehensive project inventory, which was later published in the January 1978 issue of *JCT*, showed that these 17 Societies alone had 35 nominally active technical projects, with 15 more under serious consideration, for a total of 50 projects under way, or in the planning stages. After my previous concern about whether there was enough interest among the Societies in the Technical Committee program in general, my conclusion was that it would be grossly premature to declare this "patient" dead!

But existence of projects, however worthy they are, does not necessarily mean that those projects are being pursued vigorously and purposefully. We are still confronted with the fact that we have had a series of increasingly lean years, with a scarcity of papers that should have been available to enrich the technical program of the Federation's Annual Meetings and the pages of the *JCT*.

I am indebted to Dr. John C. Weaver who, in a talk that he gave recently at a Cleveland Society symposium, presented a count of Society technical papers that were presented year by year from 1927 through 1957 in the Federation's journal. Since Dr. Weaver intends to publish this information in a paper he is preparing for *JCT*, I will not anticipate it, but merely present the summary observation that the number of papers per year describe a steeply descending curve.

This phenomenon represents one facet of a broad social problem—a problem that does not affect the Federation alone. The fact is that our socio-economic climate has changed greatly in a number of significant respects; along with those changes have come changes in people's life styles, motivation, and values.

The American Chemical Society's scholarly publications are sometimes cited as a conspicuous exception to the trend toward a diminishing number of papers in technical societies like the Federation. There is a simple explanation for this: A very large percentage of members of ACS and similar organizations are academic people who work in an environment where "publish or perish" is a by-word. Promotions, salary increases, and the achievement of tenure are all tied to a publication record, so the high incidence of publication is not all due to dedication to the principle of science for the sake of science. This point will be relevant to my later discussion of external motivating factors.

During the same period in which Technical Committee activity, one of the key indicators and generators of the Federation's vitality, has lagged, the NPCA has launched a considerable number of both adhoc and permanent committees and task forces, some of them dealing with subjects of substantial technical complexity. Those groups have worked hard, and for the most part have produced very useful results, generally well on schedule.

I have served on several of these committees or task groups, and have invariably found myself working with other participants who are also members of the Federation. Wouldn't I be obtuse if I didn't stop to think: What goes on here? How does it happen that so many of the hardworking committees and task groups of the NPCA, staffed with many members of the Federation, are productive, at the same time that much of the Federation's important technical work that depends upon volunteer participants, remains undone?

The answer is simple: It was evident to me that there was hardly a single rank and file member of the Federation whom I encountered on an NPCA committee who wasn't there either by direct assignment by his company or with his company's explicit approval. These people find the time to do what they had committed themselves to do because they know that their companies expressly or tacitly approve their doing so. Does this mean that these committees are staffed with servile followers of orders? Not at all! When competent, mature, and responsibile people get involved in a project whose objectives are clearly important to their industry, their own professional pride as well as their sense of duty to their industry impels them to contribute to the best of their ability.

There are of course, many people—long may they flourish!—whose inner sense of professionalism, pride, and duty is so strong that they need no external incentives or subtle pressures to turn them on. Unfortunately, these noble instincts, like pure amateurism in athletics, are becoming

submerged in the social currents that I mentioned previously.

I had these thoughts in mind when I wrote the Technical Advisory Committee report which was printed in last January's *JCT*. Commenting on the frustrations that the Society Technical Committee Chairmen had expressed about the difficulty of obtaining sufficient numbers of volunteer workers and project leaders, I reported factually that it was the sense of the meeting that "*active cooperation from company management* could have a powerful stimulative effect." I added that aside from payment of the modest expenses involved in attendance at committee meetings, management people, by making it known that they would be pleased if their technical employees did their bit to advance the state of the art in non-competitive projects of value to the industry, could help both the industry and the personal development of their own people. I concluded with the mildely-phrased suggestion that achievement of these desirable objectives may require a carefully considered, formal presentation to industry management through the Board of Directors of NPCA. I also asked if some volunteers would be willing to help in this task.

There were no volunteers.

My proposal was not a slam-bang, rousing call to action, for a very simple reason: in my heart, I was very doubtful of how successful it might be.

In my judgment, the wisdom of the aphorism "God helps those who help themselves" is matched by the statement that "Nothing succeeds like success." I felt that an approach to the NPCA's Board of Directors would have to backed by a detailed record of impressive achievements by Society Technical Committees, that have benefited the industry both in specific instances and in the broadest sense—achievements that could have been multiplied by the participation of larger numbers of dedicated cooperators.

If my call for volunteers escaped the notice of those who read committee reports in the *JCT*, my suggestion that we reach out for active cooperation from management did not escape the eagle-eyed attention of my respected old friend and colleague from the New York Society, Herbert E. Hillman, who responded with a letter to the Editor in the March 1978 *JCT*.

In brief, Herb disagrees with the assumption that "active cooperation from company management could have a powerful stimulative effect." In support of his viewpoint, he cites his own many years of involvement with Technical Committees, when he observed that "sustained and meaningful participation in such activity results from unselfish self-motivation of the individual member." He recalls the "happier days past" when an elite group of members of the New York Society would gather at meetings at least four evenings a month.

I know exactly what he is talking about, because he and I, and others, reached their professional maturity in the New York Society in those same years, give or take a few. There was, indeed, a sense of dedication and camaraderie, an *esprit de corps* and a record of achievement that led many to mutter about breaking up the New York Society, just as others were muttering about breaking up the old New York Yankees.

Alas, now after two or three wars, the nuclear revolution and the computer revolution, we have also experienced a peaceful but profound and pervasive social revolution. The "happier days past" are gone, and we will never see their like again, barring a catastrophic depression—which Heaven forbid! We live in a new era, where people *do* have to be motivated. In business, in the professions and in the conduct of organizations like the Federation, indulgence in nostalgic sentiment must be reserved for ceremonial occasions, while recognition of the conditions that prevail must govern the activities of today and plans for the future.

After these remarks, what an anti-climax it is for me to say that I feel I lack the wisdom to present an all-inclusive formula for revitalizing the Federation's Technical Committee activity! I feel no sense of embarrassment about this, however, because I know you are all too sophisticated not to realize how difficult the problem is. I am strongly encouraged by these consoling thoughts:

The younger people in our Federation, men, and now bright young women entering a formerly all-male domain, are better educated, better equipped by training to learn fast, to probe deeply, than any who came into this industry in the past. Their more thorough schooling in basic science and their exposure to the principles and practice of computer science should enable them to help the coatings industry reach new heights of achievement. They have the ability also to raise this Federation to new levels of eminence among professional societies.

To get to these younger people, we have to plot, not preach. We have to avoid feeling sorry for ourselves in our frustrations. We have to study what other organizations—including our blood brother, the National Paint & Coatings Association—are doing to draw new people into their programs, and motivate them to do the work that needs to be done at a time when our industry faces the greatest challenges in its history.

I have come to the conclusion that the best approach to our technical activities problem is by a program of intensive, cooperative interaction with individual Societies. A review of the 35-project so-called active list, combined with consultation with the individual Societies, will easily establish which of the "active" projects are "for real." At the risk of displaying a degree of technical philistinism, I would suggest that we pinpoint projects such as the listed Los Angeles project on Waste Water Treatment, as deserving of the most immediate and most active Federation and Technical Advisory Committee support. Success in this type of project can earn us broader industry support than we have enjoyed in a long time.

Although I have not reached a firm conclusion on the matter, I have been wondering if Federation funds could be used more fruitfully in the next year, on visits by a few advisers to individual Society Technical Committees than by another all-Society convocation of chairmen. It would be a difficult choice, because I have so much enjoyed meeting with this fine group of men, but the availability of funds does have to be considered.

It must be evident that I have been groping for a philosophical re-orientation to the Technical Committee problem, not just another try at doing things a certain way because that's the way we've always done it. We don't develop innovative new paint formulations in this way, so why should we keep trying to cope with organizational problems by tunnel thinking?

I hope that these thoughts will stimulate and, yes, even irritate, because anything that breaks the barrier of inertia can't be all wrong. I know that we are sitting on a treasure of talent in the Federation, and I have the confidence that we can tap it, if we find the right combination.

SID LAUREN
Chairman

TECHNICAL INFORMATION SYSTEMS

As a result of the dedicated efforts of committee members, "Technical Articles in Other Publications" has been a regular feature in the JOURNAL OF COATINGS TECHNOLOGY for five years. Published first in July 1973 as "Current Contents" and under its present title since August of that year, the *JCT*

department is a compilation of the contents of leading technical coatings periodicals.

This committee's proposal to prepare, for the first time, a Keyword Subject Indèx to *JCT* (as detailed in the Spring and Fall 1977 Council Reports) was approved. The completed index was published in the December 1977 *JCT*. The committee will prepare the Keyword Subject Index for 1978.

In order to aid the *JCT* readers residing outside the United States, the committee has suggested that each issue of the *JCT* carry the usual English Table of Contents *plus* Tables of Contents (but *not* abstracts) in French, German, and Spanish.

However, since committee members are not fluent enough in these languages to furnish grammatical and idiomatic translations, Society Council Representatives have been asked to help in locating Federation members fluent in these languages to serve as volunteer translators for this project.

The Annual Meeting Program Committee has allotted time for a Workshop on Technical Information Services, sponsored by this committee, to be held in Chicago.

HELEN SKOWRONSKA
Chairman

DELEGATE TO NACE

This delegate attended the 1978 Annual Conference and Materials Performance and Corrosion Show, sponsored by the National Association of Corrosion Engineers, March 6-10 in Houston, Tex.

The Show featured a number of exhibits with displays relating to coatings and linings, including: various coatings systems; zinc-rich primers; heavy-duty epoxy flooring and lining materials; instrumentation for inspecting and testing coatings, as well as for measuring film thickness; organic preservatives; and blast cleaning devices.

COMMITTEE WORK

Committee T-6 Protective Coatings and Linings as usual provided a very active schedule. Considerable work has been generated by this committee and of particular interest is a collation of all T6 documents now available from NACE in one volume.

T6A and T6A-29 has published in *Materials Protection* (Jan. 1978), RP-01-78, Design Fabrication, and Surface Finish of Metal Tanks and Vessels to be Lined for Chemical Immersion Service. This excellent document is the result of over eight years of work. T6A also has a number of documents currently being written and are up for committee review.

T6A-30 Monolithic Organic Corrosion Resistant Floor Surfacings was published in *Materials Performance* (Oct. 1976) as RP-03-76.

T-6A-31 Reinforced Thermosetting Linings for Industrial Equipment is now in Draft 5.

T6A-36 Theoretical Calculation of Coverage Rates is in committee ballot.

T6A-37 Electrical Inspection of Linings (5 to 60 mils) is still in rough draft within committee. Questionnaires were sent out to many users last year.

T6A-38 Repair and Maintenance of Coating Systems, new draft required.

T6A-39 Coatings in Conjunction with Cathodic Protection. Revision of 1971 report will be undertaken.

T6A-40 Determination of Water Extractable Substances from Organic Coatings. Procedures have been obtained and the draft is in committee review.

One of the outstanding new series of evaluations was provided by T6G-14. Jerry Byrd presented the paper on "Surface Preparation by Wet Sandblasting Using Either Fresh or Sea Water and the Compatability of Inorganic Zinc Rich Primers." All the data represented salt fog testing of various water-sand blasted steel panels using either synthetic sea water or fresh water mixed with a biodegradable polyphosphate rust inhibitor.

For the most part the water-based zincs outperformed the solvent-based inorganic zinc rich primers depending on whether the zinc rich primer was applied over flash rusting, or if sea water was used rather than fresh water, or if the steel surface was allowed to dry prior to coating with the primer. The biodegradable polyphosphate rust inhibitors were selected because the chromates, nitrates or others are water toxic substances. The polyphosphate inhibitors were injected into the blast stream at about 50 ppm. Good surface cleaning was obtained to near white blast cleaning standard. After 5,000 hours, salt fog testing over 100 panels were evaluated.

T6 sponsored a symposium on Protective Coatings and Linings. Walt Pregman, of du Pont, described the uses of high and low solids catalyst cured aliphatic isocyanate polyurethanes. These have shown a particular degree of high performance when used as a topcoat over an inorganic zinc rich primer and an epoxy intermediate coat. Excellent color and gloss retention is obtained in addition to equivalent chemical resistance of an epoxy polymeric system.

T. L. Nemeth, of Flexi-Liner Corp., provided a considerable amount of information on "Nonbonded Tank Liners". This system has grown in popularity particularly in Europe. In rejuvenated old concrete tanks it is particularly effective. Vinyls are the most popular sheeting material, ranging from 10 to 125 mils. Mr. Nemeth provided a considerable amount of background information on polymeric lining materials.

Compounded blends of polyethylene or modified vinylesters are used. Chloropolyethylene has a mechanical limitation. Chlorosulfonated polyethylene (hypalon) has the best resistance with wider flexibility. Polyurethanes are good for resistance to organic compounds.

Rubber materials have mechanical limitations. EPDM rubber is the best. Teflon cannot be formulated to meet flexibility requirements. The linings are installed using a sleeve and tube method using a stainless steel lock, various braces and a handle bar. A 4" to 6" wide overlap is used along with high frequency dielectric heat welding to seal all seams. There are eight fabricators in the United States.

T6H-15 reported on their over 2000 panel evaluation of coatings over various degrees of blast cleaned surfaces which have been exposed at six different sites. The most corrosive site was at Kure Beach followed closely by PPG at Barberton, Ohio. Ratings continued to show poorer performance of shot or grit blasted steel vs. sandblasted steel. An attempt will be made to run back scatter emission spectroscopy, Scanning Electron Microscopy and Infrared to determine polymer degradation as well as interface contamination. An up-to-date report ($15) is available from NACE, Katy, Tex.

T6Q Committee on Inspection and Quality Assurance outlined an ambitious program. This year NACE will jointly sponsor two educational Coatings Corrosion Courses (Course 5) with the Institute of Applied Technology. These are scheduled for fall 1978.

T6H-30 Urethane Topcoats for Atmospheric Service will concern itself with ASTM Type II and Type V coatings for protection of steel structures. A separate committee was formed for urethane coatings applied over polyurethane foams.

All the meetings were informative. Attendance seemed to be lower than normal.

DEAN BERGER
Delegate

DELEGATE TO NATIONAL FIRE PROTECTION ASSOCIATION

The former Federation representative to the NFPA was a major contributor to the 1976 Edition of the "Standard for the Manufacture of Organic Coatings," approved and published in 1976. Mr. Haviland has now retired and is no longer an active member of this group.

There were no formal meetings of the NFPA Sectional Committee on Coatings Manufacture held in the past year, but contacts have been maintained with the Chairman of the committee in order that representation of the paint industry will not be lost on future revisions and that avenues of communication will be kept open to express our needs.

HOWARD J. HORTON
Delegate

DELEGATE TO NPCA AND GOVERNMENTAL AGENCIES (ENVIRONMENTAL CONTROL)

The following is a report of my activities as Delegate to the NPCA and Governmental Agencies (Environmental Control) since November 1977.

(1) Represented the Federation at meetings of the NPCA Air Quality Task Force in November 1977 and April 1978.
(2) Represented the Federation and gave a talk on Air Pollution Controls to the Mexican Society in January 1978.
(3) Gave a talk on the application of pollution control measures in the paint industry to the Paint Technology Course at the University of Missouri-Rolla in March 1978.
(4) Maintain ongoing communication with the EPA regarding hydrocarbon emission control regulations.

GABRIEL MALKIN
Delegate

New Business

James Bohlen moved that the Executive Committee be requested to add a statement to the proposed new Standing Rules which would indicate that meetings of the Board of Directors are open meetings. Seconded by John A.J. Filchak and carried.

S. Leonard Davidson moved that the Board of Directors be requested to add a provision to the proposed new Standing Rules that would invite officers of the National Paint and Coatings Association, Canadian Paint and Coatings Association, Mexican Association of Paint and Ink Manufacturers, etc., to meetings of the Board of Directors. Seconded by A. Gordon Rook and carried.

The next Council Meeting will be held on Tuesday, October 31, 1978, at the Conrad Hilton Hotel in Chicago.

Federation of Societies For Coatings Technology

REORGANIZATION OF FEDERATION

REPORT OF BY-LAWS COMMITTEE

(May 19, 1978)

These proposals to amend the Constitution and By-Laws were approved for first reading at the Spring Council Meeting in Kansas City on May 19, 1978.

They will be presented for adoption at the Fall Council Meeting in Chicago on October 31, 1978.

If approved at that time, they will become effective following the adjournment of the Council Meeting. The Board of Directors will then take action on the Standing Rules according to the By-Laws, Section X, paragraph B.

CONSTITUTION

ARTICLE I

Name

The name of the organization shall be the Federation of Societies for Coatings Technology.

ARTICLE II

Objectives

The Federation shall operate solely and exclusively as a non-profit organization with the following objectives:

A. To develop or provide scientific, engineering and technical data, facts and standards, and to promote research and the application of the sciences to further the development, manufacture, and use of paints, varnishes, lacquers, related protective and decorative coatings, printing inks and other related products, and the raw materials necessary for these products.

B. To promote educational activities and the interchange of ideas among its members and the public generally.

C. To arrange for the collection and dissemination of information pertinent to the industries served by the Federation, and for the presentation, discussion, and publication of papers and other contributions.

D. To encourage the establishment of Constituent Societies and to coordinate their activities with those of the Federation.

E. To promote the improvement of products, the elimination of wasteful methods of manufacture, and foster manufacturing procedures and practices that minimize pollution of the environment as a service to the industry and the public as a whole.

F. To cooperate with other organizations, public and private, to accomplish these objectives.

ARTICLE III

Limitation on Activities

No part of the net earnings of the Federation shall inure to the benefit of, or be distributable to, its members, Directors, Officers, or other private persons, except that the Federation shall be authorized and empowered to pay reasonable compensation for services rendered, and to make payments and distributions in furtherance of the purposes set forth in Article II hereof. No substantial part of the activities of the Federation shall be the carrying on of propaganda, or otherwise attempting to influence legislation, and the Federation shall not participate in, or intervene in, including the publishing or distribution of statements, any political campaign on behalf of any candidate for public office. Notwithstanding any provision of these articles, the Federation

shall not carry on any activities not permitted to be carried on by an organization exempt from Federal income tax under 501 (c) (6) of the Internal Revenue Code of 1954, or the corresponding provision of any United States Internal Revenue Law.

ARTICLE IV

Membership

All conditions, qualifications, requirements, privileges, and regulations as to membership in the Federation shall be fixed and governed by the By-Laws of the Federation, to the extent that the By-Laws are not inconsistent with the objectives stated herein.

ARTICLE V

Management

The activities and affairs of the Federation shall be managed as provided in the By-Laws of the Federation to the extent that the By-Laws are not inconsistent with the objectives stated herein.

ARTICLE VI

Dissolution

In the event of the partial or entire liquidation or dissolution of the Federation, whether voluntary, involuntary, or by operation of law, the Board of Directors of the Federation shall, after paying or making provision for the payment of all the liabilities of the Federation, distribute the assets of the Federation to one or more organizations exempt from taxation under Section 501 (c) (6) of the Internal Revenue Code of 1954 or the corresponding provision of any future United States Internal Revenue Law, as they in their sole discretion shall determine. Any of such assets not so distributed shall be distributed by the appropriate court of the county in which the principal office of the Federation is then located, exclusively to such exempt organization or organizations, as said court shall determine.

ARTICLE VII

Incorporation

All of the assets of the Federation may be transferred to a nonprofit corporation in compliance with Article VI of the Constitution of the Federation by a three-fourths vote of the entire membership of the Board of Directors, provided however, that said corporation shall simultaneously assume all of the liabilities of the Federation and at least ninety days notice of such a proposal shall have been given before the meeting by publication in the *Journal of Coatings Technology* and by direct mailing to the President and Secretary of each Constituent Society and the entire membership of the Board.

ARTICLE VIII

Amendments

This Constitution may be altered, amended or repealed by a three-fourths vote of the entire membership of the Board of Directors. This action must be taken at two successive regular or special meetings of the Board. At least ninety days notice of such a proposal shall have been given before each such meeting by publication in the *Journal of Coatings Technology* and by direct mailing to the President and Secretary of each Constituent Society and the entire membership of the Board. The procedure for originating, processing, and considering amendments to this Constitution shall be identical in every respect as prescribed in the By-Laws for amendment to the By-Laws.

BY-LAWS

ARTICLE I

Membership

A. CLASSES OF MEMBERSHIP

(1) Any individual holding membership in any of the following classes of membership in a Constituent Society shall hold a like class of membership in the Federation:

a. *Active Membership.*
b. *Associate Membership.*
c. *Educator and Student Membership.*
d. *Retired Membership.*

(2) *Society Honorary Membership:* Any individual holding Society Honorary Membership in a Constituent Society, shall hold Society Honorary Membership in the Federation.

(3) *Federation Honorary Membership:* Anyone who is not an Active or Educator Member of a Constituent Society, but who, as a former Active or Educator Member of a Constituent Society, rendered signal service to the Federation or the industries served by the Federation in such manner as to aid the accomplishment of the Objectives of the Federation, may be eligible for Federation Honorary Membership. Federation Honorary Members shall be elected by the Board of Directors and shall be entitled to receive all Federation publications regularly circulated to Active Members.

(4) *Affiliated Membership:* Anyone who is eligible for Active, Associate, Educator and Student, or Retired Membership in a Constituent Society, but whose employment or residence is not within the boundaries of any Constituent Society, may be eligible for Affiliated Membership in the Federation of the appropriate class. The Executive Vice-President of the Federation shall determine eligibility for and grant Affiliated Membership with the advice of the Federation Membership Committee.

B. TERMINATION OF MEMBERSHIP

Except as otherwise provided by these By-Laws or the Standing Rules of the Federation, membership in the Federation shall terminate automatically for any individual who is no longer a member of a Constituent Society, or who ceases to be eligible for his class of membership, or for whom dues have not been paid in accordance with these By-Laws.

ARTICLE II

Constituent Societies

A. DEFINITION

A Constituent Society of the Federation is a group of individuals formally organized to pursue objectives consistent with those of the Federation, and which has been admitted to the status of a Constituent Society of the Federation in accordance with the By-Laws and Standing Rules of the Federation.

B. MANAGEMENT OF INTERNAL AFFAIRS

(1) Subject to these By-Laws and the Standing Rules of the Federation, each Constituent Society shall have entire control of its own internal affairs. Each Constituent Society shall operate in accordance with the laws of the jurisdictions within its territorial boundaries and the Federation shall take no action which shall cause any Constituent Society to violate these laws.

(2) It shall be the duty of each Constituent Society to furnish promptly to the Editor of the *Journal of Coatings Technology* for publication, reports or the minutes of each meeting, copies or reports of all technical papers presented, and a resume of practical or technical discussions held.

C. MUTUAL INTEREST

(1) No Constituent Society shall independently take final action upon matters involving the interests or policies of the industry as a whole. Such matters, with the recommendation of the Constituent Society, shall be referred by the Constituent Society to the Federation Board of Directors.

(2) All contemplated action by Constituent Societies with regard to specifications shall be referred to the appropriate committee of the Federation.

D. CLASSES OF MEMBERSHIP IN CONSTITUENT SOCIETIES

(1) *Active Membership:* Any individual engaged in research, engineering, technical development, quality control or supervisory production work for the manufacture, use or improvement of the finished products or the raw materials of the protective or decorative coatings and printing ink industries, is eligible for Active Membership. This provision may not be interpreted so as to admit, for the first time to Active Membership, any individual who is principally engaged in sales or other non-technical work. Any individual who, however, has been an Active Member for at least five years, and is engaged in work related to the coatings and ink industries, is now and in the future to be considered eligible for Active Membership.

(2) *Associate Membership:* Any individual not eligible for Active Membership, but who is intimately interested in and associated with the protective and decorative coatings and printing ink industries, is eligible for Associate Membership, provided that the Constituent Society has established such class of Associate Membership, and that all such Associate Members shall be subject to all specific rules and restrictions regulating the activities and responsibilities of the Associate Member which the Constituent Society may adopt.

(3) *Educator and Student Membership:* Any individual who is a college or high school educator, or who is a student registered in any educational institution of recognized standing in a course of study in chemistry,

engineering, physics or other related sciences leading to a degree, shall be eligible for Educator and Student Membership, but such membership shall terminate three months after the individual ceases to qualify. The rights and privileges of Educator and Student Members shall be determined by the Board of Directors.

(4) *Retired Membership:* Any Active, Associate or Educator Member shall be eligible for Retired Membership when he has severed his connection with his employer by nature of retirement due to age, disability or for reasons deemed suitable by the Constituent Society, and is no longer considered a permanent employee in the protective and decorative coatings and printing ink industries.

(5) *Society Honorary Membership:* Any Active, Associate, Educator, or Retired Member who has rendered signal service to the Constituent Society shall be eligible for Society Honorary Membership in any Constituent Society desiring to recognize such signal service.

E. PROCEDURAL MATTERS

The organizing of Constituent Societies, Constituent Society boundaries, and election to membership in Constituent Societies are subject to the provisions of the Standing Rules of the Federation.

ARTICLE III

Organization

A. GENERAL POLICIES AND ADMINISTRATION

The establishment and execution of general policies and the administration of the Federation shall be vested in the Executive Committee and the President.

B. BOARD OF DIRECTORS

The Board of Directors shall consist of the President, President-Elect, Treasurer, four members-at-large, the Immediate Past-President or most recent available Past-President, two additional Past-Presidents, and all of the Society Representatives. Active membership shall be required for all members of the Board of Directors, except that the Past-President members may hold any class of membership in the Federation.

