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JOURNAL OF COATINGS TECHNOLOGY

JANUARY 1982

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1981 CONVENTION WRAP-UP: DETROIT, MICHIGAN

60TH ANNUAL MEETING
Federation of Societies for Coatings Technology
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JANUARY 1982

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A Guide for Authors is published in each January issue.

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

Comment

. . . and Mr. Reagan was a Lad of Eleven

The year was 1922.

Celluloid collars were on their way out and flappers on their way in . . . . . the Eighteenth Amendment was being grudgingly tolerated, if not accepted . . . . . Babe Ruth was building a "house" in the Bronx . . . . . and California film makers were doing their thing in what were then meadows of the small farming community of Hollywood.

In Cleveland, meanwhile, on a summer day, fourteen paintmakers had temporarily abandoned their kettles for a meeting at the Hotel Winton. They represented paint production groups in Boston, Chicago, Cleveland, Dayton, Louisville, New York, Philadelphia, St. Louis, and Toronto, and they had journeyed to the Ohio city to formulate plans for coordinating their efforts and establishing closer and more cooperative ties.

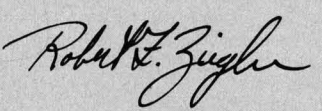
By the time discussions were concluded and George Heckel had gaveled the meeting to a close, the paintmakers had fashioned the Federation of Paint and Varnish Production Clubs, establishing a technical organization whose influence was to be felt worldwide.

Later that year, 15 delegates (one from as far away as St. Louis) attended the first Annual Meeting at the Ritz-Carlton Hotel, in Atlantic City. That was the first in a long line of Federation Annual Meetings, the most recent of which attracted to Detroit almost 5,800 industry representatives from 43 states, the District of Columbia, Puerto Rico, U.S. Possessions and Territories, and 43 other countries.

The organization that evolved from that Cleveland meeting is now 60 years young and still going strong, its membership now in excess of 6700 and the volunteer ethic that sparked its formation still the keystone of activity.

The Diamond Anniversary will be celebrated this November at the Annual Meeting in Washington, D.C., and we hope you make your plans early to attend.

For all you do, this one's for you.



Robert F. Ziegler,
Editor

Roon Awards Competition Offers $3,000 in Prizes For Winning Technical Papers Presented in 1982

The Roon Foundation Awards, established in 1957, will be continued at the Federation's 1982 Annual Meeting in Washington, D.C. where the best technical papers offered for presentation will be eligible for up to $3,000 in cash prizes donated by Leo Roon, former President of Nuodex Products Co., and a Director of the Roon Foundation.

Darlene Brezinski, Chairman of the Federation's 1982 Roon Awards Committee, stated that the papers submitted in competition for the Awards must: (1) Be of such caliber that they will reflect a step forward in real scientific contribution to the coatings industry; (2) Be directly related to the protective coatings industry; and (3) Shall describe original work not previously published or presented.

At present, the schedule of prizes is as follows: First—$1,200; Second—$800; Third—$600; and Fourth—$400.

The 1982 Annual Meeting of the Federation will be held in Washington, D.C. from November 3 to 5, and the deadline for receipt of papers is June 1.

Dr. Leslie A. Simpson was awarded First Prize ($1,000) in the 1981 Roon Awards Competition for his presentation, "Factors Affecting Metal Marking."

Principles Governing the Roon Awards

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(12) The Committee may award three or four prizes, the total of which is not to exceed $3,000. Maximum for first prize is $1,500.

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

(14) Those planning to submit a paper in 1982 must let the Chairman (Darlene Brezinski, DeSoto, Inc., 1700 E. Mt. Prospect Rd., Des Plaines, IL 60018) know by March 1. She must have seven publication manuscripts by June 1.

(15) The 1982 Awards, and accompanying certificates, will be presented during the Annual Meeting in Washington, D.C.

Annual Meeting Papers Focused on Theme 'Challenge, Change, Opportunity' in Detroit

The approximately 5,800 registrants at the 1981 Annual Meeting had the advantage of attending the many sessions keyed to the theme, "Challenge, Change, Opportunity," developed by Program Chairman Dr. Thomas J. Miranda, of Whirlpool Corp., and committee members John C. Ballard, of Kurfees Coatings, Inc.; Darlene Brezinski, of DeSoto, Inc.; Peter Hiscocks, of CIL Paints, Inc.; Percy E. Pierce, of PPG Industries, Inc.; Theodore Provder, of Glidden Coatings and Resins Div.; and Walter Stuecken, of Grow Group, Inc.

The following program was presented:

Keynote Address:

"Energy Resources for the Next Decade"—John R. Thomas, President, Chevron Research Co.