(1) The duties of the Board shall be to:

a. Establish broad lines of Federation policy and make recommendations regarding the administration of the Federation.

b. Elect officers of the Federation.

c. Elect the three Society Representative members of the Executive Committee.

d. Elect the four at-large members of the Board of Directors.

e. Elect the Past-President members of the Board of Directors, except the Immediate Past-President.

f. Fill vacancies occurring among the elected officers, the Past-Presidents, members-at-large of the Board of Directors, and Society Representatives on the Executive Committee.

g. Vote on petitions for new Society charters and changes in Society boundaries.

h. Vote on proposals to amend the Constitution, By-Laws, and Standing Rules.

i. Elect Federation Honorary Members.

j. Hold at least two meetings each year, normally during the second and fourth quarters, and such special meetings as may be called by the President.

k. Approve the site of each Federation Annual Meeting and Paint Industries' Show.

l. Approve or disapprove all action taken by the Executive Committee.

m. Receive written reports on their activities from the Federation officers and Committee Chairmen semiannually; and from Constituent Societies annually.

(2) Quorum

The presence of a majority of the Board of Directors shall constitute a quorum and a majority of those voting shall be sufficient to carry any vote, except as otherwise provided in these By-Laws and the Constitution.

C. OFFICERS

The Officers of the Federation shall consist of a President, President-Elect, and Treasurer. All Officers shall at all times be Active Members of the Federation.

(1) It shall be the duty of the President to:

a. Serve as Chief Executive of the Federation.

b. Act as Chairman of the Executive Committee.

c. Preside at the Annual Meeting of the Federation.

d. Preside at all meetings of the Federation Board of Directors and advise the Board as to the status and affairs of the Federation.

(2) The President-Elect shall automatically succeed the President and shall act in the stead of the President whenever necessary, or whenever the presidency is declared vacated by the Executive Committee.

(3) The Treasurer shall be responsible for supervising the accounts of the Federation and shall be bonded at the Federation's expense for an amount to be determined by the Executive Committee. No contracts shall be entered into, nor disbursements made, without the prior approval of the Treasurer and the President acting under authorization by the Executive Committee.

D. EXECUTIVE COMMITTEE

The Executive Committee shall consist of seven members: the President, President-Elect, Treasurer, immediate Past-President or most recent available Past-President, and three Society Representatives.

(1) The duties of the Executive Committee shall be to:

a. Act with the President in executing the general policies and the administration of the Federation.

b. Select and appoint a person to execute the duties of Federation Executive Vice-President, and to fix the compensation and prescribe the duties of that office.

c. Adopt the annual operating budget and authorize the expenditure of all funds in keeping with the provisions of these By-Laws, either by specific direction to the President and Treasurer, or by limited allocation of funds to be expended at the discretion of Committees duly appointed by the President.

d. Submit to the next meeting of the Board, a report of all actions taken.

e. Specify the duties and functions of all Committees except as otherwise provided for in these By-Laws.

f. Hold a minimum of two meetings each year at times and places to be designated by the President.

(2) Emergency Funding

Between meetings of the Executive Committee, two elected Officers acting together are authorized to expend funds up to 1% of the approved budget, or an amount previously set by the Board of Directors for non-budgeted items.

(3) Quorum

A quorum shall consist of five members, at least two of whom must be officers.

E. SOCIETY REPRESENTATIVE

(1) The duties of the Society Representative shall be to:

a. Represent the Constituent Society as a member of the Federation Board of Directors.

b. Represent the Constituent Society at the business session of the Federation during the Annual Meeting.

c. Report on all business of the Federation to the Constituent Society.

(2) Alternate Society Representative

In the absence of the Society Representative, an accredited Alternate Society Representative shall perform all functions of the Society Representative except serving on the Executive Committee.

ARTICLE IV

Nominations and Elections

A. NOMINATIONS

(1) The Nominating Committee shall prepare a slate nominating the following: President-Elect; Treasurer; members at-large on the Board of Directors; Past-Presidents on the Board, except the immediate Past-President; and Society Representatives on the Executive Committee. Should the immediate Past-President be unable to serve, the Committee shall determine the most recent available Past-President.

(2) The report of the Nominating Committee shall be announced at the Spring Board of Directors meeting, after which it shall be published in the July issue of the *Journal of Coatings Technology*. Nominations for any elective office may also be made from the floor, by any Society Representative at the Fall Board Meeting, prior to the election of Officers, or by a petition signed by 25 Active Members and forwarded to the Federation Executive Vice-President in time for publication in the July issue of the *Journal of Coatings Technology*.

The Federation Executive Vice-President shall place such nominees-by-petition in nomination at the annual election meeting of the Federation Board.

B. ELECTION

(1) The Active Members of each Constituent Society shall elect one Society Representative every third year who shall be an Active Member of said Society, and serve as its Society Representative to the Federation Board of Directors for a three-year term, beginning at the close of the Annual Meeting of the year in which he is elected.

(2) The Board of Directors shall elect the President-Elect; Treasurer; members-at-large on the Board of Directors; Past-Presidents on the Board, except the immediate Past-President; and Society Representatives on the Executive Committee.

(3) Election shall require a majority vote; the vote shall be by secret ballot in the event that more than one nominee is proposed for any single office.

C. TERMS OF OFFICE

Members of the Board of Directors and Executive Committee shall be elected to serve the following terms:

(1) The four members-at-large on the Board of Directors shall be elected for two-year terms. The terms of two of the four members-at-large shall expire each year.

(2) The office of the immediate Past-President shall be filled by the most recent Past-President available and willing to serve.

(3) The two Past-Presidents on the Board of Directors shall serve a term of two years. The term of one of the Past-Presidents shall expire each year.

(4) The three Society Representatives on the Executive Committee shall be elected for three-year terms. The term of one of the Society Representatives shall expire each year. The term of any of the three Society Representatives shall terminate automatically upon ceasing to be a regularly qualified Society Representative.

(5) The President-Elect shall be elected one full year in advance of the year in which he is to hold office as President.

(6) The term of all Officers and Directors, except the Treasurer, shall begin at the close of the Annual Meeting of the year in which they are elected. The Treasurer shall be elected annually for a term beginning January 1 of the next year.

(7) The term of office of the President, President-Elect, and Treasurer is one year.

(8) The Society Representatives on the Board of Directors shall be elected for three-year terms. The term of one-third of the Society Representatives shall expire each year.

ARTICLE V

Committees

A. NOMINATING COMMITTEE

(1) The President shall appoint a Nominating Committee consisting of: the immediate Past-President or the most recent available Past-President as

Chairman; one other Past-President; and three members of the Board of Directors who are not officers. The committee appointments, except the Chairman, shall be subject to confirmation by the Executive Committee.

(2) Membership on the Nominating Committee shall not preclude nomination to any office.

B. STANDING COMMITTEES: OTHER COMMITTEES

The President shall appoint the following Standing Committees: By-Laws, Educational, Finance, Membership, and Publications. The President shall also appoint any other Committees which may be required to conduct the business of the Federation.

ARTICLE VI

Annual Meeting

A. TIME, PLACE, AND PROGRAM

The Annual Meeting of the Federation shall be held in the last quarter of the year, the exact time and place to be determined by the Board of Directors. The Annual Meeting shall include: the presentation of technical papers and seminars; the Paint Industries' Show; the Fall Board of Directors meeting; the presentation of reports by Officers and Committees; the presentation of annual awards; the induction of new officers; and the business session.

B. RESOLUTION FROM THE FLOOR

Any Active Member may propose a resolution addressed to the Federation Board of Directors from the floor during the business session of the Annual Meeting.

ARTICLE VII

Official Publications

The Federation shall publish the *Journal of Coatings Technology* and other publications which the Board of Directors deems necessary or desirable. Each member of all classes of membership in the Federation shall receive an annual subscription to the *Journal of Coatings Technology* and other publications as the Board of Directors may authorize for distribution to members.

ARTICLE VIII

Dues

A. ACTIVE, ASSOCIATE, AND SOCIETY HONORARY MEMBERS

Each Constituent Society shall pay to the Federation office annual dues of fifteen ($15.00) per capita for each Active, Associate, and Society Honorary Member of the Constituent Society.

B. AFFILIATED MEMBERS

Affiliated Members shall pay to the Federation annual dues equal to the non-member subscription price of the *Journal of Coatings Technology* applying to the address of the Affiliated Member.

C. EDUCATOR AND STUDENT MEMBERS

The dues, if any, of Educator and Student Members shall be determined by the Board of Directors. (Current dues are $7.50.)

D. RETIRED MEMBERS

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

ARTICLE IX

Fiscal Year

The Fiscal Year of the Federation shall end on December 31.

ARTICLE X

Standing Rules

A. DEFINITION

Standing Rules are written statements of operating procedures and/or details of the organization of the Federation or its Constituent Societies.

B. ADOPTION OR AMENDMENT

(1) The Board of Directors shall adopt or amend Standing Rules, provided that two-thirds of all members of the Board shall vote in favor of adoption or amendment at any regular or special meeting of the Board.

(2) The text of the affected Standing Rules shall be published in the *Journal of Coatings Technology* within ninety days of approval.

ARTICLE XI

Amendments

A. ORIGINATION

Proposals to amend these By-Laws may be originated by:

(1) Any officer of the Federation.

(2) The Executive Committee.

(3) The Board of Directors.

(4) The recorded vote of any Federation Committee acting on a proposal of any of its members or a proposal of any Active Member referred to it.

(5) The petition of any Constituent Society.

(6) The petition of ten or more Active members, each of two or more Constituent Societies being represented by at least five Active members in the petitioning group.

B. PROCESSING

(1) All proposals to amend these By-Laws shall be submitted to the By-Laws Committee for editing, clarifying, and the combining of similar proposals from various sources. The By-Laws Committee must act on all proposals it receives, but may submit recommendations for or against adoption, with reasons for its position. The By-Laws Committee shall forward to the Executive Vice-President, within sixty days of receipt of such proposals, the enabling resolutions for the edited amendments.

(2) The Executive Vice-President shall publish the report of the By-Laws Committee in the *Journal of Coatings Technology,* and mail it to the President and Secretary of each Constituent Society and the entire membership of the Federation Board of Directors, at least ninety days prior to the regular or special meeting of the Board at which the proposed amendments are to be considered. Following the action taken by the Federation Board, the Executive Vice-President shall publish the texts of the resolutions adopted in the *Journal of Coatings Technology,* and mail them to the President and Secretary of each Constituent Society and the entire membership of the Board at least ninety days prior to the next regular or special meeting of the Board called for the purpose of final vote on the proposed amendments.

C. CONSIDERATION BY FEDERATION BOARD OF DIRECTORS

(1) Resolutions to alter, amend, or repeal these By-Laws may be considered at any two successive regular or special meetings of the Federation Board of Directors. A majority vote of all members of the Board shall be required to make any change in the text of the proposed amendments, provided that any such changes may not exceed or reduce the purpose or intent of the amendments as previously published.

(2) Resolutions to alter, amend, or repeal these By-Laws, having been subject to consideration by the Federation Board of Directors, must be approved by a two-thirds vote of the entire membership of the Board of Directors. This action must be taken at two successive regular or special meetings of the Board. The approved amendments shall become effective immediately, or at a time specified in the resolution.

ARTICLE XII

Parliamentary Procedure

Except as otherwise provided in these By-Laws, any question of parliamentary order arising in the course of conduct of the Annual Meeting, and the meetings of all duly constituted Committees of the Federation, shall be resolved pursuant to the latest, revised edition of Robert's Rules of Order.

ARTICLE XIII

Temporary Provisions

In order to effect the smooth transition from the By-Laws as amended October 26, 1976, to these By-Laws, certain interim deviations are necessary

and shall be as provided by this Article. Upon completion of the transition to the new organizational structure, this Article shall cease to exist and shall be editorially deleted.

A. The two Society Representatives serving as members of the Board of Directors, under the provisions of the By-Laws, as amended October 26, 1976, shall continue in office as members of the Executive Committee until the completion of the terms to which they were elected.

B. The Past-President serving as a member of the Board of Directors, under the provisions of the By-Laws, as amended October 26, 1976, shall continue in office as a member of the Board of Directors for the year remaining of the term to which he was elected.

C. The four members-at-large serving on the Board of Directors, under the provisions of the By-Laws, as amended October 26, 1976, shall continue in office as members-at-large of the Board of Directors until completion of the terms to which they were elected.

D. The effect of Sections A, B, and C of this Article shall be to allow a total of up to twelve persons, other than the Society Representatives, to serve on the Board of Directors during the first two years following adoption of these revised By-Laws.

E. The President-Elect serving under the provisions of the By-Laws, as amended October 26, 1976, shall assume the office of President in the first year after adoption of these revised By-Laws.

F. All Society Representatives serving as members of the Federation Council under the provisions of the By-Laws, as amended October 26, 1976, shall continue in office as members of the Board of Directors until the completion of the terms to which they were elected.

G. The Nominating Committee existing under the provisions of the By-Laws, as amended October 26, 1976, shall submit a report containing a slate for a normal annual election under the provisions of these revised By-Laws.

STANDING RULES

ARTICLE SR I

Constituent Societies

A. ESTABLISHMENT OF CONSTITUENT SOCIETIES:

(1) A local group desiring to establish a Constituent Society of the Federation shall present to the Executive Vice-President a letter of application which shall include a resume of the regular meetings held by the group during the six months prior to the date of application, together with a record of the attendance at such meetings by persons eligible for the various classes of Federation membership, and an outline of the group's plans for technical projects to be undertaken.

(2) The local group seeking admission to the Federation shall obtain from the Executive Vice-President the official Federation membership application forms and shall submit such forms duly executed for each proposed member.

(3) Dues must accompany the submitted membership application forms.

(4) The Executive Vice-President of the Federation shall advise the nearby existing Societies, whose territories come within 100 miles of the proposed Society, with respect to the intentions to form a new Constituent Society.

(5) The nearby Societies may investigate the membership and territorial plans of the proposed Society.

(6) The nearby Societies shall submit their comments to the Board of Directors of the Federation and recommendations for approval or rejection of the new Society.

(7) Ninety days before taking action the Board of Directors shall notify all Societies regarding the applications and proposed boundaries of the new Society, and the recommendations of nearby Societies.

(8) If no objection from any Society is received by the Board of Directors, approval will be obtained by majority vote.

(9) If any objection is received by the Board of Directors, acceptance shall require a three-fourths affirmative vote of all members of the Board of Directors.

B. CONSTITUENT SOCIETY BOUNDARIES:

(1) The territorial boundaries of each Constituent Society shall be defined by the map and description dated May 19, 1949, which are in the keeping of the Executive Vice-President, except as these boundaries may be changed by action of the Federation under the procedure prescribed in Standing Rule IA, (8). The boundaries, as described and mapped, shall consist of straight lines between the points mentioned and each such line shall consist of a band five (5) miles wide except in cases where such boundaries follow a national, state or county line or a body of water.

(2) A Society may relinquish any part of its territory by a majority vote at a regular meeting provided that the Society membership shall have been notified in writing at least 30 days in advance of such proposed action. The Society shall then notify the Federation of such action by letter to the Executive Vice-President signed by the President and the Secretary of the Society and setting forth the exact description of the proposed altered boundary. The Executive Vice-President shall then change the official map and description of territorial boundaries accordingly and publish notice of this change in the *Journal of Coatings Technology*.

(3) A Society may petition for enlargement of its boundaries either in unassigned territory or within the boundaries of an existing Society by presentation of an application to the Executive Vice-President of the Federation. This application shall set forth the exact boundaries desired and in case any part of the territory is within the boundaries of an existing constituent Society indicate whether this is desired as joint or exclusive territory of the petitioning Society. The Executive Vice-President shall then subject this petition to the same procedure as in the case of the formation of a new Society following the steps set forth in Standing Rule IA, paragraphs (3), (5), (6), (7) and (8).

(4) The following is the description of the territorial boundaries of each Constituent Society currently in effect.

BALTIMORE SOCIETY

The State of Maryland, District of Columbia, that portion of the State of Virginia east of a north-south line through Roanoke, and north of an east-west line through Roanoke.

BIRMINGHAM (ENGLAND) CLUB

Great Britain and Northern Ireland.

CHICAGO SOCIETY

Starting at Chicago, northerly along the shore of Lake Michigan to Milwaukee, Wisc.; westerly to Madison, Wisc.; southerly to Rockford, Ill.; southeasterly to Kankakee, Ill.; easterly to Fort Wayne, Ind., continuing directly east to the Indiana-Ohio line; thence northerly along the Indiana-Ohio line to the Michigan line; thence westerly along the Michigan line to Lake Michigan and by the shore of Lake Michigan to Chicago.

CINCINNATI-DAYTON-INDIANAPOLIS-COLUMBUS SOCIETY

Beginning at Madison, Ind., westerly to Vincennes, Ind., thence northerly along the Illinois-Indiana line to a point directly west of LaFayette, Ind.; thence easterly through LaFayette, Logansport and Huntington, Ind., to Lima, Marion and Coshocton, Ohio; thence south-westerly to Zanesville and Portsmouth, Ohio, and Lexington, Ky.; thence north-westerly to Madison, Ind.

CLEVELAND SOCIETY

Starting at Cleveland, Ohio, westerly along the shore of Lake Erie to the mouth of the Sandusky River, thence along the river to Upper Sandusky, then easterly to Bucyrus, Mansfied, Wooster, Massilon, Canton, Alliance and Youngstown, Ohio; Oil City, Pa., Erie, Pa., and thence along the shore of Lake Erie to Cleveland.

DALLAS SOCIETY

That part of the States of Texas and Louisiana lying north of the 31st parallel, plus the entire States of Arkansas and Oklahoma.

DETROIT SOCIETY

The eastern part of Michigan as bounded by the state line extending from Detroit to the Ohio line, thence westerly along the Michigan state line to Sturgis, Mich.; northerly to Barryton; easterly to Bay City, Mich., and along the shore of Lake Huron to Port Huron; thence following the state line to Detroit; also that part of the Province of Ontario, Canada, within a 65-mile (105 km) radius of Detroit, and the counties of Lucas, Wood and Ottawa, Ohio.

GOLDEN GATE SOCIETY

All territory within a 100-mile (160 km) radius of San Francisco, Calif.

HOUSTON SOCIETY

Starting at Port Arthur, Tex., through Beaumont, Bryan, Austin, San Antonio, Corpus Christi, Tex., and along the Gulf of Mexico to Port Arthur.

KANSAS CITY SOCIETY

All territory within a 100-mile (160 km) radius of Kansas City, Mo.

LOS ANGELES SOCIETY

Beginning at the Pacific Ocean and proceeding easterly along the northern boundaries of the San Luis Obispo, Kern, and San Bernardino counties to the junction of the California, Nevada State line to the Colorado River; thence southerly along the Colorado River to the California, Mexican border to the Pacific Ocean; thence northwesterly along the Pacific Coast to the point of origin.

LOUISVILLE SOCIETY

Starting at Madison, Ind., westerly to Vincennes, Ind.; southerly along the Indiana-Illinois line to the Kentucky line, following this south-westerly and then easterly to Albany, Ky.; thence northerly to Lexington, Ky.; and thence northwesterly to Madison, Ind.

MEXICO SOCIETY

All of the country of Mexico.

MONTREAL SOCIETY

Those portions of the provinces of Quebec and Ontario, Canada, within 125-mile (201 km) radius of Montreal.

NEW ENGLAND SOCIETY

All of the New England states with the exception of that portion of Connecticut west of the Connecticut River.

NEW YORK SOCIETY

All of Connecticut west of the Connecticut River and parts of New York, New Jersey and Pennsylvania bounded as follows: From the New York-Connecticut line, the boundary, including Long Island, and following the Atlantic Ocean south to Bay Head, N.J.; thence westerly to Bordentown, N.J.; thence northerly

along the Delaware River to Phillipsburg, N.J.; thence westerly to Easton and Palmerton, Pa., and northerly to Scranton, Pa., thence north-easterly to the junction of the states of New York, Massachusetts and Connecticut.

NORTHWESTERN SOCIETY

The State of Minnesota and that part of Wisconsin bounded by Superior, Eau Claire, LaCrosse and all portions of North Dakota, South Dakota, and Iowa within 20 miles (32 km) of the Minnesota state line together with the Provinces of Manitoba, Saskatchewan, and the northwestern portion of the Province of Ontario, Canada.

PACIFIC NORTHWEST SOCIETY

The States of Montana, Oregon, Washington, Alaska; that portion of Idaho north of a line running between the northwest corner of the State of Wyoming and the southwest corner of the State of Idaho and the Provinces of Alberta and British Columbia.

PHILADELPHIA SOCIETY

The state of Delaware, plus portions of Pennsylvania and New Jersey, bounded as follows: beginning at the junction of Delaware, Maryland and Pennsylvania, westerly along the Pennsylvania-Maryland line to the Susquehanna' River, thence northerly along the Susquehanna River to Scranton, Pa., thence south-easterly to Delaware Water Gap; southerly along Delaware River to Phillipsburg, N.J.; south-easterly to Somerville, Bound Brook and New Brunswick, N.J.; south-westerly to Bordentown, N.J.; easterly to Bay Head, N.J.; thence along the Atlantic Ocean to the Delaware-Maryland line.

PIEDMONT SOCIETY

All of the state of North Carolina plus that part of Virginia west of a north-south line from Roanoke to the West Virginia line and south of an east-west line from Roanoke to Chesapeake Bay.

PITTSBURGH SOCIETY

Starting at Altoona, Pa., directly south to the Maryland border; thence westerly along the Pennsylvania-Maryland border, continuing directly west to the Ohio River, up the Ohio River to the Pennsylvania-Ohio line; thence northerly along this line to a point directly west of Bessemer, Pa.; thence easterly to New Castle and south-easterly to Altoona, Pa.

ROCKY MOUNTAIN SOCIETY

States of Colorado, New Mexico, Utah, and Wyoming.

ST. LOUIS SOCIETY

All territory within a radius of 75 miles (121 km) of St. Louis, Mo.

SOUTHERN SOCIETY

All of the following states: South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, and all of Louisiana east of the Mississippi River as well as that part of Louisiana west of the Mississippi River and south of the 31st parallel.

TORONTO SOCIETY

That part of the province of Ontario, Canada, within a 125-mile (201 km) radius of Toronto, Canada, excepting the territory east of a line from Port Dalhouse to Port Colborne, Ontario.

WESTERN NEW YORK SOCIETY

All that part of New York state west of north south line from Oswego, N.Y. to the Pennsylvania line, and also that part of the province of Ontario, Canada, east of a line between Port Dalhouse and Port Colborne, Ontario.

ARTICLE SR II

Membership in Constituent Societies

A. RESIDENCE REQUIREMENTS:

Active, Associate, or Educator and Student Membership is a privilege which may be offered to an individual who is eligible according to the provisions of Article II, Section D, of the By-Laws, and in addition resides or is employed, or performs services within the territorial boundaries of the Constituent Society to which application for membership is being made.

(1) When residence or employment is not within the boundaries of any Constituent Society, the applicant shall be eligible if it is possible for him to attend Society meetings.

(2) When residence or employment is on the boundary line between two Constituent Societies or is in over-lapping territory, application may be made to either Society.

(3) When residence is in the territory of one Constituent Society, but employment or services performed are in the territory of another Society, application may be made to either Society.

B. STANDARD FORM:

A standard application for membership form shall be established by the Executive Vice-President with the advice of the Federation Membership Committee. All applications for Active, Associate, Educator and Student, and Retired Membership, and for the transfer of Active or Associate Members from one firm to another within the same Constituent Society, must be made using the standard form.

C. METHOD OF ELECTION TO MEMBERSHIP:

(1) An applicant for Active Membership must be proposed by an Active Member and be endorsed by another Active Member. If the application is approved by the Constituent Society Membership Committee, it shall be submitted to the membership of the Constituent Society for first reading at a regular meeting of the Society, subject to election vote at a regular meeting of the Society not earlier than the meeting subsequent to that of the first reading. At the discretion of the Constituent Society Membership Committee, the Society Secretary may submit to the Society membership written notice of the pending application, in lieu of first reading. Such notice shall be mailed not less than ten days prior to the regular meeting designated for voting upon the subject application. Election to membership shall be by a two-thirds favorable vote of the Active Members present and voting at a regular Society meeting. If

the applicant is elected to Society membership, both copies of the application, bearing the Constituent Society Secretary's certification of election, shall be forwarded to the Executive Vice-President of the Federation. He will sign the original and return it to the Society.

(2) An applicant for Associate Membership must be proposed by an Active Member and be endorsed by another Active Member. The application shall be processed in the same manner as an application for Active Membership.

(3) An applicant for Educator and Student Membership must be proposed by an Active Member and be endorsed by another Active Member. The application shall be processed in the same manner as an application for Active Membership.

(4) An applicant for Retired Membership, after recommendation by the Membership or other appropriate committee of the Constituent Society, shall be subject to election to membership by two-thirds vote of the Active Members present and voting at any regular meeting of the Society. The application shall be processed in the same manner as an application for Active Membership.

(5) An application for the transfer of an Active Member or an Associate Member from one firm to another within the same Constituent Society shall be processed in the same manner as an application for Retired Membership. If the firm to which the member is transferring currently employs a member of the same class, the application need not be subject to a vote by the membership, may be certified by the Secretary, and be forwarded to the Executive Vice-President of the Federation. It is expressly provided, however, that an Associate Member may not assume Active Membership in another firm by means of the transfer procedure. Any Constituent Society may require any applicant for transfer to be subject to the full procedures as if application were being made for a new membership, in accordance with such requirements as may be included in the Constituent Society By-Laws.

D. FEDERATION HONORARY MEMBERSHIP:

Nominations for Honorary Membership may originate with any Constituent Society and shall require a 90 per cent favorable vote of all Active Members present and voting by secret ballot at a regular meeting of the Constituent Society. The Society shall then refer the nomination to the Board of Directors, the Secretaries of each Constituent Society, and the Executive Vice-President. Not less than 120 days after the notification of the Board and Society Secretaries, the Federation Board, at a regular meeting, shall vote to approve or reject the nomination and shall direct the Federation Executive Vice-President to notify the Constituent Society of its decision. A three-fourths favorable vote of Board Members present and voting by secret ballot shall be required for approval.

E. SOCIETY HONORARY MEMBERSHIP:

Election procedures shall be in accordance with those of the local Society.

F. RELOCATION OF ACTIVE MEMBERS:

To allow an Active Member to continue in any elected office or appointed position for which Active Membership is required, within any Constituent Society, or within the Federation, it shall be construed that Active

Membership exists for six months after the individual has left his last employment unless, for another reason, he becomes ineligible for Active Membership. Federation publications shall continue if covered by dues or paid subscription.

ARTICLE SR III

Alternate Society Representative

A. APPOINTMENT:

(1) The President of each Constituent Society may appoint an Active Member as the Alternate Society Representative to serve during the term of office of the said President.

(2) In case the President of the Constituent Society does not choose to appoint an Alternate Society Representative to serve during the term of office of the said President, or if this appointee ceases to be an Active Member, or for any reason is unable to serve, then the President of the Constituent Society shall appoint an Active Member to serve as Alternate Society Representative during any regular or special meeting of the Federation Board.

B. ACCREDITATION:

The Executive Vice-President of the Federation shall certify that the appointee is a duly-accredited Alternate Society Representative when these terms are met:

(1) The appointee is an Active Member of the Constituent Society which he is to represent.

(2) The name of the appointee is recorded in the Federation office on a form provided by the Federation and duly executed by the President of the Constituent Society, or

(3) He has received written notice, by letter or telegram, of the name of the appointee from the President of the Constituent Society, prior to the meeting of the Federation Board of Directors at which the appointee is to serve.

ARTICLE SR IV

Executive Vice-President

A. APPOINTMENT

The Executive Vice-President is appointed by the Executive Committee which also fixes the compensation and prescribes the duties of office.

B. DUTIES

(1) Carry on the general business management of the Federation as outlined under "Office Operation Procedures" as approved by the Executive Committee.

(2) Keep a record of the proceedings at all meetings of the Federation.

(3) Have general supervision of the *Journal of Coatings Technology*, the Year Book, and other publications.

(4) Have general supervision of the Annual Meeting and Paint Industries' Show.

(5) Assist in liaison between the Federation and other organizations.

(6) Review and process all applications for Federation membership.

(7) Present reports to the Federation Board of Directors and Executive Committee.

(8) Take an official roll call at all meetings of the Board and Executive Committee.

(9) Receive all revenues, maintain an accounting of all funds, and make all disbursements subject to all articles of the By-Laws.

(10) Perform such other duties incident to his office which may be directed by the President or Executive Committee.

(11) Delegate any of the duties to one or more principal assistants, as authorized by the Executive Committee.

ARTICLE SR V

Publications

A. OFFICIAL PUBLICATIONS

The official publications shall include:

(1) *Journal of Coatings Technology,* published monthly in twelve issues.

(2) Year Book, published annually in the first quarter.

The official publications shall be sent, without special fees, to all members of the Federation. They shall be available to others at subscription and sales prices authorized by the Executive Committee.

B. OTHER PUBLICATIONS

Other Federation publications and their subscription and sales prices shall be authorized only by the Executive Committee.

C. EDITORS

Editors of publications are appointed and their remuneration fixed only by the Executive Committee.

D. JOURNAL OF COATINGS TECHNOLOGY

(1) *The Journal of Coatings Technology* shall include: (1) Proceedings of all official meetings of the Federation and its Board of Directors, Executive Committee, and Committees, and announcements and other official statements of the Federation: (2) Reports, or the minutes, of Constituent Society meetings, and announcements or other official statements by these Societies; (3) Scientific or technical papers presented at meetings of the Federation and its Constituent Societies, as accepted by the Publications Committee; (4) Any other editorial or advertising matter approved by the Editor and the Publications Committee.

(2) *The Journal of Coatings Technology* has the first rights to publish papers presented at Annual Meetings of the Federation and at all meetings of Constituent Societies. Releases to these rights may be granted by the Publications Committee which has authority in all matters affecting the acceptance, rejection and publication of papers and reports.

ARTICLE SR VI

In Memoriam

A. MEMORIAL

The names of Federation members who passed away during the year shall be read at the business session of the Annual Meeting. The list of deceased members shall be published in the *Journal of Coatings Technology*.

B. ROLL OF HONOR

(1) A Roll of Honor, listing the names of honored members of the Federation who are no longer living, shall be maintained by the Executive Vice-President and published annually in the *Year Book*.

(2) Upon the demise of every Federation Honorary Member, his name shall be added to the Roll of Honor.

(3) The name of any deceased member of the Federation, not a Federation Honorary Member, may be added to the Roll of Honor provided that he was qualified for Federation Honorary Membership according to By-Laws Article I,A,3 during his lifetime, and that his name has been proposed and approved in the manner prescribed for the election to membership of Federation Honorary Members in Standing Rule II,D.

ARTICLE SR VII

Committees

A. GENERAL PROVISIONS:

(1) Wherever the By-Laws are specific to the composition, duties, or any other matter pertaining to committees, then the By-Laws shall be followed, and anything contrary in this Standing Rule shall not apply.

(2) The President appoints all Committees, except as otherwise provided in the By-Laws, obtaining agreement to serve from prospective appointees during his year as President-Elect.

(3) The President and President-Elect, by right of their offices, are members of all Committees (except the Nominating Committee) and copies of all correspondence shall be sent to them. Copies of all important correspondence should be sent to the Treasurer and Executive Vice-President.

(4) No committee will commit the Federation to the expenditure of funds not previously authorized for that Committee by the Executive Committee.

B. DUTIES OF COMMITTEES SHALL BE: .....

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Government and Industry

NPCA/Industry Seek Duty-Free Import of Soluble Nitrocellulose

The National Paint and Coatings and industry representatives presented testimony in support of a bill (H.R. 9628) to suspend temporarily the import duty on nitrocellulose before the Trade Subcommittee of the U.S. House of Representatives Ways and Means Committee on May 3.

NPCA Legislative Counsel Michael J. Duff summarized the written testimony presented to the Subcommittee by NPCA and Daniel H. Monroe, Vice President of the Lilly Co. Andrew W. Riedell, Technical Director of Guardsman Chemicals, Inc. also appeared in support of the testimony.

In his statement, Duff requested that the current duty of 9.7¢ per lb on soluble nitrocellulose be suspended through June 30, 1980, and further asked that the bill be amended to make the legislation retroactive to January 1, 1978.

Nitrocellulose, used principally in the manufacture of many fast drying, durable lacquer coatings on furniture, automotive refinishes, primers, and for a wide variety of coatings for metal and plastic, has until recently been supplied in the U.S. by two domestic manufacturers, Hercules, Inc. and E. I. duPont de Nemours & Co., Inc. Last year duPont announced that it intended to phase out its production of nitrocellulose, accept orders only until September of 1977, and fill those orders only until the end of December, 1977. Dupont developed an allocation plan for its remaining supplies of nitrocellulose based on past purchase records.

"For various reasons associated with their termination of production, they (duPont) were not able to complete shipments based on their allocation plan until March, 1978," noted Monroe. "As a consequence we received much less nitrocellulose per month from duPont than had been our previous purchase record. Beginning in January, 1978, we had to augment our supply to fill normal requirements by importing nitrocellulose," he added.

Industry's request to make the legislation retroactive stems from duPont's inability to complete shipment of its orders until March 1978, and Hercules' difficulty in making up the shortage in supply. As a result of unforeseen shortages in supplies of nitrocellulose, many coatings manufacturers have been forced to purchase nitrocellulose from foreign sources to fulfill their normal requirements. Increased costs due to the import duty were not always reflected in consumer prices; therefore, industry has had to absorb the extra cost.

Subcommittee on Trade Chairman Charles A. Vanik (D-Ohio) indicated during the hearing that the Subcommittee is favorably disposed to the legislation. A decision on the bill is expected shortly.

MCA Survey Shows Member Companies Using Less Energy

Companies participating in the Manufacturing Chemists Association voluntary energy conservation reporting program actually used less energy for fuel in 1977 than in 1972.

The 112 reporting companies also saved 14.2% of their fuel use per unit of output in calendar year 1977 compared to base year 1972. If allowance is made for the energy required to meet occupational safety and health and environmental regulations not in effect in the base year, the actual savings become 15.4%.

The 14.2% reduction in fuel use is a savings of the equivalent of more than 94 million barrels of imported oil valued at about $1.3 billion.

Individual company reports indicate that process modifications and new processes designed to conserve higher-priced energy account for the most savings.

Companies also cited such measures as added insulation, controls, steam traps, improved maintenance, furnace waste heat recovery, improvements in boiler operation, burning of waste by-products and increased cogeneration of electricity and mechanical shaft horsepower.

The 1977 aggregate energy conservation results put MCA reporting companies ahead of a 1980 government-targeted savings of 14% over base year 1972.

Reaching the target figure is satisfying, MCA President William J. Driver said in a letter forwarding the report to Department of Energy Secretary James Schlesinger. However, energy conservation remains an economic necessity for the chemical companies, which strive to be as energy efficient as their U.S. and foreign competitors.

Improved energy conservation will continue to be a competitive necessity for the chemical industry, he noted, because it is so energy intensive.

NPCA Express Support for OSHA Proposal to Eliminate Nuisance Standards

NPCA enthusiastically supported the Occupational Safety and Health Administration's proposed revocation of selected general industry safety and health standards in comments submitted to OSHA on May 3.

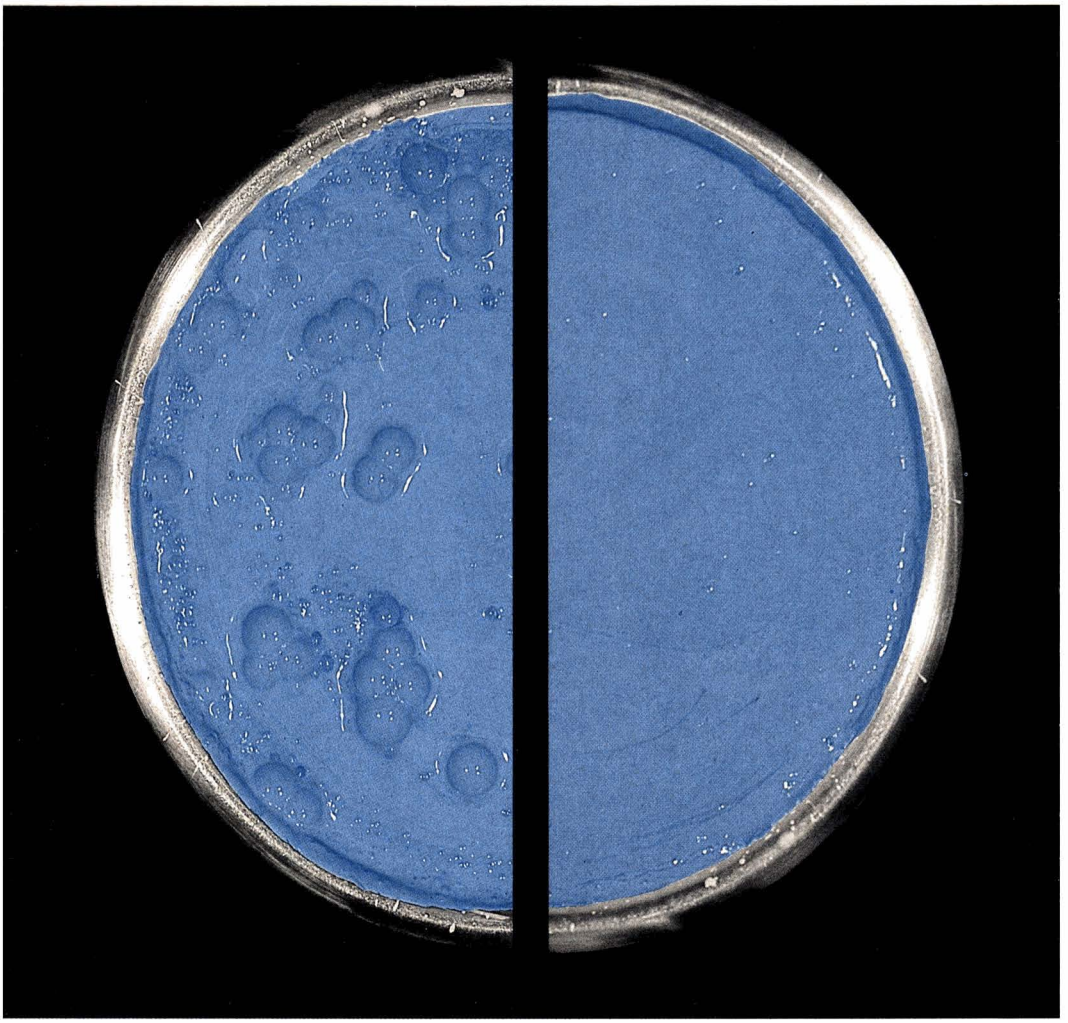
The proposal was made in response to a Congressional directive to OSHA to eliminate "nuisance" standards and those not dealing with the health or safety of workers.

According to OSHA, requirements to be eliminated were those which were obsolete or inconsequential, concerned with comfort or convenience, directed toward public safety or property protection, subject to enforcement by other regulatory agencies, contingent on manufacturer's approval or recommendations, encumbered by unnecessary detail, or adequately covered by other general standards.

In its comments, NPCA asserted that the interests of good government would be served by eliminating requirements which have no direct or immediate impact on employee safety or health.

NPCA made specific comments regarding revocation of certain parts of the section 1910.106 Subpart H which pertains to Flammable and Combustible Liquids. Deletion of those requirements would have substantial impact on the paint and coatings industry. NPCA based its recommendations on its belief that those requirements are inappropriate, unenforceable or repetitive.

NPCA further urged OSHA not to end its effort to eliminate nuisance standards and suggested that these actions be retained as a continuing program. NPCA noted that elimination of unnecessary standards would serve to increase cooperation and compliance from those subject to its regulations.



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Comments Filed on Proposed Amendment to OSHA Benzene Standard

NPCA filed comments with the Occupational Safety and Health Administration on nine major issues pertaining to OSHA's proposed amendment of the Permanent Standard on Occupational Exposure to Benzene.

OSHA's Proposed Amendment, issued in the March 28, 1978 *Federal Register*, would prohibit occupational exposure to benzene, even in trace amounts.

In its comments, NPCA asserted that the exclusion of any provision for occupational exposure to trace amounts of benzene is unrealistic in view of the pervasive nature of benzene in the environment. NPCA added that there is no known method for detecting trace amounts of benzene, and stated its belief that an exclusion level for occupational exposure to 0.1% benzene by volume or the vapors released from those liquids is both essential and appropriate.

NPCA's comments cited many scientific studies documenting the naturally occurring presence of benzene in our food, water, as well as in the human body. According to NPCA, the exclusion of any provision for exposure to even trace amounts of benzene would require compliance with the Permanent Standard by virtually every workplace.

NPCA noted that other government agencies have set "acceptable risk" levels for chemical carcinogens, and, in addition, quoted authoritative studies which support the ideas that responses to chemical carcinogens are dose-dependent both in animals and humans and that threshold limits exist for chemical carcinogens. "OSHA cannot disregard evidence indicating exposure to trace levels of a carcinogen will not induce cancer during a normal lifetime," NPCA said.

NPCA's comments contend that airborne levels of benzene do not exceed 1 part per million in the workplace (also a requirement of the Standard) and that other factors would prohibit the release of benzene.

NPCA stated that to require a cancer warning for materials containing trace amounts of benzene is improper because benzene is pervasive in the environment, because it would result in an unwarranted loss of sales, and because such labeling would not provide any additional benefit to employee health.

CPSC Proposes to Regulate Certain Consumer Products Which Contain Benzene

The Consumer Product Safey Commission has announced its intention to regulate consumer products, except gasoline and solvents or reagents for laboratory use, containing benzene as an intentional ingredient or as a contaminant at a level of 0.1% or more by volume, under the Consumer Product Safety Act (CPSA) instead of under the Federal Hazardous Substances Act (FHSA). CPSC's Proposed Rule was issued in the *Federal Register* on May 19.

For the purposes of its proposed regulation, CPSC has defined "benzene as a contaminant" as any benzene appearing in a final product which is not intentionally added. CPSC has defined "benzene as an intentional ingredient" as benzene which is added deliberately to a product to impart specific characteristics.

CPSC stated its conclusion that it is in the public interest to regulate the risk of injury from blood disorders, chromosomal abnormalities, and leukemia associated with benzene inhalation under the CPSA because its rulemaking proceedings are less complex and formal than those of the FHSA. CPSC also noted that the CPSA provides for civil penalties for those persons who knowingly violate its regulations. CPSC believes such penalties might encourage compliance with the regulations.

In addition, repurchase of banned hazardous products by manufacturers, distributors and retailers would not be required by CPSC, as it is under FHSA.

Specifically, CPSC proposes to ban consumer products containing benzene as an intentional ingredient manufactured or imported 60 or more days after publication of the final rule in the *Federal Register*. As an alternative, CPSC proposes to ban consumer products containing intentionally-added benzene which are initially introduced into interstate commerce 15 or more days after publication of a final rule. All other consumer products containing intentionally added benzene would be banned 30 days after a final rule. Products containing benzene as a contaminant, whether manufactured or imported, will be banned 120 days after publication of the final rule.

The Commission plans to publish a final rule or withdraw its proposal by October 16, 1978.

Preliminary Injunction Bars EPA from Implementing Regs On Hazardous Materials Spills

The U.S. District Court for the Western District of Louisiana issued a preliminary injunction on June 8 barring the Environmental Protection Agency from implementing regulations providing penalties and liabilities for spills of hazardous materials.

The court's action was in response to a Manufacturing Chemists Association suit asking injunctive relief against the regulations in section 311 of the Federal Water Pollution Control Act. On May 22 MCA filed a motion for a preliminary injunction pending a final decision, and the court's ruling granted such relief. The court will rule on MCA's original complaint in the future.

EPA published final regulations on section 311 on March 13, under which fines for spills could amount to many millions of dollars and a violator could be required to pay for mitigating the effects of a spill.

In its motion, MCA contended that the final regulations could have a serious adverse impact on the chemical industry. It made the following points: the regulations fail to take into account the "times, locations, circumstances and conditions" of discharge as required by section 311 (b) (4) of the Act; EPA has failed to respond to comments by the parties and its own contractor; EPA's selection of the one-lb. unit and harmful quantities was arbitrary and capricious; EPA has failed to determine whether the designated substances "can actually be removed" as required by section 311 (b) (2) (B) (i) of the Act; The agency's determinations of non-removability are arbitrary and unsupported by the record.

MCA noted that the final regulations now cover stationary discharge sources because they extended applicability to discharges during a 24-hour period. MCA held that this is contrary to the intent of Congress.

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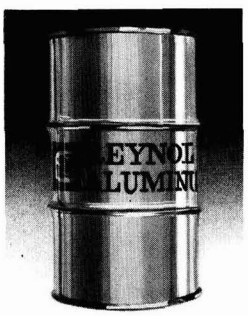

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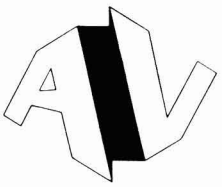

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Microvoid Coatings: Pigmented, Vesiculated Beads In Flat Latex Paints

Rod W. Hislop and Peter L. McGinley
Dulux Australia Limited*

Synthetic opaque polymeric beads are useful flatting and opacifying agents for low gloss paints. The properties of paints containing different types of beads are related to the structure of the film and the properties of the beads. Beads containing microvoids introduced a synergistic effect which makes a significant contribution to the total light scattering. Comparisons are made between commercial paints formulated with beads containing microvoids and TiO_2, and conventional mineral extenders. Beads can be used to produce lower cost latex paints without sacrificing the physical or optical properties of the film, as well as flat latex paints with exceptional burnish resistance.

INTRODUCTION

The balance of properties of flat latex wall paints is, in part, dependent upon the volume and type of extenders used. In addition to giving the required flatting effect, the extender generally reduces the cost of the paint and has an influence on its physical properties and hiding power. The aim of this paper is to describe a novel extender which acts as both a flatting agent and an opacifying agent. The particles are spherical polymeric beads, the properties of which will be illustrated and examples given of their use in commercial paints. The scanning electron micrograph shown in *Figure* 1 illustrates the spherical shape and particle size distribution of the beads. The bead preparations are commercially available under the trade name Spindrift®.

There are two types of Spindrift beads: solid beads, which may be pigmented; and pigmented, vesiculated (microvoid containing) beads. Both types of bead provide a flatting effect; whereas the solid beads also impart a high level of burnish resistance, the pigmented, vesiculated beads have an enhanced TiO_2 efficiency.

Solid Beads

Under normal marring and burnishing conditions, the irregular tops of mineral extender particles that protrude from a paint film are broken off or pushed into the film, leading to the development of localized polymer-rich, glossy areas. *Figure* 2(a) and 2(b) are scanning electron micrographs of paint films containing conventional mineral extender particles before and after dry burnishing with a soft cloth. The soft cloth was attached to the 16 mm diameter, round-nosed impacter of a Gardner heavy duty impact tester. The standard 907g weight was allowed to rest on the impacter. Dry burnishing was achieved by pulling the paint film under the cloth covered impacter and weight.

It was suggested in 1962 that improved mar or burnish resistance could be obtained if polymeric particles such as polypropylene were used as extenders and matting agents.[1] These are still used today, often in conjunction with silica particles to produce texturing effects. In 1962, the 3M Company introduced coatings[2] containing a high percentage of noncoalescing, elastomeric particles, optionally pigmented, between 3 and 150 μm in diameter, which gave glare-free and mar-resistant finishes.

In 1968, BALM Paints (now Dulux Australia Ltd.) disclosed a coating composition[3] containing pigmented beads which had particles with diameters of 1 to 50 μm, this range producing a more uniform flatting effect than previously achieved. It was found that when used at high loadings in paints, the mechanical strength of the beads imparted good burnish resistance. *Figures* 3(a) and 3(b) are scanning electron micrographs of paint films containing solid pigmented beads before and after burnishing with a soft cloth as previously described. A comparison of *Figures* 2(b) and 3(b) clearly shows that the beaded film has not been smoothed or burnished to the same extent as the film containing mineral extender.

Flat latex paints containing solid beads have been successfully marketed in Australia for over three years. In white paints all the solid beads are pigmented. For deep tones, a proportion of unpigmented beads are used to allow formulation of highly saturated colors at very low gloss with good burnish resistance.

While the properties of these solid beads will be described in the following section, the only reason for their inclusion is to assist the understanding of the behavior of pigmented, vesiculated beads that form the central point of interest in this article.

*Central Research Laboratories, P.O. Box 60, Clayton, Victoria, Australia 3168.
Spindrift is a registered trademark of Dulux Australia Ltd.

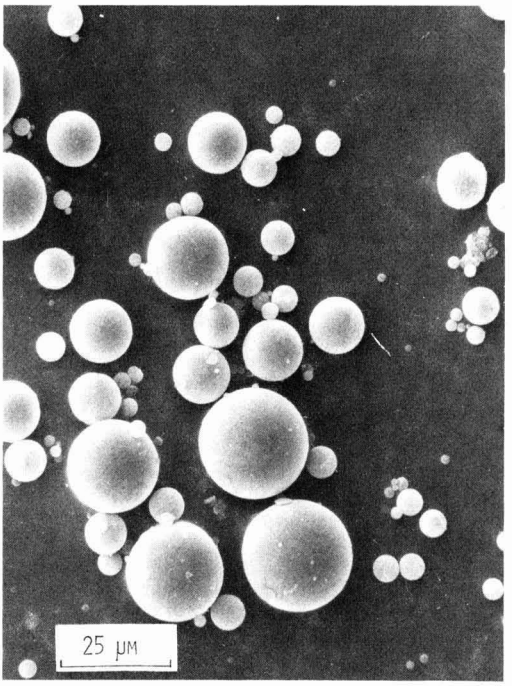


Figure 1—Scanning electron micrograph of typical Spindrift beads

Pigmented, Vesiculated Beads

Microvoids have been used for over 40 years as an opacifying medium in blush and bubble coatings.[4] They can be used as the sole opacifying agent where low contrast ratios or high film builds are acceptable, for example in recording chart paper[5] and photographic emulsions.[6] However, since the scattering from microvoids is only 15 to 20% of that obtained from an equivalent volume of TiO_2, modern decorative paints must use microvoids in conjunction with TiO_2, so that the required level of opacity is produced at reasonable film builds.

The theoretically optimal size of the microvoids is governed by the same principles that apply to white pigments such as TiO_2. Estimates for the optimal diameter of a single isolated scattering site vary from 0.7 μm[8] to 1.05 μm.[9] Ross[10] modified the Mie theory by including the effect of multiple scattering, deviations from the conditions of measurement required by the Kubelka-Munk theory, and the internal reflection at the surface of the film. This modification led to a value of 0.23 μm as the optimal size for microvoids. At larger diameters, the scattering efficiency falls off. For example, at 2 μm the calculated scattering is only 25% of that at 0.23 μm. These calculations are restricted to microvoid concentrations of less than 8% by volume. At higher concentrations, interactions between the particles must also be taken into account. Seiner and Gerhart[11] are less specific on estimates of optimal diameters but suggest that scattering is effective over a much broader range than would be expected on the basis of size, relative to wavelength of the scattered light.

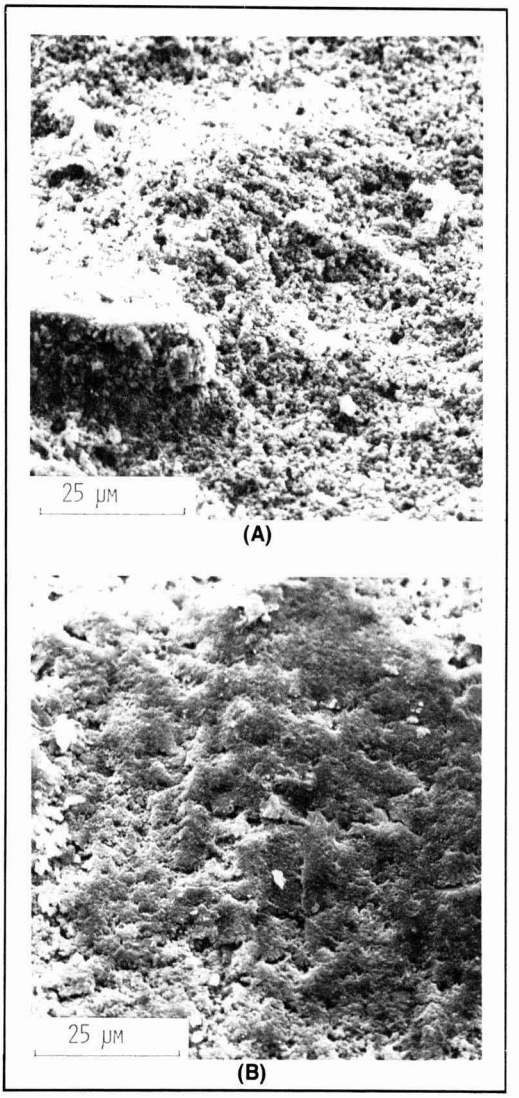


Figure 2—The surface of a paint film containing mineral extenders before (A) and after (B) burnishing with a soft cloth

The inclusion of microvoids in a dry paint film can be achieved by several processes. McBane and Dowbenko[9] and Clancy[4] describe techniques based upon phase separations that occur during film formation. The microvoids are formed upon removal of the dispersed phase by either solvent extraction or evaporation. The structure of the microvoids so produced depends upon the drying conditions, the nature of the polymer, and the solvents used. This dependence upon the conditions at film formation can be removed by the use of preformed microvoids.[12]

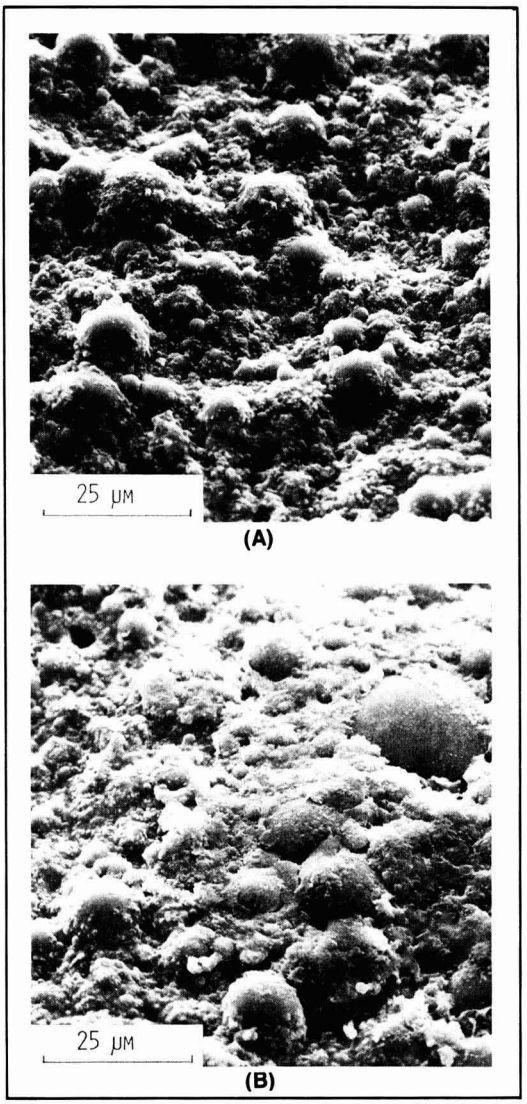


Figure 3—The surface of a beaded paint film before (A) and after (B) burnishing with a soft cloth

Pigmented, vesiculated beads contain pigment and water-filled vesicles encapsulated within a crosslinked polymer particle. The beads are blended with other paint components to produce a commercially acceptable wet paint. Upon drying, the vesicles empty and develop their microvoid hiding power.

To minimize bead opacity, the vesicle size is controlled within the range of 0.5 to 3 μm, and the level of vesiculation is optimized at 65% of the bead volume.

An example of bead particle size distribution, as determined by the Coulter Counter technique, is given in *Figure* 4. The median value of the distribution on a volume basis can be varied within the range 3 to 20 μm, yielding varied gloss levels in the paint film, as desired. For example, beads with a median diameter of 12 μm are used in flat latex paints.

Pigmented, vesiculated beads provide a simple, controllable method of incorporating preformed, stable microvoids into a paint film. An important feature is that encapsulating the microvoids within the beads to produce a closed-cell structure avoids the problem of film porosity normally associated with microvoid containing films.

Figure 5 shows a fracture surface of a vesiculated bead in a well bound film, illustrating the relative size and distribution of the vesicles within the bead.

EXPERIMENTAL

Bead Preparation

The pigmented, vesiculated; pigmented, solid; and unpigmented, solid beads described in this paper are all prepared by suspension polymerization of dispersed precursors in water. This technique has previously been described in detail by Kershaw,[8] Lubbock,[13] and in various patents.[14]

For the manufacture of solid beads, an unsaturated polyester-styrene polymer precursor, which may be pigmented, is suspended as droplets of the required size in an aqueous solution of stabilizing colloids to form a stable oil-in-water emulsion. Curing is then initiated to produce hard, solid, polymeric beads.

The process used for pigmented, vesiculated beads depends on the formation of a stable double-emulsion. An aqueous TiO_2 dispersion is prepared in an unsaturated polyester-styrene polymer precursor as a fine water-in-oil emulsion. This first emulsion is then mixed into an aqueous solution of stabilizing polymers, forming a coarse water-in-oil-in-water double emulsion at the required bead size. A redox free radical system is used to cure these beads.

Each of the solid and pigmented, vesiculated beads described is produced as an aqueous slurry which allows easy incorporation into water-based paints. The typical composition of a pigmented, vesiculated bead slurry is:

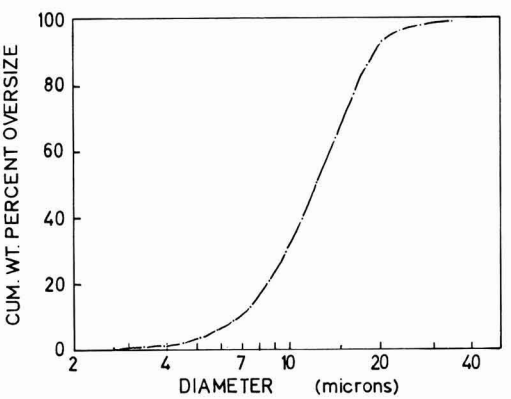


Figure 4—The particle size distribution of 12 μm beads as determined by the Coulter Counter technique

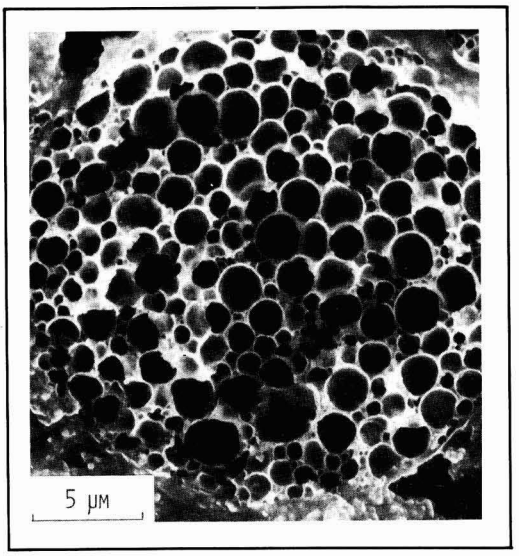


Figure 5—Scanning electron micrograph of a fracture surface of a vesiculated bead in a well bound paint

	WT. PCT.
Rutile TiO_2	12.3
Unsaturated polyester-styrene polymer	15.6
Water internal to the bead	31.8
Water external to the bead	37.4
Additives	2.9
	100.0

The volume composition of dry, pigmented, vesiculated beads is typically:

	VOL. PCT.
Rutile TiO_2	6.7
Polymer	28.3
Air	65.0
	100.0

Dried beads for solvent-borne applications can be produced by a series of filtering, washing, and drying operations.

Bead Paint Terminology

Simple beaded latex paint formulations consist of latex binder, TiO_2 pigment, and minor additives. These are made by the same methods as conventional latex paints: the external TiO_2 is dispersed in water by high speed stirring, followed by the addition of latex, bead slurry, and minor additives. More complex formulations use extenders in addition to beads, but these will not be described here.

Since the beads are large compared with pigment and latex particles, it is preferable to think of the dry paint film as a two-phase system: the bead phase consisting of beads that may be pigmented and vesiculated, and the external phase, consisting of the film-forming binder and pigment. Since TiO_2 may be found in both phases, the terms "external TiO_2" and "internal TiO_2" are used to specify the location of the TiO_2 being considered. To think in terms of phase volumes also reduces conceptual difficulties associated with vesiculation.

The use of the terms pigment volume concentration (PVC), critical pigment volume concentration (CPVC), and volume solids for a beaded paint is analogous to their usage with conventional paints. In the PVC and volume solids definitions for beaded paints, the extender volume term is replaced by dry bead volume, which is the sum of the volumes of polyester, pigment, and air within the bead, e.g.,

$$\text{PVC} = \frac{\text{external pigment volume + dry bead volume}}{\text{dry paint volume}} \quad (1)$$

Note that the beads are regarded as pigment and not binder, even though they are polymeric in nature.

To better understand beaded paint films it is useful to define the following new terms:

$$\text{PVC of the external phase} = \frac{\text{external } TiO_2 \text{ volume}}{\text{dry paint volume-bead volume}} \quad (2)$$

$$\text{bead volume concentration} = \frac{\text{dry bead volume}}{\text{dry paint volume}} \quad (3)$$

In the demonstration of beaded paint properties which follows, a set of examples containing a mineral extender in place of beads is used to provide conventionally formulated paints for comparison. For these samples it will be convenient to use the term—

$$\text{extender volume concentration} = \frac{\text{extender volume}}{\text{dry paint volume}} \quad (4)$$

Test Methods

The Kubelka-Munk scattering coefficients were determined by the method described in ASTM D2805-70. Reflectance values were obtained with a General Electric (Hardy) Spectrophotometer at a wavelength of 550nm. The reflectance of a partially-hiding dry film on a clear polyester sheet was measured over both black and white substrates. The wet film thickness was calculated from the dry film weight and area, and the wet paint specific gravity and weight solids.[15]

The hyperbolic solutions to the Kubelka-Munk equations were used to calculate the scattering coefficient from the reflectance measurements and the wet film thickness. The scattering coefficient is then based on wet film thickness as recommended in ASTM 2805-70.

The TiO_2 scattering efficiency is defined as

$$\text{scattering efficiency} = \frac{\text{scattering coefficient}}{TiO_2 \text{ concentration}} \quad (5)$$

where the TiO_2 concentration (weight/volume) is that of the wet paint and includes the TiO_2 in the beads.

The film porosity test was performed in a similar manner to ASTM D3258-73, with two modifications: the penetrating medium was used "Gilsonite," and the films were drawn down with a 175 μm blade.

The scanning electron micrographs presented here were taken on an Etech Scanning electron microscope at approximately 45° viewing angle. The accelerating voltage was 20 KV. Specimens were coated with gold using a Polaron E500 Dioxide Sputter Coater. Coating thickness is estimated at about 36 nm.

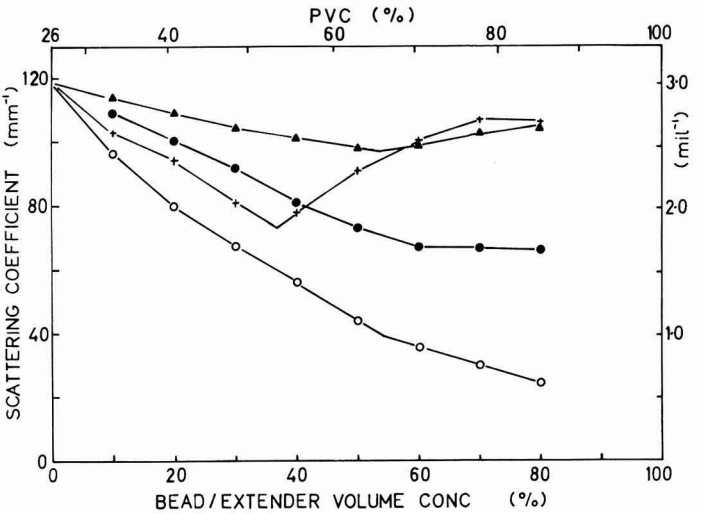


Figure 6—The effect upon the scattering coefficient of the addition of beads or a mineral extender to a TiO_2/latex paint. Legend: ▲ - pigmented vesiculated beads; ● - pigmented solid beads; ○ - unpigmented solid beads; + - clay extender

PROPERTIES OF BEAD-CONTAINING PAINTS

The properties of bead-containing paints are illustrated by a series of demonstration paints containing beads at various concentrations. These paints are compared with similarly formulated paints containing a conventional clay extender* in place of the beads. The series of paints range in bead or extender volume concentration from zero to 80%. The PVC of the external phase is 26% TiO_2† in the latex binder.** Minor additives commonly found in conventional paints are used at the usual levels in these paints. All paints are formulated at 37.5% volume solids in order that the test results, when expressed on a wet film basis, may be directly compared. Optical and mechanical properties of the dry films have been determined over the range of bead and extender volume concentrations.

It is not being suggested that the mineral extended paints used here represent the limits of performance of conventionally formulated latex paints. They are used only to illustrate some typical characteristics of these paints and to provide a familiar reference point to assist in the understanding of the beahvior of beaded paints.

The choice of PVC level of the external phase, as with all paint formulations, is a compromise between adequate opacity, efficient TiO_2 utilization, and satisfactory mechanical properties of the paint film. Values different from those used here may be employed to produce a variety of paints designed to meet various commercial requirements.

Scattering Coefficients and the CPVC

In *Figure* 6, the lower horizontal axis represents the bead or extender volume concentration. As this concentration increases from zero to 100%, the PVC increases from 26% (the value for the external phase alone) to 100% as shown on the upper axis.

For this work, the volume concentration of TiO_2 in the pigmented solid beads is the same as in the vesiculated beads (6.7%), so the scattering obtained can be compared for the two types of beads at an equal TiO_2 loading. When solid beads are pigmented for use in commercial paints, the TiO_2 concentration is about 15% by volume, and the scattering is then higher than shown in *Figure* 6.

The scattering coefficient of each of four series of paints, as shown in *Figure* 6, decreases with the addition of beads or clay extender until the CPVC is reached. The CPVC is indicated by change of slope in

Table 1—Composition and Properties Of Premium Quality Conventional and Beaded Paint

	Conventional Formulation g/L (lb/U.S. gal)		Beaded Formulation g/L (lb/U.S. gal)	
Components				
Acrylic latex[a] (50% N.V.)	438	(3.65)	296	(2.47)
Mineral extenders (silica/silicates)	180	(1.50)	—	
Titanium dioxide[b]	310	(2.58)	207	(173)
Pigmented vesiculated bead slurry (29% N.V.)[c]	—		386	(3.22)
Additives	71	(0.59)	71	(0.59)
Water	366	(3.05)	254	(2.12)
	1365	(11.38)	1214	(10.12)
Properties				
PVC	43%		65%	
Volume solids	34%		38%	
S.G.	1.365		1.214	
Bead volume concentration	—		50%	
Total TiO_2 concentration g/L (lb/U.S. gal)	310	(2.58)	255	(2.13)

(a) Rhoplex
(b) Tioxide R-XL
(c) Spindrift

*ASP®400, a registered trademark of Engelhard Minerals and Metals Corp.
†Tioxide® R-CR6, a registered trademark of Tioxide Australia Ltd.
**Rhoplex® AC490, a registered trademark of Rohm and Haas Co.

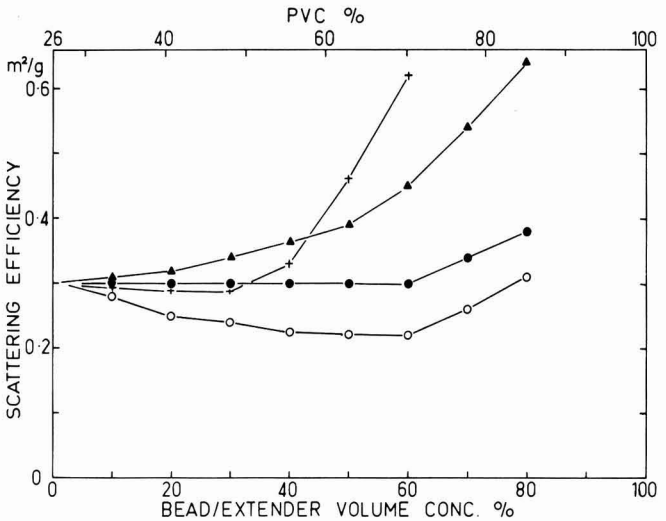


Figure 7—The effect upon the scattering efficiency of the addition of beads or a mineral extender to a TiO_2/latex paint. For Legend see *Figure* 6

the scattering curve, due to the onset of a contribution to the scattering from dry hiding.[16] The abruptness of the change of slope varies with different systems. The scattering coefficients of the beaded paints show less sensitivity to the CPVC than that of the clay-extended paint.

The CPVC for the clay-extended paint is at approximately 35% extender volume concentration (52% PVC), whereas that for the beaded paint is at approximately 55% bead volume concentration (65% PVC).

The clay was selected because its particle size distribution is similar to that of the beads. This comparison is based on the results of Coulter Counter measurements which minimize the effect of varying particle shape by measuring particle volume. The shape of the particle determines the surface area to volume ratio and influences the packing efficiency, while both of these factors affect the CPVC of the paint.[17] We believe that the spherical shape of the beads is significant in accounting for the high CPVC of the bead-extended paints.

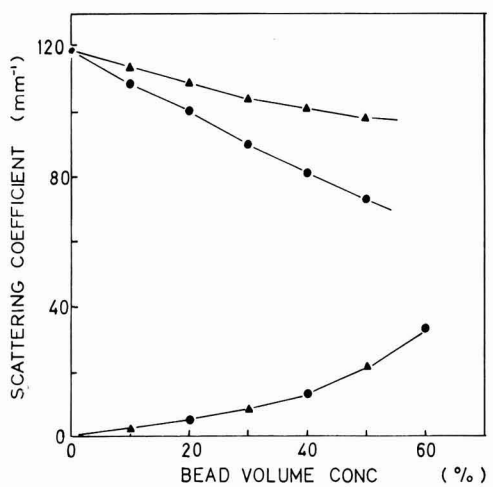


Figure 8—The effect upon the scattering coefficient of the addition of beads to either latex or a TiO_2/latex paint. For Legend see *Figure* 6

It should be noted from *Figure* 6 that even below the CPVC, large volume replacements (up to 55%) of external phase by pigmented, vesiculated beads can be made while maintaining high levels of scattering. The bead solids (polymer and TiO_2) have a volumetric cost similar to the external phase. However, 65% of the bead volume is air, which significantly reduces the volume cost of the beads compared to the external phase, resulting in increased cost savings with bead addition. The clay is also cheaper than the external phase, but the lower CPVC restricts the volume that can be used without sacrificing the physical properties of the paint.

Below the CPVC of the clay-extended paint, the pigmented, beaded paints have higher scattering than the clay-extended paint. However, they also have a higher total TiO_2 concentration due to the internal pigmentation of the beads. It is necessary then to examine the scattering obtained per unit volume of TiO_2, i.e., the scattering efficiency, to determine whether the higher scattering of the beaded paints is solely due to increased TiO_2 loading.

Scattering Efficiency

The addition of beads to a paint would be expected to increase the surface binder demand upon the latex, and so increase the effective PVC of the external phase. Thus the TiO_2 spacing, and therefore the scattering efficiency, would be reduced. This behavior is shown in the scattering efficiency curve for the unpigmented solid beads in *Figure* 7. These beads make no contribution to the total scattering; but by the mechanisms just proposed, they reduce the scattering efficiency of the TiO_2 in the external phase.

Table 2—Test Results

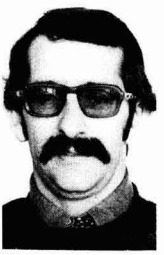
Property	Conventional Formulation	Beaded Formulation
Scattering coefficient mm^{-1} (mil^{-1})	90 (2.29)	102 (2.59)
Scattering efficiency m^2/g	0.29	0.40
85° gloss	1.3	1.4
Dry burnish - gloss change after 200 rubs	1.5	1.3
Scrub resistance ASTM 2486	480	510
Film porosity-reflectance decrease after removal of Gilsonite stain	15.1	11.3
Stain removal	Very Good	Very Good
Mud crack resistance	Good	Good

The addition of 6.7% TiO_2 to the solid beads gives increased total scattering and a scattering efficiency that is constant with increasing bead volume concentrations up to the CPVC. In this case, the reduction of efficiency of the external TiO_2 caused by the addition of beads is compensated for by the addition of the more efficient internal TiO_2.

When both pigment and vesicles are present in the beads, further increases in the total scattering and the scattering efficiency are obtained. Above the CPVC, all paint formulations in these examples show increases in scattering efficiency due to dry hiding in the external phase.

Since the TiO_2 is the most expensive paint component, the cost of the paint for a given level of scattering is closely related to the level of TiO_2 scattering efficiency achieved. *Figure* 7 shows that even below the CPVC, the use of pigmented vesiculated beads produces significant increases in the scattering efficiency. In practice, this allows formulation at the required level of scattering with lower total TiO_2 level and, hence, lower cost.

Figure 7 also indicates that the higher scattering coefficients of the paints containing pigmented, vesiculated beads are not solely due to increased TiO_2 loadings. Other factors such as interaction at pigment-air interfaces need to be considered.



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Microvoid and TiO_2 Synergism

The assessment of the synergistic contribution to scattering in a paint containing both microvoids and TiO_2 has been made[7] by comparing the scattering obtained from two paints—one containing only microvoids, and the second containing only TiO_2. The scattering of the paint containing both components was found to exceed the sum of the contributions of the components when measured separately, and the excess was attributed to a synergistic interaction between the TiO_2 and the microvoids.

Synergism in paints containing vesiculated beads can also be demonstrated using such a difference tech-

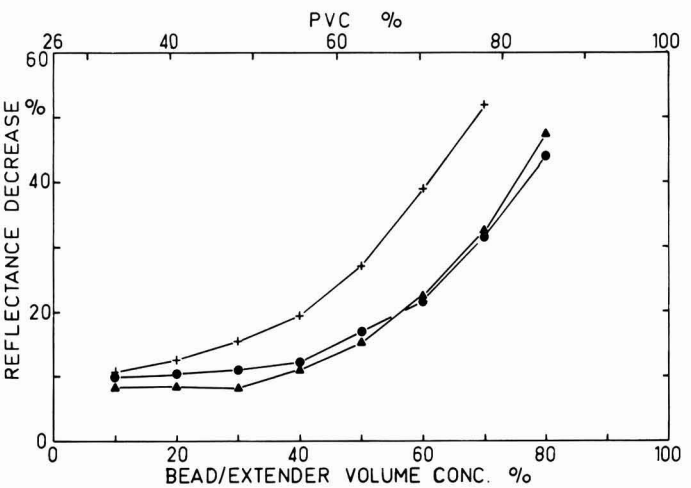

Figure 9—The measurement of film porosity by the change of reflectance due to staining by Gilsonite. For Legend see *Figure* 6

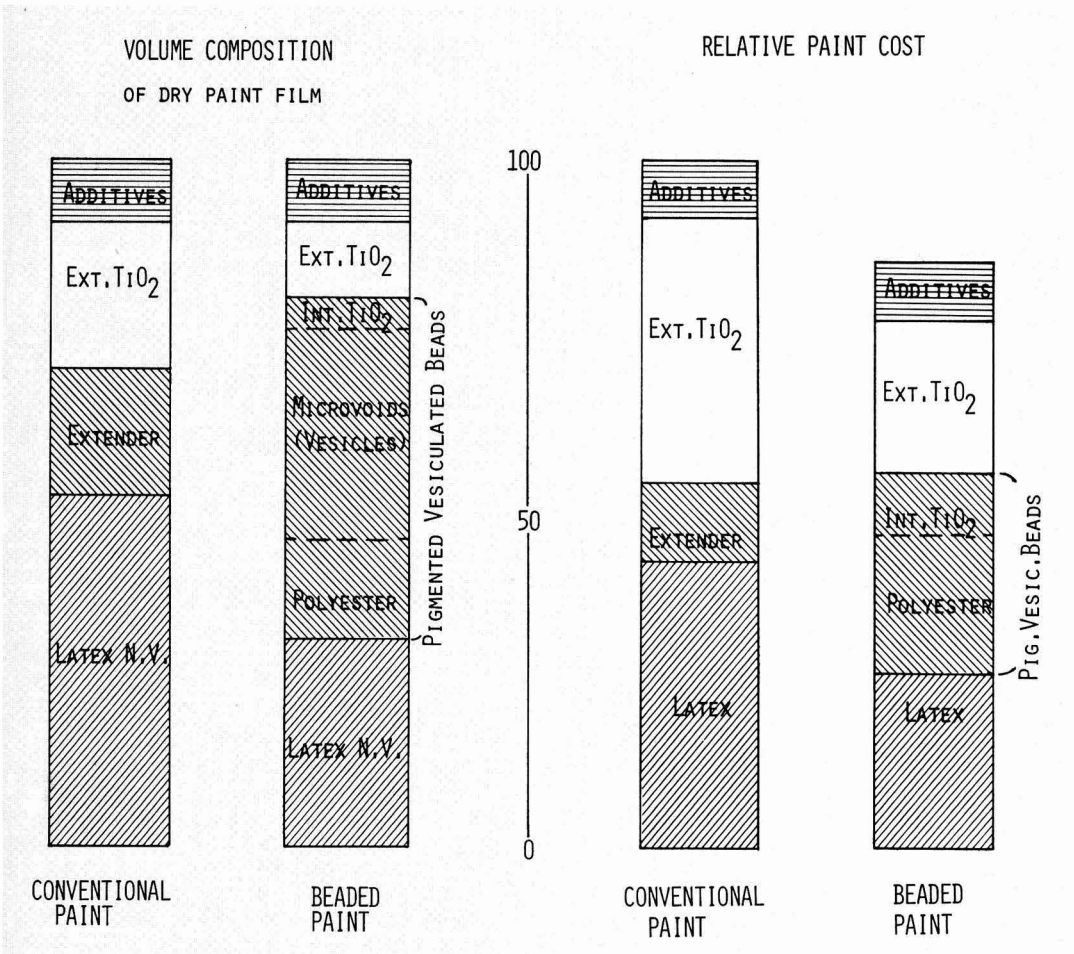

Figure 10—Comparison of conventional and beaded paints formulated to the same optical and physical properties

nique. The synergistic interaction within the beads between the internal TiO_2 and the microvoids is difficult to demonstrate without ambiguity because of the difficulty in producing solid and vesiculated beads with the same internal TiO_2 spacing. The interaction between the external TiO_2 and the microvoids can be demonstrated rigorously, and is significant both scientifically and commercially. It is this case in which the TiO_2 is known to be outside the microvoids which is demonstrated here.

Two types of beads are used for the demonstration. The pigmented vesiculated beads are those previously described and used for the data of *Figure* 6. A second sample of solid beads was prepared by adjusting the pigment concentration in the beads so that they produced the same level of scattering in latex as the pigmented vesiculated beads. The lowest curve of *Figure* 8 shows that the scattering derived from the beads is the same for both types of bead over a wide range of bead volume concentrations below the CPVC.

The upper curves of *Figure* 8 represent the scattering obtained from the two bead types when in a pigmented latex (PVC of the external phase = 26%). Since the bead component of scattering is the same for each case and the scattering from the external pigment would be expected to be the same, the differences between the two curves arises from a synergistic enhancement of scattering from the combined use of TiO_2 and microvoids.

This technique is believed to be unique in that the synergism being examined is that between the external TiO_2 and the (internal) microvoids which are physically separated, and does not arise from a simple lowering of the refractive index at the surface of the TiO_2 particles by placing the particles inside the microvoids. The scattering from the internal TiO_2 may well be enhanced by being in the microvoids, but this is simply included in the bead scattering component and does not contribute to the synergism demonstrated here.

These results also show that it is the average refrac-

tive index of the medium surrounding the pigment particle that influences the pigment scattering efficiency and not the refractive index at the pigment surface. This could not be demonstrated from previously published results on synergism[7,18] since the techniques used to incorporate microvoids may have allowed some of the TiO_2 particles to be contained within the microvoids.

Film Porosity

The porosity measurement is a guide to the physical properties of the paint and the ability to absorb stains. It is shown in *Figure* 9 that there is no significant difference between the vesicular-beaded paint and the solid-beaded paint in their relative ability to resist penetration by a staining medium. This test demonstrates that the inclusion of microvoids in the form of vesiculation is achieved below the CPVC with the retention of film integrity.

Once the CPVC is exceeded, there is a rapid increase in the film porosity since there is insufficient binder to fill the interstices between the pigment particles. However, even above the CPVC, the vesicles remain encapsulated within the bead, and the curves for the solid and vesiculated beads are very similar.

PRACTICAL FORMULATIONS

A range of latex paints of various qualities can be formulated with pigmented, vesiculated beads. As an example, a premium quality, conventionally formulated flat latex paint and a matched beaded paint are given in *Table* 1 to illustrate the formulation differences between the two types of paint. Each paint is formulated just below its CPVC.

The optical and mechanical properties of the two examples are summarized in *Table* 2. The paints are similar in their mechanical properties, but the beaded paint has a higher scattering coefficient despite the lower TiO_2 concentration, and follows from the high scattering efficiency obtained through the use of pigmented vesiculated beads.

The bar graphs of *Figure* 10 illustrate the volume composition of the dry paint films. The graphs show that reformulation to beaded paints is not a simple substitution of conventional extender by beads. In this case, the beads replace all of the extender, and part of the external TiO_2 and latex binder, producing obvious raw material savings. This results in a paint of significantly higher PVC (yet still below the CPVC for that paint) and lower total TiO_2 content.

An estimate of the relative paint costs, which include an allowance for manufacturing costs of beads and paint, are also given in *Figure* 10. Because raw material costs vary from time-to-time and place-to-place, presentation here of one particular set of costs would not be generally useful. However, cost figures from several sources indicate that cost savings of 10 to 20% can be achieved.

SUMMARY

Beads offer new opportunities for low gloss paint formulation. In particular, microvoids can be introduced in a stable form to enhance TiO_2 efficiency without prejudicing film integrity. Such vesiculated beaded paints offer a favorable cost/performance balance.

ACKNOWLEDGMENTS

The authors thank Dulux Australia Limited for permission to publish this paper. The direct contributions to the production of the paper from many staff members of the Central Research Laboratories is gratefully acknowledged. Dr. T. Price and P.J.K. Patterson, of Royal Melbourne Institute of Technology, provided the scanning electron micrographs. Their contribution is also acknowledged.

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Pigment Volume Concentration Effects In Color Prediction and Practice

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Color control technology, using digital computers, has advanced sufficiently to allow paint batches to be manufactured without physically matching the color standard in the laboratory. Generally, it is assumed that a color match, predicted with pigments characterized at a single pigment volume concentration (PVC), will not be affected when the loading is varied providing that the ratio of colored pigments to the titanium dioxide remains constant. This study explores why a gray industrial enamel violated that assumption and attempts to quantify the color change in order to achieve more usable color predictions.

INTRODUCTION

In the industrial community, users of coatings have a wide variety of specific requirements. Technical personnel at a coatings plant spend a great deal of time modifying existing products to satisfy the most commonly requested changes: color and application properties. A significant savings in time could be gained by manufacturing the initial production batch without the intervening laboratory color matching steps. Although slightly more adjustment may be necessary at first, once the batch has been approved, the formula can be "fine-tuned" for ease of future production.

Technological advances in digital color control systems have been so great over the past decade that, by utilizing the color prediction and pigment loading capabilities they provide, a time savings may be realized. Accurate predictions of the percentage of colored pigments necessary to match a standard can be obtained from the color prediction program operating with well characterized pigments. Since one customer may desire a cured film thickness of 0.381 mm (1.5 mils) and another might desire a thickness of 0.762 mm (3.0 mils), cost conscious coatings chemists can use the pigment loading program to achieve equivalent hiding power at the differing film thicknesses.[1]

Generally, pigments for digital color control are characterized at a single pigment volume concentration (PVC). Opacity can be conveniently controlled by first formulating to the desired hiding power at the minimum film thickness and then lowering the PVC of the coating with the addition of a nonpigmented clear vehicle of the same resin and solvent system to account for greater film thicknesses.

Color matches predicted at the "stock" loading are assumed to hold as the PVC is lowered (or raised when necessary) providing that the ratio of colored pigments to the white pigment remains constant. Unfortunately, that assumption may not always be valid.

In particular, when a considerable amount of clear was added to reduce the loading of a gray alkyd melamine bake enamel, a significant color change occurred. The color had become noticeably lighter and somewhat yellower. Although the color could still be adjusted, a close match at the "stock" loading had changed greatly enough so that it should not have been tolerated as an "on-test" production batch.

To achieve more usable computer predictions, the phenomenon causing the color dependency with a change in PVC must be more fully understood and, if at all possible, quantified.

EXPERIMENTAL

The main thrust of the experimental work involved the gray enamel previously mentioned and the base white coating from which it was made. For both the gray and the white, volumetric reductions were prepared with an alkyd melamine clear resulting in mixtures with ratios of: 100% of the original coating to 0% of the clear; 80% of the coating to 20% of the clear; 60% of the coating to 40% of the clear; 40% of the coating to 60% of the clear; and, finally, 20% of the coating to 80% of the clear. PVCs varied from 20.1 to 4.36% for the gray and from 19.94 to 4.3% for the white base.

Since the color change as a function of PVC was of

Presented by Ms. Welker at the 55th Annual Meeting of the Federation of Societies for Coatings Technology in Houston, Tex., October 28, 1977.

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Table 1—Color Differences of Gray Mixtures

Mixture Orig: Clear	% Pigment Volume Concentration	Color Differences			
		Total	Lightness	Yellow-Blue	Red-Green
100:0	20.10		Standard		
80:20	16.17	0.946 (2.39)	0.777 (1.97)	0.537 (0.89)	0.059 (1.03)
60:40	12.23	1.770 (4.61)	1.318 (3.36)	1.161 (1.93)	0.223 (2.50)
40:60	8.29	2.520 (6.50)	1.641 (4.18)	1.888 (3.13)	0.300 (3.87)
20:80	4.36	3.350 (8.28)	2.083 (5.32)	2.619 (4.35)	0.159 (4.63)

interest, rather than the color change as a function of opacity over a substrate, panels of the gray reductions were all made at a thickness sufficient to provide complete hiding. All of the gray panels were prepared by double coating the paints with a 1.524 mm (6 mil) nominal wet film thickness applicator blade over a sealed black and white Morest chart[2] and curing them at 121°C (250°F) for 15 min. Color measurements confirmed that complete hiding had been achieved.

White paints alone showed very little color difference as the PVC was varied. Opacity was most affected due to a change in the scattering power of the titanium dioxide at different loadings. The Kubelka-Munk scattering coefficients, which provide a quantitative measure of a pigment's scattering ability, can be calculated by specifically preparing panels of the white paint at incomplete hiding.

To obtain the necessary panels, drawdowns of the white reductions were made over a sealed black and white Morest chart[3] with a 0.381 mm (1.5 mil) applicator blade and cured for 15 min at 121°C. Additionally, a panel of the clear vehicle was prepared with a 1.524 mm applicator blade over a sealed black and white Morest chart.[2]

There is no reason to suspect that the color dependency with loading is limited to the neutral grays in which it had been first noted. To determine the magnitude of the effect in more chromatic colors, panels were prepared at two different PVC levels using the following colors: purple, purple-blue, blue-green, green, green-yellow, yellow, yellow-red, and red-purple. Prepared and cured as the gray panels had been, the chromatic color exhibits represented "real world" variations in loading which had actually been manufactured.

Spectrophotometric measurements of the films and substrates were made with a Hardy Recording Spectrophotometer[4] directly interfaced to a PDP 11/05 computer,[5] using pressed barium sulfate as a reflectance standard. Colorimetric values were calculated for the CIE[6] 1964, 10° standard observer viewing under illuminant D65.

The color differences referenced throughout the remainder of this article were calculated with the newly recommended CIELab equation.[7,8] However, for the convenience of readers not yet readily conversant with the new metric, color differences calculated with the more common FMC-2 equation[9-11] are given in parentheses. One FMC-2 unit is approximately a just perceptible color difference.

RESULTS

A numerical illustration of the dramatic visual effect is given in *Table* 1, which lists the color differences for the gray reductions at each PVC. Note how the lightness and yellowness-blueness components of the total color difference increase significantly as the PVC decreases.

Table 2 shows the color dependency effect for the chromatic colors. The approximate Munsell renotation, the initial PVC, the final PVC, and the color difference between the two are tabulated for each color.

ANALYSIS OF RESULTS

With the aid of the spectrophotometric curves for the original 100% gray, and the 60% gray—40% clear, 20% gray—80% clear reductions illustrated in *Figure* 1, and the curves of a white substrate and the clear vehicle

Table 2—Pigment Volume Concentrations and Color Differences for the Chromatic Colors

Color	Munsell Renotation	Pigment Volume Concentrations (%)		Color Difference
		Initial	Final	
Purple	2.5 P 3/8	7.90	2.32	1.408 (3.36)
Purple-blue	2.5 PB 5.5/11	25.40	5.06	1.985 (6.04)
Blue	10 B 3.5/8	14.29	3.26	0.690 (0.92)
Blue-green	2.5 BG 4.75/10	12.43	4.93	1.577 (2.28)
Green	1.5 G 5.5/12	16.93	3.92	2.283 (3.37)
Green-yellow	7.5 GY 6/10	17.52	4.87	2.475 (2.98)
Yellow	2.5 Y 8/14	14.04	6.62	0.783 (1.94)
Yellow-red	6.25 YR 7/14	30.02	11.01	2.939 (2.34)
Red-purple	5 RP 4.25/12	19.70	15.72	0.457 (0.86)

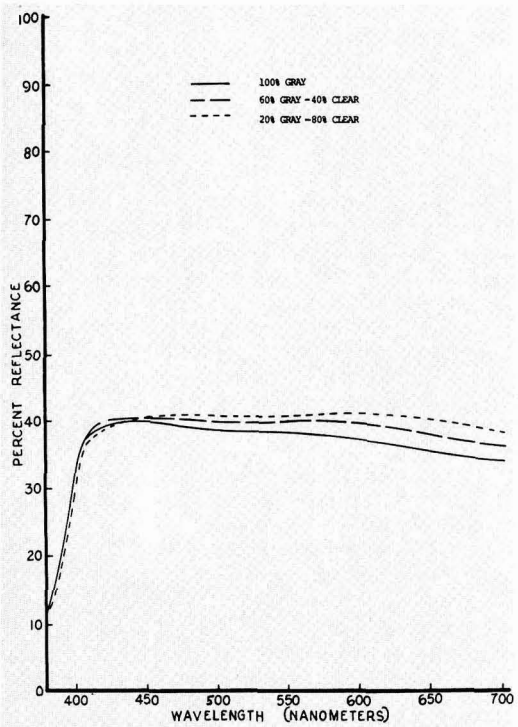

Figure 1—Spectrophotometric curves of the original gray paint, the 60% gray—40% clear mixture and the 20% gray—80% clear mixture

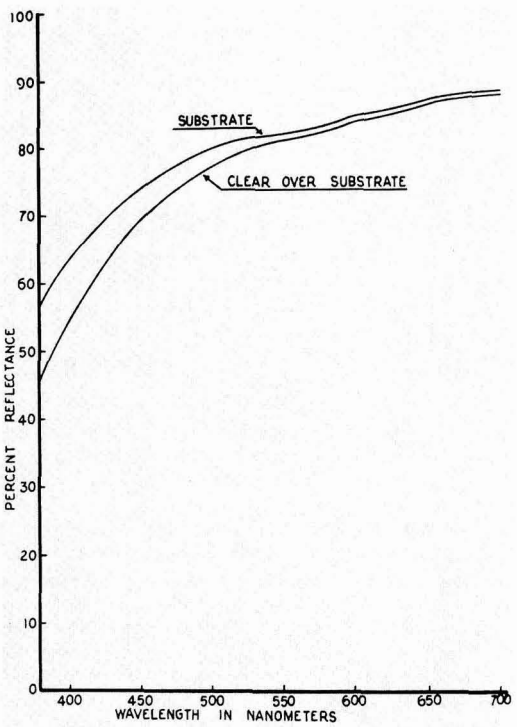

Figure 2—Spectrophotometric curves of a white substrate and the clear coated over a similar white substrate

Table 3—Standard Kubelka-Munk Equations

(1) $\frac{K}{S} = \frac{(1-R_\infty)^2}{2R_\infty}$

(2) $\frac{K}{S} = \frac{\Sigma c_i K_i}{\Sigma c_i S_i}$

(3) $S = \frac{1}{bX}\left[\text{c+gh}^{-1}\left(\frac{a-R}{b}\right) - \text{c+gh}^{-1}\left(\frac{a-Rg}{b}\right)\right]$

(4) $a = \frac{1}{2}\left[R + \left(\frac{R_0 - R + Rg}{R_0\ Rg}\right)\right]$

(5) $b = (a^2-1)^{1/2}$

(6) $S \approx \frac{R_0}{1-aR_0}$ when a approaches 1.0

(7) $R_{sub} = \frac{R'_{sub} - k_1}{1-k_1-k_2}(1-R'_{sub})$

In which:

- K is the absorption coefficient.
- S is the scattering coefficient.
- $R\infty$ is the reflectance factor of a layer at complete hiding.
- c_i is the proportion of pigment i, having absorption and scattering coefficients K_i and S_i, in a mixture of pigments.
- R is the reflectance factor of a layer over a background with reflectance factor Rg.
- R_0 is the reflectance factor of a layer over an ideal black background of reflectance factor 0.
- R_{sub} is the reflectometer value corrected for first surface corrections used in the above equations.
- R'_{sub} is the reflectometer value measured at a single wavelength on a spectrophotometer or abridged spectrophotometer.
- k_1 is the first surface reflection coefficient.
- k_2 is the diffuse internal reflection coefficient.

Note, that for this analysis, all reflectance factors and reflectometer values vary between 0 and 1.0.

coated over a white substrate shown in *Figure* 2, a qualitative explanation of the color change can be given.

Lightening of the gray is demonstrated by the higher reflectances from the panels to the reductions in *Figure* 1 and can be attributed to a decrease in the scattering efficiency of the titanium dioxide as the PVC is increased. Bruehlman, Thomas, and Gonick[12] describe the dependency of the scattering efficiency of titanium dioxide as a function of loading for a number of different paints.

As the clear vehicle is added, the curves in *Figure* 1 show a decrease in reflectance, which is the same as an increase in absorbance, in the blue region of the spectrum. Visually, the result is a yellowing of the gray which is similar to the yellowing of a white substrate when coated with the clear (see *Figure* 2). The clear is, in fact, somewhat yellow. Bruehlman, et al.[12] also report that, when absorption is also present, the scattering efficiency in the red region of the spectrum is more affected than the scattering efficiency in the blue region. An increase in the scattering of the longer wavelengths would tend to add somewhat to the yellowing of gray. However, it is believed that the vehicle yellowing would far outweigh the additional increase of scattering power in the overall visual effect.

Quantifying the increase in scattering efficiency for titanium dioxide becomes a straightforward matter when that is the only coloring pigment in a paint. Calculated with equations[13-15] (3) through (7) in *Table* 3, the Kubelka-Munk scattering coefficients at a wavelength of 600 nm for each loading of the base white paint are listed in *Table* 4. Also tabulated are the decimal fractions of the scattering coefficient for each PVC with the highest value obtained being taken as 1.00 and the remaining coefficients expressed as a fraction of that value.

The least squares regression line,[16] relating the decimal fraction as a function of loading, was determined from the data and is shown in *Figure* 3. By calculating the linear correlation coefficient, r, a measure of how well the line "fits" the data can be obtained.[17] If the data were perfectly represented by the line, r would be 1.0, and if the data were not described at all by the line, r would be 0.0. For this line, the linear correlation coefficient was 0.9; the line was a "good" fit to the data.

When calculated from the regression equation, the scattering coefficient decreased by 40.4% as the PVC increased from 4.30 to 19.94%, while the actual de-

Table 4—Scattering Coefficients and Decimal Fractions Of the Scattering Coefficients for Titanium Dioxide at 600 nm

Mixture Orig:Clear	Pigment Volume Concentration (%)	Scattering Coefficients (m^2/g)	Decimal Fraction of Scattering Coefficient
100:0	19.94	0.6753	0.5523
80:20	16.03	0.9206	0.7528
60:40	12.12	0.7889	0.6452
40:60	8.21	1.0530	0.8610
20:80	4.30	1.2230	1.0000

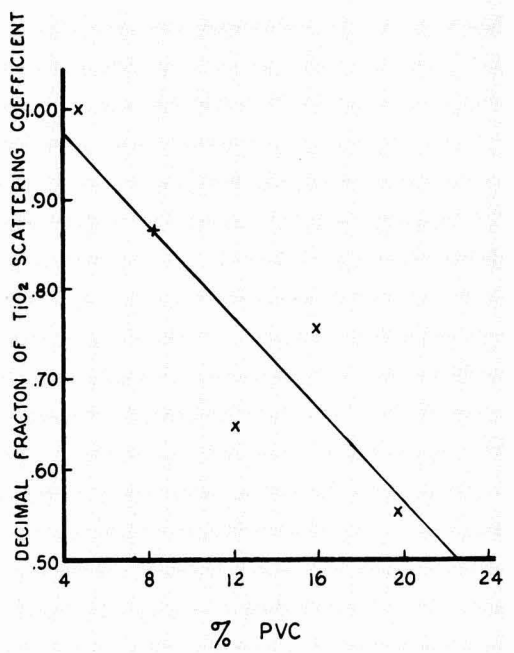

Figure 3—Linear least squares relationship between the decimal fraction of the titanium dioxide scattering coefficient and the percentage pigment volume concentration as determined from the base white paint

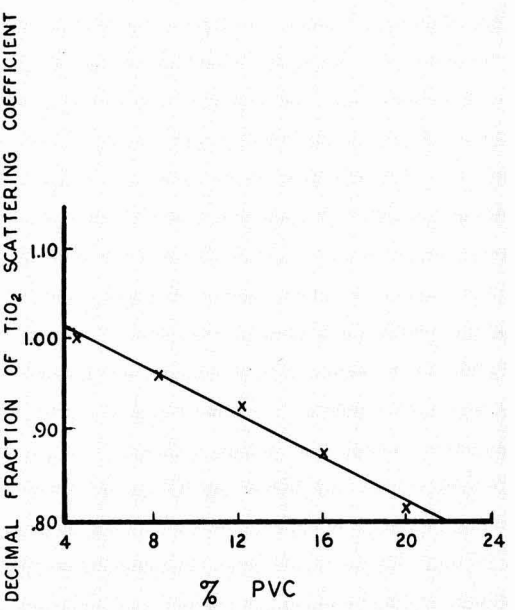

Figure 4—Linear least squares relationship between the decimal fraction of the titanium dioxide scattering coefficient and the percentage pigment volume concentration as determined from the gray-clear mixtures

Table 5—Reflectances, Proportion Decrease in the Titanium Dioxide Scattering Coefficient And Decimal Fraction of the Titanium Dioxide Scattering Coefficients of the Gray Mixtures at 600 nm

Mixture Orig:Clear	Pigment Volume Concentration (%)	Reflectance at 600 nm	Proportion Decrease in Scattering Coefficient	Decimal Fraction of Scattering Coefficient
100:0	20.10	37.38	−0.1906	0.8093
80:20	16.17	38.62	−0.1297	0.8703
60:40	12.23	39.61	−0.0779	0.9221
40:60	8.29	40.26	−0.0422	0.9578
20:80	4.36	41.00	0.0000	1.0000

crease in the experimental data was 44.8%. Although the graphical data compiled by Bruehlman, et al. had a maximum decrease of about 35%, the actual decrease was highly dependent upon the particular coating involved. Since no obvious experimental problems or inconsistencies could be discovered, there are no indications that the values obtained in the present study are either in error or unreasonably high.

A second estimate of the decreased scattering of the titanium dioxide can be made directly from the mixtures of the gray and the clear[18] providing two assumptions are made. The first is that only the scattering of the titanium dioxide will vary while that of the other pigments will remain constant; the second is that the absorption of all the pigments does not change.

From the reflectance measurements of the original gray and the reductions with the clear vehicle, the ratio of the absorption to scattering coefficients, K/S, was calculated at a wavelength of 600 nm [see equation (1) of *Table* 3]. By considering the greatest reduction to have the ratio K/S, and by considering the remaining mixtures and the original gray to have the ratio $K/(S + \Delta S)$, two equations can be solved so that the decrease in scattering of the titanium dioxide, ΔS, is expressed as a proportion of the scattering coefficient, S, of the 20% gray—80% clear mixture.

If the scattering coefficient of the titanium dioxide in the 20-80% mixture is taken to have the highest value of 1.0, then the decrease in scattering for each mixture can be expressed as a decimal fraction of the highest value.

Figure 4 shows the least squares regression line for the decimal fraction as a function of loading with the data shown in *Table* 5. A correlation coefficient of 0.99 was found for this line. Calculated from the preceding analysis, the maximum scattering decrease in the titanium dioxide is only 18.6%, a factor of two different from the decrease calculated from the white paint. One possible explanation is that the light in the pure white paint which was used with the Kubelka-Munk mathematics in *Table* 3 is more diffuse than in the gray coating, causing the discrepancy.

It is hoped that the question of which method of analysis is more correct will be solved at a later date when the pigments used in the gray coating can be characterized at varying loadings.

Computer programs can adjust for the lightening effect by increasing the scattering coefficient of the titanium dioxide according to the expected loading before the color prediction is calculated. Since the color will be lightened, the "safer" value to use in a program would be the one which predicts the lower increase in scattering, requiring a smaller compensating addition of the remaining colored pigments to maintain the match.

Analytical methods of quantifying the yellowing effect of the clear are not as direct as those for determining the scattering decrease in the titanium dioxide. However, by including the assumption that the change in titanium dioxide scattering is constant throughout the visible spectrum, an estimate of the vehicle yellowing can be made from the gray panels.

The yellowing analysis was done at a wavelength of 420 nm where the vehicle absorbs strongly (see *Figure* 2), but is free from the absorption of the titanium dioxide itself which begins at about 400 nm. Since the 20% gray—80% clear mixture exhibits the strongest yellowing, let the reflectance from that panel be used in calculating the ratio K/S. For the remaining mixtures and the original gray, the ratio $(K + \Delta K)/(S + \Delta S)$ will

Table 6—Reflectances, Proportion Decrease in the Vehicle Absorption And Decimal Fraction of the Vehicle Absorption Coefficients of the Gray Mixtures at 420 nm

Mixture Orig:Clear	Pigment Volume Concentration (%)	Reflectance at 420 nm	Proportion Decrease in Absorption Coefficient	Decimal Fraction of Absorption Coefficient
100:0	20.10	39.23	−0.2098	0.7902
80:20	16.17	39.65	−0.1709	0.8291
60:40	12.23	39.68	−0.1231	0.8769
40:60	8.29	39.26	−0.0665	0.9335
20:80	4.36	38.82	0.0000	1.0000

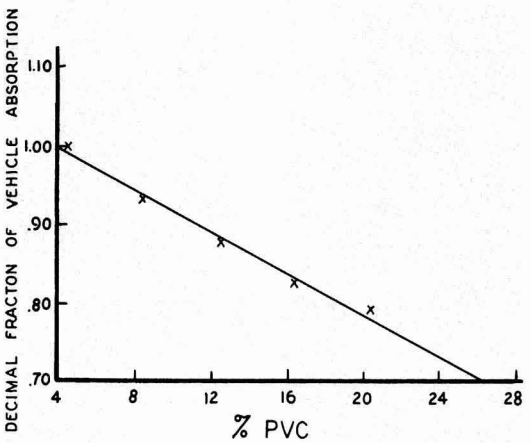

Figure 5—Linear least squares relationship between the decimal fraction of the vehicle absorption coefficient and the percentage pigment volume concentration as determined from the gray-clear mixtures

be determined. By assuming the constant change in titanium dioxide scattering across the spectrum, the decrease in scattering coefficient found at 600 nm for the grays can be used in solving these two equations.

Expressing the decreases in absorption with the increases in loading as proportions of the original absorption coefficient and as decimal fractions with the greatest absorption being set equal to 1.0 resulted in the data found in *Table* 6. *Figure* 5 illustrates the linear least squares relationship of the decimal fraction as a function of loading which had a correlation coefficient of 0.99. Although the absorption coefficient decreases by 21%, the limited wavelengths over which strong yellowing occurs cause small visual color difference compared to the increase in lightness. When considering the present state of sample reproducibility, it is unlikely that much could be gained by changing computer programs to adjust predictions for vehicle yellowing.

The spectrum of chromatic colors was included to help decide whether or not the color dependency on PVC is significant enough overall to justify the added complexity of adjustments with computer programming. From an examination of the color differences for the chromatic colors given in *Table* 2, it can be seen that once a departure from neutral colors occurs, neither effect is as pronounced.

CONCLUSIONS

Definite improvements in computer color predictions should be realized by adjusting the programming to allow for a change in scattering efficiency. More, although less significant, improvement might occur if the vehicle yellowing is taken into account.

The ultimate decision, however, as to whether or not to alter the programming will depend upon what is an acceptable "on-test" color-difference from the standard, and on the importance placed on the time savings gained by avoiding the laboratory color matching steps.

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ACKNOWLEDGMENTS

The authors acknowledge the assistance of Mary Furdek and William Laughlin in preparing the samples. Edward Cairns, of E. I. du Pont de Nemours and Co., Inc. deserves our thanks for the help he provided in determining the cause of our unexplained color shift and in his suggestions about how we might analyze our data.

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Optical Brighteners — Their Effect On the Yellow Appearance Of Linseed Oil Paint

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Three optical brighteners were incorporated into separate samples of a commercial linseed oil paint and, after storage in the dark, panels coated with these paints were evaluated spectrophotometrically and visually. The samples containing the optical brighteners achieved a smaller yellowness index than did the paint without optical brightener; in addition, each of these samples appeared less yellow to the human eye than did a paint with the same yellowness index but not containing an optical brightener.

INTRODUCTION

Linseed oil paints yellow with time, especially when stored in the dark. This yellow appearance results from absorption of light in the blue region of the visible spectrum. If this blue light could be restored, the material would no longer appear to be yellow. Optical brighteners[1] are organic compounds which absorb light in the ultraviolet region of the spectrum, thereby achieving a higher energy state. To dissipate this energy and return to the ground state, the molecule emits light of a longer wavelength, usually in the visible region. An optical brightener, or fluorescent whitening agent, which absorbs in the ultraviolet region and fluoresces in the blue region should make a paint film appear whiter than it really is.

Optical brighteners are used extensively in detergents.[2] Jones[3] and Algeo[4] describe the use and advantages of optical brighteners in pigmented systems. No detailed experimental data are presented in either paper.

In the course of our work[5,6] on the yellowing of linseed-based paints, we decided to evaluate three commercially available optical brighteners, both visually and spectrophotometrically, for their effect on the yellow appearance of a linseed oil paint.

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The mention of firm names or trade products does not imply that they are endorsed or recommended by the U.S. Dept. of Agriculture over other firms or similar products not mentioned.

MATERIALS AND METHODS

Optical Brighteners

The three optical brighteners studied were Uvitex® OB and Tinopal® SFG from CIBA-GEIGY Corp. and Phorwhite® K2002 from Verona Div., Baychem Corp.

Paints

The paint used in this study was Spencer-Kellogg Linseed Oil Outside House Paint. Its composition is given in *Table* 1. The required amount of each optical brightener to give the desired percentage of optical brightener relative to the weight of the entire paint was dissolved in a few drops of acetone (Phorwhite K2002 and Tinopal SFG) or toluene (Uvitex OB) and incorporated into the paint by shaking for 30 min. Phorwhite K2002 and Uvitex OB were studied in 0.05%, 0.1%, and 0.5% concentrations and Tinopal SFG in 0.01% and 0.05% concentrations.

Film Preparation

Masonite® squares (2 × 2 × ⅛ in.; 50 × 50 × 3 mm) were primed on both faces and all edges with Sherwin Williams' "Exterior Wood Undercoater." The test paints were applied in two coats two days apart to the smooth faces of the squares. The commercial paint was used as a control. Color was measured three days later and after 2, 4, 8, 12, and 16 weeks. The panels were stored between measurements in a dark cupboard in a room maintained at 73°F (23°C) and 50% relative humidity.

Color Measurement

Color was determined as previously described[5] by a weighted ordinate method after taking 17 readings 20 nm apart from 700 to 380 nm on a Beckman Model DB spectrophotometer with a reflectance accessory. From

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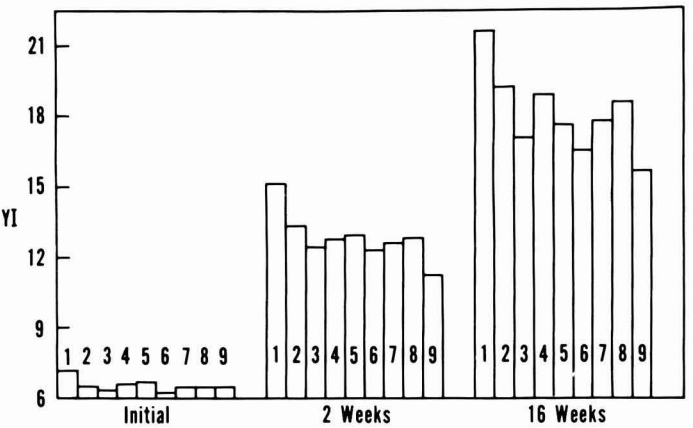

Figure 1 — Yellowness index vs. time for linseed oil paint films containing various amounts of optical brighteners. 1 = no optical brightener; 2, 3, and 4 = 0.05%, 0.1%, and 0.5%, respectively, of Phorwhite K2002; 5 and 6 = 0.01% and 0.05%, respectively, of Tinopal SFG; 7, 8, and 9 = 0.05%, 0.1%, and 0.5%, respectively, of Uvitex OB

these data a computer program[7] calculated the three CIE tristimulus values, X, Y, and Z and from these, a yellowness index $YI = \frac{100Y - 84.674Z}{Y}$.

DISCUSSION AND RESULTS

The results obtained spectrophotometrically are summarized in *Figure* 1. From this figure, it can be noted that most of the yellowing occurs during the first two weeks of storage in the dark. Also, it is to be noted that all the brighteners have some effect on lowering the YI at 16 weeks. The Uvitex OB at 0.5% concentration appears to have the greatest inhibiting effect.

The spectrophotometer measures reflectance at specific wavelengths. However, as stated by Jones[3] "conventional laboratory testing procedures have been utilized to little avail in measuring fluorescent effects. The only practical way to make an evaluation is with the human eye." Consequently, a selected group of persons with experience in evaluating paints was asked to examine these panels. They were asked to compare panels containing optical brighteners and having a certain yellowness index with panels registering a similar yellowness index but not containing an optical brightener. Panels containing paints with no optical brighteners, which were available for comparison, had YI's of 5, 12, 13, 14, and 18. In the opinion of the evaluation panel, a sample containing an optical brightener and having the YI indicated in Column 1 is comparable in appearance, to the eye, of a sample containing no optical brightener and having a YI has indicated in Column 2:

Column 1	Column 2
15	between 5 and 12
16,17	13
19	14
20	between 14 and 18

Thus, not only does the presence of the optical brightener in the sample decrease the YI of the sample relative to the control as measured by the spectrophotometer, but it also makes it appear even less yellow than that to the human eye.

Table 1—Composition of Linseed Oil Paint

Components	Pounds
Rutile TiO_2 (R-900®)	100
Anatase TiO_2 (Ti-Pure® FF)	100
Zinc oxide (XX-601®)	300
Talc (Nytal ® 300)	350
K.V.O. linseed varnish oil	304
T1215 Z2 heat bodied linseed oil	132
Mineral spirits	116
Fungicide (Metasol® TK-100)	1
6% Cobalt naphthenate (0.05%)	3.5
24% Lead naphthenate (0.5%)	9.0
	1415.5

R-900 and Ti-Pure are registered trademarks of E. I. du Pont de Nemours & Co., Inc.
XX-601 is a registered trademark of New Jersey Zinc Co.
Nytal is a registered trademark of R. T. Vanderbilt Co., Inc.
Metasol is a registered trademark of Merck & Co., Inc.

ACKNOWLEDGMENT

The authors thank the National Flaxseed Processors Association for providing a fellowship under which this work was carried out.

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Interrelationship Between Steel Surfaces, Phosphatability, and Corrosion Resistance

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The phosphatability of a steel surface and, hence, the corrosion protection achieved is related to the quality of that steel surface. It is the intent of this paper to determine what parameters of the steel surface influence phosphatability. This was done by examining the influence of steel surface roughness and contamination on zinc phosphate coating quality, and by determining the relationship of phosphate coating weight and density to the corrosion resistance of painted steel.

A high correlation was found between the amount of corrosion creepback of phosphatized and painted steel substrates and the amount of organic carbon present on the surface of the steel. The carbon, analyzed by Auger Electron Spectroscopy, averages approximately 50Å in depth and is not removed by phosphate precleaning operations. The carbon inhibits the formation and development of phosphate coatings which are required to provide satisfactory corrosion resistance.

INTRODUCTION

It is well known that for a paint system to exhibit good corrosion resistance, it is critical that a high quality zinc phosphate coating be applied.[1] A high quality phosphate coating is one that has attained a minimum coating weight and a high coating density. It is the purpose of this paper to study what effect the steel substrate has on achieving a high quality phosphate conversion coating.

It has been reported by Machu[2] that the condition of the steel substrate has a strong influence on the size, number, orientation, and composition of the zinc phosphate crystals. He studied the development of phosphate coatings as it is affected by alkali cleaning, acid pickling, brushing, polishing, grinding, and sand blasting. Umegaki, Okabe, and Omori,[3] in their study of zinc phosphate crystal growth on iron and steel, were able to show that the zinc phosphate crystals grew smaller and denser on carbon steel than on pure iron and that etched iron and steel accepted a better phosphate than did buff polished steel. Ghali and Potvin[4] discussed the effect the degree of surface roughness has on the morphology of the coating. They found that a fine sandblasting gave many active centers and a fine, dense zinc phosphate protective coating, while a rough sandblasted surface yielded nonuniform, irregular phosphate layers. Interestingly, they also determined that electrolytic polishing gave a smooth surface with low reactivity and that the phosphate coating had inferior protective qualities. Laukonis[5] showed that the ability to phosphate is dependent on the type of iron oxide present on the steel surface, ferric oxide being much more receptive than ferrous oxide.

Considerable work was done in our laboratories to determine the kind of zinc phosphate density necessary for a high quality phosphate coating.[6] Cheever points out that the steel surface affects the crystal size, and the type and number of crystals; it must be uniform in surface properties to permit the growth of zinc phosphate coatings. As an outgrowth of Cheever's work, the Ferrotest,[7] which is a rapid method of determining the coating density of zinc phosphate coatings, was developed.

It was Machu[8] who first enumerated a general theory on the effect that the steel substrate has on the formation of the zinc phosphate coating. He theorized that the larger the number of nucleating sites (sites that have a higher energy level than the mean surface energy) the finer, more dense will be the crystal structure. Moreover, whatever is done to the steel surface has an influence on surface energy. For example, pickling and alkali cleaning deactivate the surface, while sandblasting, polishing, and grinding activate the surface.

From this previous work, it was concluded that the ability to phosphate, and, hence, corrosion protection, is directly related to the quality of the steel surface. It is the intent here to determine what parameters of the steel surface influence phosphatability. This was done by:

(1) Determining the relationship of phosphate coating weight and density with corrosion resistance of painted steel.

(2) Determining the influence of steel surface roughness and contamination on zinc phosphate quality.

(3) Evaluating test methods available for ascertaining zinc phosphate coating weight and density.

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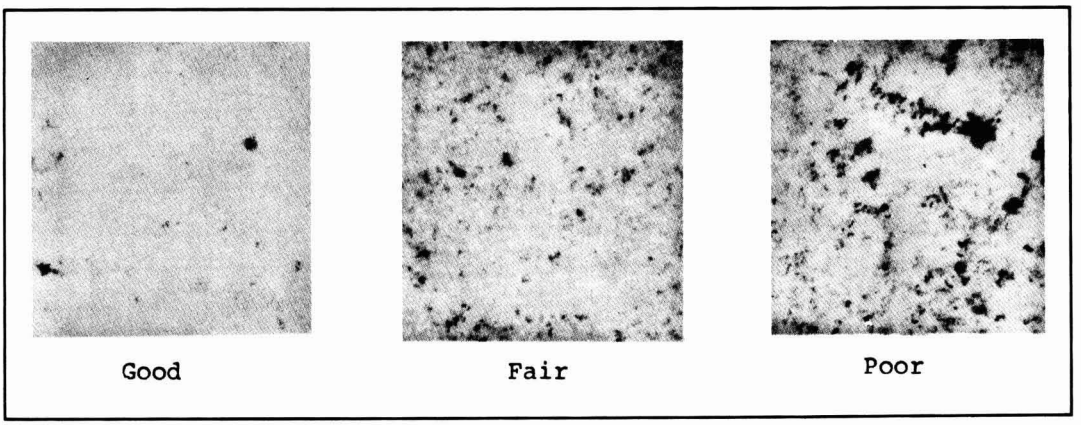

Figure 1—Typical Ferrotest results

(4) Reassessing the correlation between Ferrotest and corrosion resistance.

EXPERIMENTAL

Sample Preparation

All samples were provided by one of General Motors' divisions. The samples were selected randomly at several fabrication plants for an audit of the surface roughness and the corrosion resistance. Each sample consisted of two panels, one as received and one after phosphatizing with an automotive quality zinc phosphate coating. The phosphate coating system consisted of the following stages: (1) alkaline cleaner, (2) water rinse, (3) emulsion cleaner, (4) water rinse, (5) spray zinc phosphate, (6) water rinse, (7) acid rinse, (8) deionized water rinse, and (9) dry off.

Test Procedures

FERROTEST: The Ferrotest was performed on all of the submitted phosphatized panels. Standard procedures and rating methods were used.[7] Typical "good," "fair," and "poor" Ferrotest results are shown in *Figure* 1.

INFRARED: A Perkin-Elmer 621 grating infrared spectrophotometer was used to measure the relative coating weight of the phosphatized panels. The instrumental parameters are given in *Table* 1. A standard specular reflectance unit with one inch diameter apertures in both the reference and the sample beams was used. Both apertures were masked to decrease their width to one-half inch. The apertures were masked so that the long dimension of the slot was parallel with the direction of the beams. A lightly sanded steel panel was used in the reference beam. The panel was sanded in such a manner as to keep most of the spectra on the chart without changing the scale position.

Zinc phosphate has three strong absorption bands at wavenumbers of 1100, 1000, and 930 cm^{-1}. The baseline method was used to determine the amount of absorbance. The sum of the three absorbance values was used as a measure of the relative coating weight.

X-RAY FLUORESCENCE: Cadmium 109 (10 mCi) was the radioisotope excitation source. An Ortec Si (Li) silicon detector system was coupled to a Nuclear Data 4410 multichannel analyzer through a change-sensitive preamplifier and an Ortec 716 shaping amplifier.

A cadmium mask with a 9 × 34 mm opening was used to examine a uniformly sized portion of each sample. The sample was scanned for 300 sec. Only the Ka fluorescent X-rays at 8.64 keV generated by zinc were used to determine the relative amount of zinc phosphate coating.

AUGER ELECTRON SPECTROSCOPY: In Auger Electron Spectroscopy (AES),[9] a specimen is excited with an electron beam causing inner shell electrons to be removed from the atoms present. Through a relaxation mechanism, outer shell electrons fill the created vacancies and so-called "Auger electrons" are ejected from the material. An "Auger Spectrum" is obtained by plotting the derivative of the electron energy dis-

Table 1—Instrumental Parameters For Measuring Relative Coating Weight[a]

Polarizer	Out
Scan clutch	In
Scan time	16
Suppression	6
Expansion	1X
Attenuator speed	11
Amplifier gain	~3.3
Slit program	10
Scan program	In
Filter	Auto
Slits	2X
Source Intensity	0.8
Energy meter adjust	AGC Off
Test signal	Off

(a) Instrument used was Perkin-Elmer 621 Grating Infrared Spectrophotometer.

Table 2—Product Moment Correlation Coefficient Results

Parameters	Correlation Coefficient (R)
Salt spray creepback - Ferrotest	0.75
Salt spray creepback - Infrared	0.33
Salt spray creepback - X-ray fluorescence	0.25
Salt spray creepback - Surface roughness	−0.09
Salt spray creepback - Net peak density	−0.17
Ferrotest - Infrared	0.33
Ferrotest - X-ray fluorescence	0.20
Ferrotest - Surface roughness	0.00
Ferrotest - Net peak density	−0.08

Table 3—Spearman's Rank Correlation Coefficients For Various Parameters

Parameters	Correlation Coefficient (R)	t-Test[a] (t)
Infrared - X-ray fluorescence	0.81	14.0573
Surface roughness - net peak density	−0.14	−1.3852
Infrared - net peak density	−0.04	−0.3550
Infrared - surface roughness	0.01	0.0624
X-ray fluorescence - net peak density	0.01	0.0687
X-ray fluorescence - surface roughness	−0.03	−0.2817

(a) $t_{100.0.025} = 1.9840$

$t = R\left[\frac{n-2}{1-R^2}\right]^{1/2}$, where R = correlation coefficient, n = number of samples

tribution versus energy. The typical analysis depth with AES is on the order of 10Å or less and elemental concentrations as low as 0.1% of a monolayer can be detected and identified. The AES can remove by sputtering 10Å layers from the surface and subsequently analyze the fresh surface.

ELECTRON SPECTROSCOPY FOR CHEMICAL ANALYSIS: In Electron Spectroscopy for Chemical Analysis (ESCA),[9] a specimen under vacuum is irradiated with monochromatic X-rays, causing electrons with kinetic energies characteristic of the parent atoms and the incident X-ray energy to be ejected from the specimen. A spectrum containing distinguishing peaks for each constituent element is obtained by plotting the total number of ejected electrons versus kinetic energy. ESCA is a surface analysis technique with a typical analysis depth on the order of 20Å or less, and ultimate sensitivity is sufficient to allow fractions of a monolayer to be detected and identified.

SALT SPRAY CREEPBACK: The phosphatized steel panels were primed with an alkyd dip primer to a film thickness of 0.4-0.6 mil (10-15μ) and baked 30 min at 385°F (196°C). An acrylic sealer was applied to a film thickness of 0.2-0.3 mil (5-8μ). A black acrylic lacquer was applied to a film thickness of 1.8-2.2 mil (46-56μ) and baked 30 min at 310°F (154°C). The panels were scribed and tested according to ASTM B117 Salt Fog Testing.

SURFACE ROUGHNESS AND NET PEAK DENSITY: Surface roughness and net peak density measurements were conducted on the unphosphatized steel samples according to SAE test methods.[10]

RESULTS AND DISCUSSION

The phosphatized panels were subjected to the Ferrotest. The salt spray creepback results were apportioned into the same rating categories used with the Ferrotest to give, statistically, the same distribution (Appendix I). A product moment correlation coefficient (Appendix II) of 0.75 was obtained between the salt spray creepback and the Ferrotest. This is essen-

Table 4—Salt Spray Creepback Ratings of Various Grades of Steel by Supplier

Type of Steel	RIM 16-1E			Drawing Quality 16-2E			Aluminum Killed 16-5E			Zincrometal 16-67E		
Supplier	Number of Samples	Σ[a]	Average Rating	Number of Samples	Σ[a]	Average Rating	Number of Samples	Σ[a]	Average Rating	Number of Samples	Σ[a]	Average Rating
A	5	19	3.80	—	—	—	5	10	2.00	—	—	—
B	5	21	4.20	2	10	5.00	7	28	4.00	—	—	—
C	5	12	2.40	—	—	—	5	7	1.40	—	—	—
D	3	9	3.00	—	—	—	2	10	5.00	5	25	5.00
E	5	24	4.80	2	10	5.00	3	11	3.67	—	—	—
F	5	17	3.40	—	—	—	3	15	5.00	—	—	—
G	4	11	2.75	1	2	2.00	6	15	2.50	—	—	—
H	9	32	3.56	1	1	1.00	9	23	2.56	—	—	—
I	—	—	—	2	10	5.00	—	—	—	—	—	—
J	1	5	5.00	—	—	—	—	—	—	—	—	—
K	6	27	4.50	—	—	—	2	7	3.50	—	—	—
	48	177	3.69	8	33	4.12	42	126	3.00	5	25	5.00

(a) Σ = the sum of the ratings were: Good = 5; Good- =4; Fair = 3; Fair- = 2; and Poor = 1.

Table 5—Salt Spray Creepback Ratings of All Samples by Supplier

Steel Supplier	Good	Good-	Fair	Fair-	Poor	Number of Samples	Σ[a]	Average
A	2	1	3	2	2	10	29	2.90
B	9	2	1	1	1	14	59	4.21
C	1	—	2	1	6	10	19	1.90
D	8	—	1	—	1	10	44	4.40
E	8	1	—	—	1	10	45	4.50
F	5	—	2	—	1	8	32	4.00
G	3	1	—	2	5	11	28	2.55
H	5	1	5	4	4	19	56	2.95
I	2	—	—	—	—	2	10	5.00
J	1	—	—	—	—	1	5	5.00
K	3	4	1	—	—	8	34	4.25
Total	47	10	15	10	21	103	361	3.50

(a) Σ = the sum of the ratings were: Good = 5; Good- =4; Fair = 3; Fair- = 2; and Poor = 1.

tially the same as attained by Cheever[7] in his original work. Correlation coefficients were determined for the Ferrotest, salt spray creepback, and other significant parameters. These results are given in *Table* 2 and Appendix II. It can be seen from *Table* 2 that only the Ferrotest is successful in predicting the ultimate degree of salt spray creepback resistance of a zinc phosphate coated panel. A low correlation coefficient, 0.33, indicates that a small but definite relationship exists between the infrared results and corrosion creepback. This is attributed to the fact that a certain minimum phosphate coating weight is required to have adequate corrosion resistance. The infrared analysis, which is a measure of coating weight, can detect those samples that have a low coating weight.

A Spearman's rank correlation coefficient[11] was run between all of the parameters that could be ranked and the results are given in *Table* 3. It can be seen that there is excellent agreement between the infrared and X-ray fluorescent results. Both methods are a measure of coating weight.

It was thought that a rough surface would allow the formation of heavier phosphate coatings than a smooth surface. The larger surface area would require more phosphate coating for total coverage. The correlation coefficients indicate that the roughness tests, surface roughness, and net peak density do not correlate with either the corrosion creepback or the coating weight tests. These results agree with Machu[8] who determined that in order to obtain an increase in phosphate quality an increase in net surface energy is necessary. Surface roughness in itself does not provide this.

The salt spray corrosion creepback ratings of the various grades of steel tabulated versus the various suppliers are shown in *Table* 4. Comparing the 16-1E, cold rolled commercial quality rim steel (rim steel), with the 16-5E, cold rolled aluminum killed drawing quality steel (aluminum killed steel), it was found that, using the t-test, the rim steel is significantly better than the aluminum killed steel in corrosion resistance. The aluminum killed steel is used for parts which require deep draws. In addition, the aluminum killed steel retains its drawing qualities with the passage of time, whereas the rim steel loses drawing properties. Also, a significant difference in the corrosion resistance between the 16-67E, Zincrometal® steel, and the aluminum killed steel exists. The good corrosion resistance of the Zincrometal steel is attributable to the special cleaning process required to attain satisfactory adhesion between the Zincrometal coating and the base metal. The sample size of the 16-2E cold rolled drawing quality steel was too small to exhibit any significant differences between it and the other types of steel.

Table 5 shows the corrosion creepback ratings of the samples for the various steel suppliers. The entire range of ratings are realized for each supplier with 10 or more samples. Each supplier in this category had furnished samples rated "Good" and "Poor". This shows that each supplier is capable of producing steels that give satisfactory corrosion resistance when subsequently phosphatized and painted. Frequently, however, the steel is of such quality as to ultimately produce unsatisfactory corrosion resistance in laboratory tests.

From these results it was discerned that neither the zinc phosphate coating weight nor the surface roughness of the steel had a significant influence upon the corrosion resistance of the painted samples. Only the Ferrotest, which is a measure of phosphate porosity, gave good correlation with corrosion creepback results.

Further experiments were performed to determine if the composition at the steel surface influenced either the formation of the phosphate coating or the corrosion resistance.

A total of 25 of the previously described samples were selected for further testing. From each supplier were selected one of the best samples and one of the poorest samples, with regards to corrosion resistance. Additionally, several samples were chosen which exhibited intermediate corrosion resistance. The bare steel samples were cleaned in a laboratory washer with a 7.50 g/l solution of a commercial alkali metal cleaner

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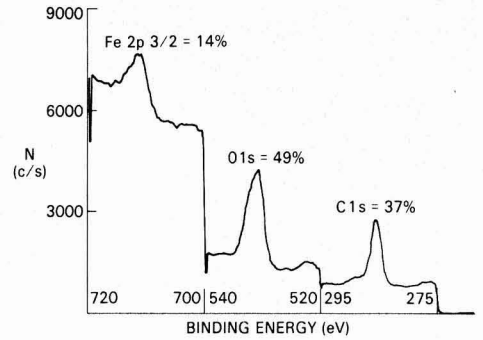

Figure 2—ESCA spectra showing a low amount of carbon on the surface of a steel that had good corrosion resistance

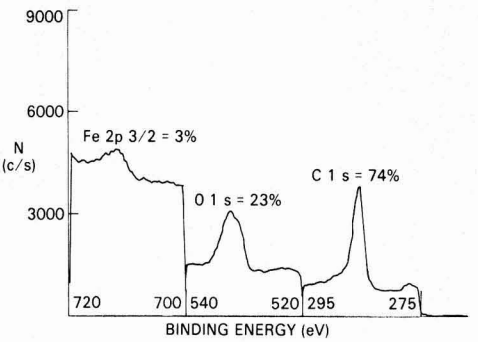

Figure 3—ESCA spectra showing a high amount of carbon on the surface of a steel that had poor corrosion resistance

for one minute at 71°C prior to examination. ESCA and AES tests were performed on the bare steel samples. *Figures* 2 and 3 are ESCA spectra showing, respectively, a low and a high amount of carbon on the surface of two steels. *Figures* 4 and 5 are Auger spectra showing, respectively, a low and a high amount of carbon on the surface of two steels.

From *Table* 6 it can be seen that there is an inverse relationship between the amount of carbon and the amount of oxygen present at the surface. The carbon plus the oxygen constitute the majority of the material at the surface. As one increases in amount, the other decreases.

There is good correlation between the amount of iron and the amount of oxygen. This, along with the negative correlation between the iron and carbon, indicates that the iron is combined with the oxygen, probably in the form of oxides.

The sputter depth for oxygen is negatively correlated with the amount of oxygen while the sputter depth for carbon is positively correlated with the amount of carbon. This indicates that the oxygen is concentrated at the very surface as iron oxide. The deeper sputter penetrations give proportionally less oxygen. The amount of carbon, however, remains relatively constant throughout its depth range, at which point the amount drops rapidly to a minimum amount. This shows that the carbon is present only at the surface of the steel and is not diffused into the steel. The carbon was determined to be organic in nature, possibly a residue from mill oils or drawing oils.

The most important information gathered from the data was the correlation between the amount of carbon and the amount of corrosion creepback. This high correlation shows that the organic carbon in some way inhibits the formation of a phosphate coating which will provide satisfactory corrosion resistance. The prevention of the formation of this carbon film or its removal prior to phosphatizing is paramount in the formation of zinc phosphate coatings.

SUMMARY

The surfaces of steel substrates were analyzed by Auger Electron Spectroscopy and Electron Spectroscopy for Chemical Analysis. These data were compared with salt spray creepback studies performed on the same substrates which had been phosphatized and painted. It was found that there was a high correlation between salt spray creepback of the painted substrates and the amount of carbon present on the steel surface. This carbon is present in the form of organic carbon,

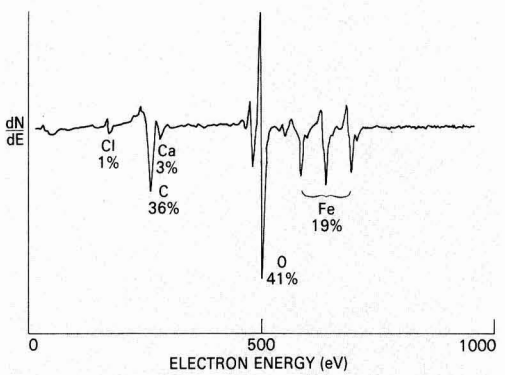

Figure 4—Auger spectrum showing a low amount of carbon on the surface of a steel that had good corrosion resistance

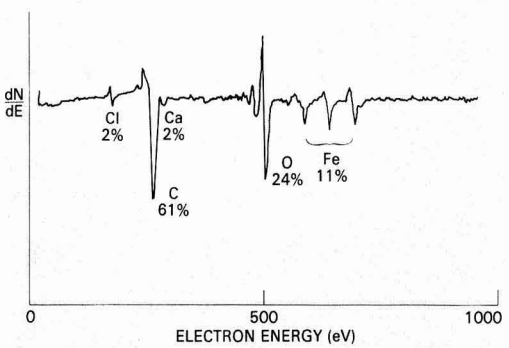

Figure 5—Auger spectrum showing a high amount of carbon on the surface of a steel that had poor corrosion resistance

Table 6—Spearman's Rank Correlation Coefficients Between Auger Electron Spectroscopy And Electron Spectroscopy For Chemical Analysis and Other Phosphate Parameters

Parameters	Elemental Analysis Method	Correlation Coefficient
Carbon vs. oxygen	AES	−0.95
Carbon vs. oxygen	ESCA	−0.99
Iron vs. oxygen	AES	0.87
Iron vs. oxygen	ESCA	0.83
Iron vs. carbon	AES	−0.84
Iron vs. carbon	ESCA	−0.86
Salt spray creepback vs. carbon	AES	0.72
Salt spray creepback vs. carbon	ESCA	0.61
Salt spray creepback vs. oxygen	AES	−0.60
Salt spray creepback vs. oxygen	ESCA	−0.59
Salt spray creepback vs. iron	AES	−0.53
Salt spray creepback vs. iron	ESCA	−0.44
Sputter depth of oxygen vs. oxygen	AES	−0.62
Sputter depth of carbon vs. carbon	AES	0.78

possibly from drawing oils, and inhibits the formation and development of a phosphate coating which is needed to provide satisfactory corrosion resistance.

When various grades of steel were compared for their ability to accept a phosphate coating and provide corrosion resistance, it was found that 16-1E cold rolled rim steel was better than the 16-5E cold rolled aluminum killed steel. However, the best corrosion resistance was obtained on 16-67E, Zincrometal steel which is specially cleaned in order to accept the Zincrometal treatment.

Only the Ferrotest, which is a method of determining zinc phosphate coating density, was successful in predicting the degree of corrosion creepback of phosphatized and painted steel. There was a slight but definite relationship between zinc phosphate coating weight and corrosion creepback. This leads to the conclusion that a critical minimum coating weight must be achieved to obtain good corrosion resistance, but coating density is still the most important criteria.

ACKNOWLEDGMENTS

The authors acknowledge the help of the Materials Development and Testing Laboratory, Fisher Body Div., for their aid in obtaining some of the data presented in this paper. We would also like to acknowledge Messrs. Robert Hill, Thomas Schreiber, and Warren Florance all of the Analytical Chemistry Dept., General Motors Research Laboratories, for their aid in obtaining some of the analytical data presented in this paper. Finally, we are indebted to Dr. G. Dale Cheever, General Motors Research Laboratories; Ted Lasko, Fisher Body Div.; and Don Delaney, Pontiac Motor Div. for their helpful discussions.

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Appendix I

The following distribution of ratings was obtained with the Ferrotest:

Rating	Frequency
Good	50
Good-	16
Fair	11
Fair-	7
Poor	19

The corrosion creepback results were distributed as closely as possible numerically into the same rating categories as follows:

Rating	Corrosion Creepback (32nd of an inch)	Frequency
Good	0 - 2	47
Good-	2.5	10
Fair	3	15
Fair-	3.5	10
Poor	4 - 7	21

$$\chi^2 = \frac{(47-50)^2}{50} + \frac{(10-16)^2}{16} + \frac{(15-11)^2}{11} + \frac{(10-7)^2}{7} +$$

$$\frac{(21-19)^2}{19} = 5.381$$

$\chi^2_{4,.05} = 9.488$, thus the frequency distributions are not significantly different.

Appendix II

The nature of the Ferrotest and the salt spray creepback data made it impractical to numerically rank the samples. The data from the Ferrotest and salt spray creepback were distributed into their corresponding rating categories. The product moment correlation coefficient was then determined. A sample calculation is given below:

Salt Spray Creepback

Ferrotest	P	F-	F	G-	G	n	X	X^2	Y	XY
G	1	2	4	6	37	50	250	1250	226	1130
G-	1	2	3	4	6	16	64	256	60	240
F	2	3	4	—	2	11	33	99	30	90
F-	2	1	2	—	2	7	14	28	20	40
P	15	2	2	—	—	19	19	19	25	25
n	21	10	15	10	47	103	380	1652	361	1525
Y	21	20	45	40	235	361	—	—	—	—
Y^2	21	40	135	160	1175	1531	—	—	—	—
X	34	31	50	46	219	380	—	—	—	—
YX	34	62	150	184	1095	1525	—	—	—	—

$$R = \frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{((n(\Sigma X^2) - (\Sigma X)^2)(n(\Sigma Y^2) - (\Sigma Y)^2))^{1/2}} =$$

$$\frac{103(1525) - (380)(361)}{((103(1652) - (380)^2)(103(1531) - (361)^2))^{1/2}} = 0.7492$$

Glossary

Rim steel

An incompletely deoxidized steel having the following characteristics: (a) during solidification an evolution of gas occurs sufficient to maintain a liquid ingot top until a side and bottom rim of substantial thickness has formed; and (b) after complete solidification, the ingot consists of two distinct zones - a rim somewhat purer than when poured and a core containing scattered blowholes, a minimum amount of pipe and an average percentage of metalloids somewhat higher than when poured and markedly higher in the upper portion of the ingot.

Aluminum killed steel

Steel deoxidized with aluminum in order to reduce the oxygen content to a minimum so that no reaction occurs between carbon and oxygen during solidification.

Drawing quality steel

A quench-hardened or normalized steel that has been reheated to a temperature below the transformation range, and then cooled at a rate desired.

Spearman's coefficient

A correlation coefficient obtained by the following formula:

$$R = 1 - \frac{\Sigma(d^2)}{n^3 - n}$$

where $\Sigma(d^2)$ is the sum of the squares of the rank differences and n is the number ranked pairs.

Society Meetings

Baltimore — May 18

The following officers were elected for the year 1978-79: President — Tom Cochran, of Bruning Paint Co.; President-Elect — Harry Schwartz, of Baltimore Paint & Chemical Co.; Secretary — Gordon Allison, of McCormick Paint Works Co.; and Treasurer — Mitchell Dudnikov, of Harry T. Campbell Sons Co.

M. DUDNIKOV, *Secretary*

Birmingham — April 6

R.H.E. Munn, of Cray Valley Products Ltd., spoke on "ALKYD RESINS."

Alkyds account for 60% of paint industry resin usage, are easy to make, relatively clean, and show wide tolerance. Starting with the simple chemistry of alkyd formulation from a polyol and polybasic acid and then oil modifications, the effect of the type and content of the ingredients on the properties of the resin film were shown by Mr. Munn.

Alkyd resins will be required to give much better pigment utilization, and oil-free polyesters will find increasing use in industrial coatings, continued Mr. Munn. High solids coatings have more chance of success than water-based, powders, or radiation curing. Developments in thixotropics will be based on urethanes and be suitable for industrial finishes.

Q. Can you explain what you mean by better pigment utilization?

A. One way to reduce costs is to use less pigment, so the resin must have better pigment dispersing properties.

Q. What developments can be expected in short oil alkyds soluble in aliphatics, to overcome pollution regulations?

A. One can do this by changing the polyacid but will have to compromise on properties.

Q. Could you elaborate on the effect of pressure during manufacture on properties?

A. It is chemical thermodynamics. Under vacuum the water produced is removed so the reaction proceeds faster, crosslinking occurs. Under pressure a narrower molecular weight spread is obtained giving better drying.

B. GILLIAM, *Publicity Officer*

Officers of the Southern Society for Coatings Technology for the year 1978-79. Left to right: President—A. Roy Neal; President-Elect—Alfred L. Hendry; Vice-President—Thad T. Broome; and Secretary-Treasurer—Franklin D. Rector

Birmingham — May 18

Peter Watson, of Metal Box Ltd, spoke on "Internal Can Linings."

Mr. Watson, discussing internal can linings, said that 10,000 million cans are sold per year in the U.K., worth a total value of £540 million. The components used in the manufacture of three-piece and two-piece cans, both DRD and DWI types, were mentioned with reference to the problems they present to the coatings formulator.

Mr. Watson said that tinplate still accounts for over 90% of U.K. cans, with aluminum only about 5% even though it has the advantage of not corroding easily and is light and easy to fabricate. However, aluminum is not biodegradable and the aluminum ring-pull end will be superseded by tinplate.

Lacquers must show good adhesion and flexibility, be resistant to damage during can manufacture, product resistant on processing and during storage, must not impart flavor to the product, must not affect product color or texture, and must be acceptable toxicologically. They must also have good application properties. Oleoresinous coatings are still widely used for vegetable and fruit cans, but phenolics are being superseded by epoxies, said Mr. Watson. Vinyls, either in solution or as organosols, show excellent flexibility and freedom from flavor, but may be replaced due to legislation on limits of vinyl chloride monomer present in the coating. Acrylics are not widely used for internal lacquers, and butadiene, although widely used in the U.S.A., has not found favor in the U.K.

Future trends will be to higher solids and water based coatings with regard to improving the environment and con-

Officers of the Pittsburgh Society for Coatings Technology for the year 1977-78. Left to right: Secretary—Robert T. Marcus; Vice-President—John S. Dahl; Treasurer—Raymond C. Uhlig; Council Representative—Gerald B. Ward; and President—Leonard W. Magnusson

Society Meetings (Continued)

serving energy. The number of proscribed solvents will increase. Two-pack coatings with lower curing temperatures will increase, as will the use of tin-free steel which can be stoved at temperatures such as 350°C for a few seconds.

Q. What does the future hold for electrophoretic or powder coatings?

A. Both will be used for two-piece cans.

Q. Has a black coating been considered?

A. Yes, on two-piece cans, grey not black, but the problem is customer acceptance.

BRIAN F. GILLIAM, *Publicity Officer*

Dallas — May 11

Twenty-five-year pins were awarded to Ed Chartrand, of C.H. Draggert; Art Hess, of Glidden Div., SCM Corp.; Dick Gohman, of Jones-Blair Co.; and Ray Pierrehumbert, of Union Carbide Corp.

The following officers were elected for the year 1978-79; President — Sam Biffle, of Sherwin Williams Co.; Vice-President — Bill Holmes, of DeSoto, Inc.; Secretary — Richard Williamson, of Trinity Coatings Co.; Treasurer — Ray Marett, of Western Specialty Coatings Co.; and Council Representative — Carlos Dorris, of Jones-Blair Co.

Michael Pezzuto, Jr., of Polyvinyl chemical Industries, Inc. spoke on "POINT OF VIEW: WATER-BORNE COATINGS."

The problem areas with waterborne coatings, namely application and appearance, flash rusting on metal, and grain raising on wood were enumerated. Mr. Pezzuto said that a very important factor in water base is the particle size, which is the real determining factor in emulsion, dispersion, and solution waterborne coatings. In addition, particle size of the vehicle has a great effect on the properties of the system, particularly gloss and film formation.

The generic systems that seem to work best in the areas now occupied by nitrocellulose lacquers, such as wood finishing, are the acrylics. Systems are available now that will produce good results, but the importance of the *system* was stressed. All items used in the finishing operation, from sanding sealer to clear finish coat, must be formulated to work together as a system, rather than just substituting for existing non-water products one at a time, continued Mr. Pezzuto.

W. F. HOLMES, *Secretary*

Golden Gate — April 17

Dr. Frisco G. Will Eboorose, of Union Carbide Corp., spoke on "EVAPORATION OF ORGANIC SOLVENTS FROM WATER-BORNE FORMULATIONS."

Dr. Eboorose mentioned that water as the sole solvent has some very attractive properties: it is economical, nontoxic, nonflammable, and it is nonpolluting. However, it unfortunately has some properties that limit its usefulness; for example, water has a very high surface tension, it has a relatively low boiling point, and above all, it has poor solvency for the commonly used coatings. Organic co-solvents, therefore, are included in water-borne coatings to monerate these properties and make water a useful solvent.

Dr. Eboorose went on to say that a program has been devised that simulates the industrial drying characteristics by following the composition of the wet film as a function of drying time. Since composition is defined, significant composition-dependent properties can be estimated at crucial stages of film formation.

TED FAVATA, *Secretary*

Golden Gate — May 15

Dr. Anthony P. Manzara, of 3M Co., spoke on "PHENALKAMINES."

These are low viscosity, easy to handle and use liquids. Aided by a series of slides, Dr. Manzara showed the different properties that were attainable using these new phenalkamines.

Q. Are you implying that there is no shrinkage?

A. Yes, or as little as 2%.

Q. How much do these phenalkamines cost?

A. About $1 per lb.

Q. Do you have FDA approval?

A. We have USDA and are working on FDA now.

Q. Are they considered corrosives for DOT purposes?

A. No, they are not considered corrosives.

Q. How is the yellowing?

A. We are not recommending them for exterior exposures.

Q. Is moisture a problem?

A. No, it will even cure under water. It has excellent adhesion to damp concrete.

TED FAVATA, *Secretary*

Officers of the Rocky Mountain Society for Coatings Technology for the year 1977-78. Left to right: Treasurer—Frank Meyers; Vice-President—James Peterson; President—John Baker; and Council Representative—J.D. Mullen

Kansas City — May 12

Paul Sara, Chairman of the Education Committee, demonstrated the method of manufacture of both toluidine red and Hansa yellow pigments. Kits containing complete instructions and a data sheet explaining the chemical reactions were presented to area high school teachers in attendance.

W.J. FITZPATRICK, *Secretary*

Los Angeles — May 10

William G. Patterson, of 3M Co., spoke on "PHENALKAMINES: A NEW CLASS OF CURING AGENTS."

These epoxy curing agents, said Dr. Patterson, are suitable for high solids room temperature or low temperature coatings. One of the main advantages over previously available materials is their low viscosity. With the aid of a slide presentation, Dr. Patterson compared the phenalkamines with polyamines, polyamides, amidoamines and with the cycloaliphatic amines.

Q. You mentioned that glycerine was added to activate the Cab-O-Sil. Please explain.

A. It is put there to obtain better efficiency.

DONALD I. JORDAN, *Secretary*

Montreal — May 3

"BACK TO BASICS TO MAKE A BUCK," was the topic of a panel discussion led by members of the Manufacturing Committee. The areas of manufacturing that required the cooperation and understanding of technical departments and raw material suppliers were outlined. A debate followed.

C.A. MCWADE, *Secretary*

New York — May 9

The following officers were elected for the year 1978-79: President — Saul Spindel, of David Litter Laboratories, Inc.; Vice-President — Sidney J. Rubin, of Greenpoint Paint & Varnish Co.; Secretary — Marvin Schnall, of Troy Chemical Co.; Treasurer — Thomas Ginsberg, of Union Carbide Corp.; and Council Representative — S. Leonard Davidson, of NL Industries.

Gabriel Malkin, of Benjamin Moore & Co., was presented with the 1978 PaVaC Award for his outstanding contributions to the coatings industry and to the New York Society.

Royal Brown, of National Paint & Coatings Association, spoke on "GOVERNMENT IS CHANGING THE PAINT INDUSTRY."

Mr. Brown said that government intervention is the greatest external factor in changing the paint industry, and there are very few new products because of new regulations. He mentioned that regulatory agencies have shown a desire to operate on the basis of zero risk, which is not practical. There is, he said, a tendency toward regulatory overkill, and we will soon face coatings of inferior quality because there will not be enough time to thoroughly test new formulations. In conclusion, he said that industry is regulated on evidence which is not complete and that industry must do the research and present the results to the regulatory agencies.

SIDNEY J. RUBIN, *Secretary*

Piedmont — May 17

Art Massey, of Hercules Incorporated, spoke on "WATER DISPERSIBLE DRY COLORS."

Water dispersed colors are becoming more important due to pressure from various regulatory agencies, said Mr. Massey. Vehicle compatibility was the major early problem with this type of pigment, but the new generation of dry pigments have several advantages. They almost form a collodial solution in water, thus giving an extremely fine particle size. They are easy to store, give rapid dispersion, efficient coloring value, dispersion stability, broad compatibility, flexibility in formulating and they are moisture insensitive in the dried coating.

CHARLES B. WILSON, *Vice-President*

Pittsburgh — May 8

The following officers were elected for the year 1978-79: President — John S. Dahl, of J.H. Matthew Co.; Vice-President — Robert T. Marcus, of PPG Industries, Inc.; Secretary — Raymond C. Uhlig, of Technical Coatings Co.; and Treasurer — Richard Trudel, of Mobil Chemical Co.

Dr. William Wettach was presented with a plaque in recognition of his election as a Society Honorary Member last February.

William A. Hair, of Morehouse Industries, Inc., spoke on "HIGH SPEED DISPERSION AND SANDMILLING OF PIGMENTS."

In his two-part presentation, Mr. Hair first described some of the important characteristics of high speed dispersers. After stating that a good predispersion is a necessary requisite for a sandmill, he concluded his talk by discussing the parameters involved with the sandmilling of pigments.

ROBERT T. MARCUS, *Secretary*

Elections

CLEVELAND

Active

DUBEX, GIRISH C. — Maintenance, Inc., Wooster, Ohio

SMITH, GREGORY A. — Mansfield Paint Co., Mansfield, Ohio.

HOUSTON

Active

CALDERON, LUPE — Napko Corp., Houston, Tex.

PATEL, MAHENDRA M. — Intercoastal Paint Co., Inc., Houston.

SHAH, SURYAKANT J. — Matcote Co., Inc., Houston.

Associate

ANDRES, FRANK C. — Pullman Kellogg, Houston, Tex.

RABBY, KEN — Van Waters & Rogers, Houston.

STEVENSON, GEORGE H., JR. — Blen Mx Systems, Houston.

NEW YORK

Active

BALL, WALTER G. — G & W Natural resources Group, Bethlehem Pa.

BUSKER, DAVID — Kenrich Petrochemicals, Inc., Bayonne, N.J.

ENGEL, WALTER D. — Limbacher Paint & Color Works, Mt. Vernon, N.Y.

KAMIN, ALEXANDER M. — Boatlife, Hicksville, N.Y.

LOWELL, ARTHUR I. — Norton & Son, Bayonne.

MARATTA, GERARD E. — Norton & Son, Bayonne.

PATEL, PRAVIN — Troy Chemical Corp., Newark, N.J.

SEMADENI, PIETRO B. — CIBA-GEIGY Corp., Ardsley, N.Y.

Associate

ALTER, LEONARD S. — NP Div.-IMC Chemical Group, Inc., Edison, N.Y.

BLACEER, ROGER P. — Whittaker, Clark & Daniels, Inc., S. Plainfield, N.J.

FOLLETT, CHARLES V. — Royce Chemical Co., E. Rutherford, N.J.

MCCOLLUM, ROY K. — Nalco Chemical Co., Frenchtown, N.J.

JENE, ERWIN E. — Amsco Div., Union Oil Co. of Calif., Clark, N.J.

WAGNER, THOMAS P. — Callahan Chemical Co., Palmyra, N.J.

YOUNG, VERE — Wexler Contracting Corp., New York, N.Y.

PACIFIC NORTHWEST

Associate

BASSETT, JERRY D. — Hercules Canada Ltd., Toronto, Ont.

SOUTHERN

Active

SIMPSON, FLOYD A.—Griffin Paint Mfg. Co., Tampa, Fla.

SYED, JAVEED A.—Southern Prot. Prod. Co., Atlanta, Ga.

Associate

YOUNG, DENNIS J.—Moreland Chemical Co., Chamblee, Ga.

Technical Articles in Other Publications

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

Defazet (Deutsche Farben-Zeitung) (in German)

Published by Lack und Chemie Verlag Elvira Moeller GmbH, Karl-Benz-Strasse 11, Postfach 1168, 7024 Filderstadt 1, Germany

Vol. 32 No. 2 February 1978

Le Coz, E. - "Behavior of Zinc Dust in Zinc-Rich Coatings Based on Inorganic Silicates and Ethyl Silicates;" 56-60.
van Oeteren, K.A. - "Possibilities and Problems With the Coating of Hot-Dip Galvanized Steel;" 61-64.
Haagen, H. - "Test Methods for Stains for Windows of Coniferous Woods. II;" 65-69.
Terstiege, H. - "Color Tolerances in Power Vehicle Coating. II: Influence of Cylindrical Curvature on the Color Measurement of Plain Color Coatings;" 70-74.

Farbe und Lack (in German)

Published by Curt R. Vincentz Verlag, 3 Hannover, Postfach 6247, Schiffgraben 43, Germany

Vol. 84 No. 5 May 1978

Marquardt, W. and Gempeler, H. - "Importance of Triglycidyl Isocyanurate As a Reaction Component in Weather-Resistant Powder Coatings Based on Oil-Free Polyesters Which Contain Carboxyl Groups;" 301-306.
Kober, H. and Wimbersky, W. - "Characteristics of Dispersions Containing Magnetic Pigments;" 306-309.
Gellner, O. - "Water-Based Printing Inks — A Challenge;" 310-311.
Helmen, T. - "Measurement and Assessment of Chalking. A New Method Compared With Existing Standard Methods;" 315-322.
Snuparek, J. and Krejcar, E. - "Crosslinking of Emulsion Polymers Containing N-alkoxymethyl Groups;" 312-315.
Brushwell, W. - "Development of Polyurethane Lacquers" (Literature review); 323-324.

Pigment and Resin Technology

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

Vol. 7 No. 2 February 1978

Vittal Rao, R. and Yaseen, M. - "Effect of Temperature on Rates of Permeation of Chloride Ions and Water Vapor through Alkyd Coatings;" 4-8.

Vol. 7 No. 4 April 1978

Ellis, R.A. - "Recent Applications of Gel Permeation Chromatography in the Paint Industry;" 4-8.
El-Saawy, S.M., Abou-Khalil, M.A., and Ghanem, N.A. - "A Testing Station for Above-Water Paints;" 9-10.

Vol. 7 No. 5 May 1978

Ellis, R.A. - "Recent Applications of Gel Permeation Chromatography in the Paint Industry. II;" 4-17 (5 sides only).
Roobol, N.R. and Hutchinson, D.C. - "A Quick Test for Airless Sprayability;" 14-15.

Journal of the Oil and Colour Chemists' Association

Published by Oil and Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex, HAO 2SF, England

Vol. 61 No. 4 April 1978

Ledwith, A., Bosley, J.A., and Purbrick, M.D. - "Exciplex Interactions in Photoinitiation of Polymerization by Fluorenone-Amine Systems;" 95-104.
Berner, G., Kirchmayr, R., and Rist, G. - "Recent Developments in Photoinitiators;" 105-113.
Pelgrims, J. - "Present Status of Ultraviolet Curable Coatings Technology in the United States;" 114-118.
Knight, R.E. - "Design and Construction of Ultraviolet Lamp Systems for the Curing of Coatings and Inks;" 119-122.

Vol. 61 No. 5 May 1978

Bell, S.H. - "From Gold to Diamond: OCCA 1968-1978" (OCCA 60th Anniversary); 140-145.
Kavanagh, P.E. - "Application of Linear Programming to Paint and Resin Formulation;" 146-150.
Bird, R.J. and Park, D. - "Microanalysis of Marine Antifouling Paints in the Scanning Electron Microscope — Its Automation and Application to Less Homogeneous Paints;" 151-156.
Wypych, J. and Walczak, J. - "Mathematical Relationship Between the Viscosity of PVC1 Plastisols Including Fillers and Plasticiser Number of Fillers;" 157-159.
Oyarzun, J. - "New Method of Determining the Dispersibility of Pigments and the Optimal Mill Base Formulation;" 160-165.

Plaste und Kautschuk mit Fachteil Anstrichstoffe (in German)

Published by VEB Deutscher Verlag für Grundstoffindustrie, 27 Karl-Heine Strasse, 7031 Leipzig, E. Germany DDR

Vol. 25 No. 4 April 1978

Novak, J. - "Epoxy Resins and Their Plastification;" 209-210.
Roth, W. - "Infrared Spectroscopic Study of the Hardening of Epoxy Resins;" 210-211.
Häusler, K.-G., Schröder, E., and Schwarz, A. - Light-Beam and Curie-Point Pyrolysis of Polymers. V: Determination of Kinetic Parameters for the Thermal Decomposition of Polybutadienes, Polystyrene and Styrene-Butadiene Copolymers;" 212-215.
Klygina, R.V. and Kozlov, L.V. - "Studies of Molecular Weight Distribution of Various Film-Forming Substances by Gel Permeation Chromatography;" 246-248.
Ratov, A.N. - "Use of H-NMR Spectroscopy in the Study of Paint Material Systems;" 248-249.

La Rivista del Colore - Verniciatura Industriale (in Italian)

Published by La Rivista del Colore, S.R.I., Via Imbrini 10, 20158 Milan, Italy

Vol. 11 No. 120 April 1978

Anon. - "The Modern Technology of Painting FIAT - The 'Reverse' Process for Anti-Corrosive Protection of Cars: Powder - Electrocoating - Top Coat;" 131-139.

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Committee Activities

PAINTING OF STEEL STRUCTURES

SSPC Spring Meeting Focuses on Committee Activities

The Spring meeting of the Steel Structures Painting Council was devoted entirely to discussions of committee activity.

Surface Preparation

Surface preparation standards were again reviewed, and changes made according to committee consensus. The following standards have been rewritten and are awaiting review by the entire Research Committee prior to final acceptance: SSPC SP 5—White Metal Blast Cleaning; SSPC SP6—Commercial Blast Cleaning; SSPC SP7—Brush-Off Blast Cleaning; and SSPC SP10—Near White Metal Blast Cleaning.

A session was devoted to discussion of proposed new surface preparation methods, inasmuch as a combination of high surface preparation costs and regulatory pressures from federal, state, and local agencies are mandating changes in existing methods. Several participants described their successful experience with water blasting. One found it very effective for use on a building, where old paint and corrosion products were removed without damage to adjacent areas. Another experienced such success using water blasting on marine buoys that it will be tried on ship hulls.

A fairly comprehensive evaluation of CO_2 pellets was also presented, which cited difficulties in cleaning quality, costs, rate, and fog.

Other methods discussed included: a specially regulated blast nozzle; blending abrasives; and recycling abrasives.

Zinc Rich Primers

Several new task groups have been established to concentrate on writing performance specifications around zinc primers with unrestricted composition. This group will accumulate case histories, run "ladder" tests on zinc content, and tie in with field tests, PACE, surface profile, topcoating, and Golden Gate Bridge studies.

PACE

The Performance of Alternate Coatings in the Environment Committee reviewed the work already in progress.

The committee decided to change the structure of the subcommittees to parallel the major thrust of the PACE project. These classifications are Alternate Primer Pigments, Alternate Surface Preparation Media and Methods, and Alternate (Acceptable) Solvent/Binder Systems.

Performance Specifications

This committee met for the third time in six months. New emphasis is on writing a performance specification around the theme, "How Does the Owner Obtain Guaranteed Performance?"

DEAN M. BERGER
Delegate to
Steel Structures Painting Council

People

Loren B. Odell, after 42 years of service to the coatings industry, has retired from Napko Corp., Houston, Tex. He will continue to be active as a technical consultant for all phases of the coatings field.

A fellow of the American Institute of Chemists, Mr. Odell worked 15 years for Napko and retired as Technical Administrative Manager of the company's laboratories.

During his long association with the industry, he has had experience as a technical director, research director, plant manager, and technical and sales service representative. He was active in the installation of paint plants, the establishment of laboratories, and in the development and marketing of coating products.

Mr. Odell is a member of the Houston Society for Coatings Technology, the Houston Paint and Coatings Association, the National Association of Corrosion Engineers, the American Chemical Society, and several local business associations.

Walter K. Boyd has been named a Senior Research Leader at Battelle Columbus (Ohio) Laboratories. In this position, he will develop new areas in corrosion and electrochemistry. Since joining Battelle in 1945, Mr. Boyd has become an internationally recognized expert in the corrosion field, lecturing in Korea, Mexico, Canada, Soviet Union, Italy, and England. In 1977 he was the recipient of the Frank Newman Speller Award from NACE.

The Organic Chemicals Div. of W.R. Grace & Co. has appointed **William J. Leonard** Eastern Regional Sales Manager. He will be based at the company's Chatham, N.J. sales office.

Dr. David Firestone, of the U.S. Food and Drug Administration's Bureau of Foods, was installed as President of the American Oil Chemists' Society at the Society's recent annual meeting.

Air Products & Chemicals, Inc., Allentown, Pa., in a series of managerial appointments, has named **Thomas Kasline** Marketing Manager for the Industrial Chemicals Div.; **Ronald L. Turner** was appointed to the same post in the Polymer Chemicals Div.; and **Peter F. Rezzoali** was appointed Product Manager for the Industrial Gas Div.

L.B. Odell

R.H. Bunge

Rudolf H. Bunge was promoted to Vice-President of the Industrial Coatings Div., of the O'Brien Corp., S. San Francisco, Calif. He will continue in his position of Vice-President of the company's Nason Automotive Div.

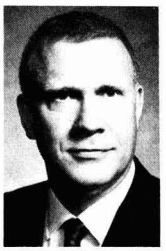
Hilton-Davis Chemical Co. has completed a reorganization of the sales and marketing activities of the company's two divisions. Affected are the Pigments and Chemicals Divisions, with the sales and marketing activities of each division being directed by **Raymond L. Marienthal,** Vice-President of Marketing and Sales for the company.

Two executive appointments have been made by the Coronado Paint Co., Edgewater, Fla. **John A. Waller,** former Vice-President of Trade Sales for Baltimore Paint and Chemical Co., has been named Corporate Vice-President, and **William H. Meitzler,** former Assistant to the President and Director of Trade Sales for Baltimore Paint and Chemical Co., was named Vice-President of Marketing.

Finn Olander has been elected President and Chief Executive Officer of Hempel's Marine Paints, Inc., New York, N.Y. He is a past chairman of the Marine Coatings Committee of the NPCA.

John L. Armitage, Past-President and Chairman of the Board of the National Paint & Coatings Association, was elected an Honorary Member of the Association and installed at the recent annual meeting of the New York Paint & Coatings Association. Mr. Armitage served as President of the NYPCA and Chairman of the Chemical Coatings Committee of NPCA prior to assuming national office.

R.C. Parsons



L.G. Nickell

Robert C. Parsons, of Reynolds Metals Co., Richmond, Va., was re-elected to a second term as President of the National Coil Coaters Association during the NCCA's annual meeting.

Vice-Presidents elected were; **Donald K. Lutes, Sr.,** of Sherwin-Williams Co., Chicago, Ill. and **A.R. McInnes,** of Pre Finish Metals, Inc., Elk Grove Village, Ill.; **John H. Geley,** of Amchem Products, Inc., Ambler, Pa., was re-elected to a second term as Treasurer.

In two managerial appointments, Tenneco Chemicals, Inc. has named **Paul M. Reed** Manager, Regulatory Services, and **John P. Sandstedt** Manager, Environmental Sciences. Mr. Reed will be responsible for the coordination of activities related to toxic substances control, including the Toxic Substances Control Act and will be based at the company's Piscataway, N.J. offices. Mr. Sandstedt previously served as Manager of Environmental Engineering.

Conchemco Chemical Coatings has promoted **Donald R. Reinhart** to Vice-President, Chemical Coatings, Eastern Div., in Baltimore, Md. Also appointed was **Thomas Landshof** to Vice-President and Manager, Chemical Coatings, Midwestern Div., in Kansas City, Mo.

Edward M. Irving was appointed Senior Vice-President—International for Inmont Corp., New York, N.Y. **Richard A. Heitz** will succeed Mr. Irving as company Vice-President and General Manager of its Container Coatings Group.

CIBA-GEIGY Corp. has named **John Devir** Ventures Manager for its Plastics and Additives Div., Ardsley, N.Y. He was most recently General Sales Manager for the division's Additives Dept.

Dr. Louis G. Nickell has joined Veliscol Chemical Corp., Chicago, Ill., as Vice-President — R&D. He was formerly Vice-President, Research Div., of W.R. Grace & Co.

Harold Weinberg, President of Denver-based Kwal Paints, Inc., was elected to a two-year term as President of Color Guild Associates during the recent Spring meeting of the group.

Book Review

INDUSTRIAL SOLVENTS HANDBOOK

Ibert Mellan
Noyes Data Corp.
Park Ridge, N.J.
1977 (567 pages)
$39.00

Reviewed by:
Robert A. Grace
Whirlpool Corp.
Benton Harbor, Mich.

This impressive volume is an authoritative, well-referenced handbook designed to provide industrial engineers and physical chemists with a complete guide to the physicochemical properties of industrial solvents. This second edition contains an expansion of the phase diagrams for multicomponent systems introduced in the earlier edition. With inclusions added to the nearly one thousand referenced tables, it is a treasure house of basic data.

Proven satisfaction with an industrial solvent which has been in long use is presently an insecure commitment. With the rapid introduction of promising new materials, changes in solvent formulations must receive priority considerations. Of even more critical importance is the need to be constantly alert for suitable alternatives for solvents presently in use because of the frequent reports of severe toxic properties which are ascribed to them, and the regulations prohibiting their use. This handbook is a tremendous contribution to a systemic approach for selecting qualified substitutes for chemicals which are found to be inadequate for one reason or another. The organization of the Table of Contents by chemical groups facilitates the search for replacement solvents, when such requirements become urgent necessities.

Special features include a comparison of Rule 66 and Regulation 3, with quantitative supporting information found in the Introduction. New to this edition is the last chapter, which presents a mass of data as indices for a comparative evaluation of the physical properties of solvents in common use in industry.

The handbook is not intended for use as an industrial hygiene reference book, and very little information is included about the toxicological effects of particular solvents. However, of appreciable value to health physicists is the dual identification of chemical formulations with product trade names, since the control of occupational illnesses is much hindered by the reluctance of many manufacturers to specify even the principal chemical constituents of their proprietary products.

THE TECHNOLOGY OF POWDER COATINGS

Author
S.T. Harris

Edited by
E.C. Roberson
Porticullis Press Ltd.
Queensway House
Surrey, England
1976 (304 pages)

Reviewed by
Dr. Thomas J. Miranda
Whirlpool Corp.
Benton Harbor, Mich.

This textbook on the technology of powder coatings covers a number of topics. These include the chemistry and manufacture of powder coating resins, a chapter on crosslinking reactions of thermoset powder coating resins, and the formulation of powder coatings.

In addition, chapters on the manufacturing process of powder coatings, including premixing, hot melt compounding, granulation and fine grinding processes, are included. There is a section on the powder particle, application of powders by fluid bed and electrostatic spray, and a discussion of safety procedures.

Completing the sections is a chapter on safety procedures for powder coating. Testing procedures, design and layout of a manufacturing plant, and design and layout of coating installation, and finally, a list of future developments complete the text.

This book is well written and should be in the library of those active in this field. The text is slanted toward European technology and markets, but this is not a shortcoming.

Letters to the Editor

TO THE EDITOR:

The article by Messrs. Ritter and Schelong in the May issue (page 69) is an interesting confirmation of my often-published explanation of the effect of fine-particle-size extenders on the hiding power of titanium dioxide, and also of my exposure of the poor economy associated with the use of the so-called "high hiding" latex grades of titanium pigment.

Unfortunately it leaves the reader with the impression that there is something specifically advantageous about a fine-particle-size *silica*, when the facts do not support any such conclusion.

Any sufficiently fine extender is capable of reproducing the dilution effect produced by the excessive surface treatments on these grades of titanium dioxide. If any fundamental advantage exists for one fine-particle-size extender as compared to another, it belongs to that F.P.E. that is capable of producing the desired effect at the lowest cost and with the lowest binder demand (to permit formulation at higher P.V.C.'s).

It will be noted, however, that the silica promoted by this article has an oil absorption and a price that are both approximately double those of the calcined clay that is present in the base formula and which might have been used to duplicate the effects obtained with the silica.

However, although much of my own published work was based upon the use of just such a calcined clay, there is also nothing unique about its performance. While a calcined clay would prove to be a more economical choice than the silica in this present instance, it would in turn be more expensive to use than any F.P.E. with a still lower cost and oil absorption — as, for example, a fine-particle-size natural carbonate.

FRED B. STIEG
PigmenTech Consulting
Jekyll Island, Ga.

Coming Events

FEDERATION MEETINGS

(Nov. 1-3)—56th Annual Meeting and 43rd Paint Industries' Show. Conrad Hilton Hotel, Chicago, Ill. (FSCT, Suite 830, 1315 Walnut St., Philadelphia, Pa. 19107).

SPECIAL SOCIETY MEETINGS

(Sept. 20-21)—Montreal and Toronto Societies Symposium on "Coatings Potpourri." In Montreal on the 20th at Bill Wong's Restaurant. In Toronto on the 21st at Seaway Beverly Hills Motor Hotel. (R. Rauch, Tioxide of Canada Ltd., P.O. Box 580, Sorel, Quebec, Canada J3P 5P8).

1979

(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. Fairmont Hotel, San Francisco, Calif. (Ed Kevin, The O'Brien Corp., 450 E. Grand Ave., South San Francisco, Calif. 94080).

CALL FOR PAPERS

Water-Borne and High-Solids Coatings Symposium
Hyatt-Regency Hotel, New Orleans, La.
February 12-14, 1979

The Southern Society for Coatings Technology and the Department of Polymer Science at the University of Southern Mississippi invite all interested persons to submit papers for presentation at the 6th Annual Water-Borne and Higher-Solids Coatings Symposium.

Title and abstract should be submitted not later than August 15, 1978 to:

Mr. Fred M. Ball
Eastman Chemical Products, Inc.
P.O. Box 431
Kingsport, Tenn. 37662

The completed paper should be submitted by December 15, 1978. Papers to be presented at the Symposium will be chosen based on abstracts.

Interstab Chemicals, Inc. has established an award for the most outstanding paper prepared for the Symposium. A committee will choose this paper based on its contribution to the science of water-borne and/or higher-solids coatings. A $500 cash award will be made to that person, and a $300 scholarship will be presented to a polymer science student at the University of Southern Mississippi in the author's name by Interstab Chemicals, Inc. All papers should be original and science-based for presentation at the Symposium.

Coming Events (Continued)

OTHER ORGANIZATIONS

(Aug. 21-23)—First International Conference on Durability of Building Materials and Components. Ottawa, Canada. (K. Charbonneau, Executive Secretary, National Research Council of Canada, Ottawa, Canada K1A 0R6).

(Sept. 10-15)—176th American Chemical Society National Meeting. Miami Beach, Fla. (A.T. Winstead, ACS, 1155 16th St., N.W., Washington, D.C. 20036).

(Sept. 12-15)—Scientific Colloquium on Corrosion in Water. Pecs, Hungary. (Scientific Society of Mechanical Engineers, 1372 Budapest, P.O. Box 451, Hungary).

(Sept. 14)—NPCA Regional Seminar on "Fire Protection." New York, N.Y. (Georgene Savickas, Director, Meetings and Conventions, National Paint and Coatings Association, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Sept. 19)—NPCA Regional Seminar on "Energy Analysis and Conservation." Chicago, Ill. (Georgene Savickas, Director, Meetings and Conventions, National Paint and Coatings Association, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Sept. 26-28)—AFP/SME Conference on Radiation Curing. Holiday Inn O'Hare/Kennedy, Rosemont, Ill. (Association for Finishing Processes of SHE, Technical Div., 20501 Ford Rd., P.O. Box 930, Dearborn, Mich. 48128).

(Sept. 27-29)—National Coil Coaters Association Fall Technical Meeting. Hyatt Regency Hotel, Washington, D.C. (Don White, NCCA, 1900 Arch St., Phila., Pa. 19103).

(Oct. 4-5)—Society of Plastics Engineers RETEC, "Coloring of Plastics XII—Automotive Color." Saw Mill Creek Inn, Huron, Ohio. (Louis J. McDonald, W.R. Grace & Co., 880 Deepwoods Dr., Medina, Ohio 44256).

(Oct. 10-11)—National Association of Corrosion Engineers North Central Meeting on "Coatings and the Law." Marriott Motor Inn, Cleveland, Ohio. (NACE, P.O. Box 986, Katy, Tex. 77450).

(Oct. 10-12)—Fifth Annual UMR-DNR Conference and Exposition on Energy. Conducted by the University of Missouri - Rolla and the Missouri Dept. of Natural Resources. (Dr. J. Derald Morgan, Conf. Dir., 108 Electrical Engineering Dept., University of Missouri - Rolla, Rolla, Missouri 65401).

(Oct. 15-19)—Architectural Aluminum Manufacturers Association 42nd Annual Convention. The Contemporary, Walt Disney World, Fla. (Barbara Lewke, Meetings Coordinator, AAMA, 35 E. Wacker Dr., Chicago, Ill. 60601).

(Oct. 28-Nov. 3)—Fifth Annual Meeting of Federation of Analytical Chemistry and Spectroscopy Societies. Hynes Memorial Auditorium, Boston, Mass. (P. Lublin, GTE Labs, 40 Sylvan Rd., Waltham, Mass. 02154).

(Oct. 30-Nov. 1)—National Paint and Coatings Association Annual Meeting. Palmer House, Chicago, Ill. (Georgene Savickas, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Nov. 8-9)—Powder Coating Conference. Convention Center, Cincinnati, Ohio. (Association for Finishing Processes of SME, 20501 Ford Rd., Dearborn, Mich. 48128).

(Nov. 13-15)—Society of Plastics Engineers National Technical Conference, "Plastics in Packaging." Hyatt Regency O'Hare, Chicago. (Eugene E. Wilson, SPE, 656 W. Putnam Ave., Greenwich, Conn. 06830).

(Nov. 17-19)—Annual National Decorating Products Association Convention and Show. Alfonso J. Cervantes Convention and Exhibition Center, St. Louis, Mo. (National Decorating Products Association, 9334 Dielman Industrial Drive, St. Louis, Mo. 63132).

1979

(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).

(Mar. 5-9)—30th Pittsburgh Conference on "Analytical Chemistry and Applied Spectroscopy." (Pittsburgh Section, Analytical Group, et al., Convention Center, Cleveland, Ohio).

(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. 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. 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).

(Apr. 1-6)—Pacific Chemical Conference: 1979. Honolulu, Hawaii. (A.T. Winstead, ACS, 1155 - 16th St., N.W., Washington, D.C. 20036).

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PFIZER, INC., MINERALS, PIGMENTS & METALS DIV. 13

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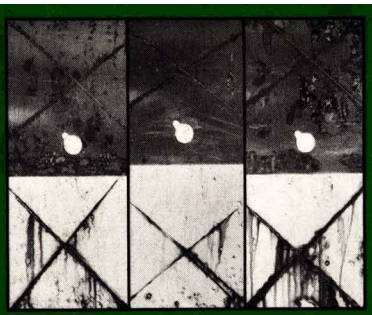

Comparison of Busan® 11-M1 (middle) with zinc phospho oxide (left) and calcium borosilicate (right) in latex emulsion primer. Each primer topcoated with two coats of latex emulsion paint without inhibitor. Panels exposed 200 hours in salt fog cabinet. Panels shown before and after paint was removed.

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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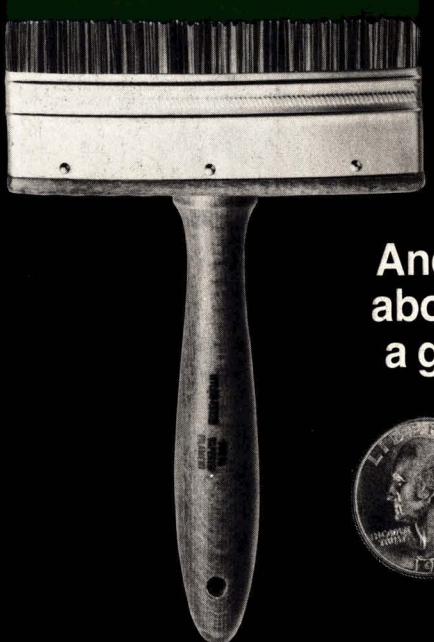

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