Innovations in Coatings-I:

"Dynamic Surface Effects in Coatings Processes"—Ronald E. Smith, PPG Industries, Inc.

"Evaluation of Linings for SO_2 Scrubber Service"—Dean M. Berger, Robert J. Trewella, and Carl J. Wummer, Gilbert/Commonwealth.

"Recovery of Glycol Ether Solvents from Ultrafilter Permeate in Cathodic Electrocoat Operations Using Reverse

Continued on page 10

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Annual Meeting Papers Focused on Theme 'Challenge, Change, Opportunity'

Continued from page 8

Osmosis"—W.S. Springer, G.G. Strosberg, and J.E. Anderson, Manufacturing Processes Laboratory, Ford Motor Co.

"Coatings Performance on Low Alloy Weathering Steel: A 20-Year Study"—Arnold J. Eickhoff, Technical Consultant-Coatings, Ramsey, NJ and Douglas N. Nash and Nunzio Pisani, NL Chemicals/NL Industries, Inc.

Innovations in Coatings-II

"Factors Affecting Metal Marking"—Leslie A. Simpson, BTP Tioxide Limited.

"Application of HPGPC and HPLC to Characterize Oligomers and Small Molecules Used in Environmentally Acceptable Coatings Systems"—Cheng-Yih Kuo, Theodore Provder, Richard M. Holsworth, and Ann F. Kah, Glidden Coatings and Resins Div., SCM Corp.

"Physico-Chemical Interpretation of Paint Film Adhesion and Techniques Used for Its Measurement"—Swaraj Paul, Soab AB.

"A New Dimension in Corrosion Protection"—Walter Sniff, CRS Company, Inc.

"Comparative Cure Kinetics and Thermal-Mechanical Property Characterization of Organic Coatings By Dynamic Mechanical Analysis (DMA) and Differential Scanning Calorimetry (DSC)"—Theodore Provder, Richard M. Holsworth, and Thomas H. Grentzer, Glidden Coatings and Resins Div., SCM Corp.

PRI Seminar

"Molecular Orientation in Solvent-Cast Polymeric Films"— William M. Prest, Jr., Xerox Corp.

"Rheological Studies at Glidden"—Richard R. Eley, Glidden Coatings and Resins Div., SCM Corp.

"Cooperative Research in the Graphic Arts—A Case Study"—William D. Schaeffer, Graphic Arts Technical Foundation.

"Recent Development in Color Measurement"—James G. Davidson, Macbeth Div. of Kollmorgen Corp.

"Oscillatory Shearing As a Technique for Evaluating Leveling"—James S. Dodge, B.F. Goodrich Co.

Manufacturing Committee Seminar

"High Speed Dispersion"—James W. White, Hockmeyer Equipment Corp.

"Small Media Milling"—Leo Dombrowski, Chicago Boiler Co.

"S-W Mill"— Mike Fujimoto, The Sherwin-Williams Co.

"Ball Mills and Attritors"—Elio Cohen and Ray Pineiro, Daniel Products Co.

Raw Materials to Finished Product-I

"Kinetics of Thermal Dissociation of Blocked Isocyanate Crosslinkers"—Detroit Society for Coatings Technology.

"Water-Borne Intumescent Coatings"—G.O. Fanger, Great Lakes Chemical Corp.

"Effect of the Pigment-Vehicle Interaction on Magnetic Coating Film"—Yukihiro Isobe, Kiyotaka Okuyama, Akihiki Hosaka, and Yuichi Kubota, Magnetic Recording Products, TDK Electronics Co., Ltd.

"Characterization of Functional Latexes for Autodeposition"—Cleveland Society for Coatings Technology.

"Coatings Industry and Waste Solvent Distillation"—C. Kenneth Claunch, Finish Engineering Co., Inc.

Raw Materials to Finished Product-II

"Practical Application of Kubelka-Munk Theory for the Near Infrared Region"—Dennis Osmer and Joseph Kettanecker, CIBA-GEIGY Corp.

"Reclaiming the Energy Value of Coatings Wastes Through Pyrolysis"—Louisville Society for Coatings Technology.

"Stabilizing the Viscosity and Thixotropic Index of Hardener Free Epoxy Resin Systems With Fumed Silica"—Harold D. Stanley, Degussa Corp.

"High Solids and Water-Borne Silicone Resins for High Temperature Durable Protective Coatings"—William T. Saad, Silicone Products Div., General Electric Co.

"Low Pollution Routes to Glamour Metallic Automotive Finishes"—Alan G. Backhouse, Imperial Chemical Industries Limited, Paints Div.

Raw Materials to Finished Product-III

"Reactive Silane Modified Pigments—I. Silanized Talc With Acrylic Latex"—Los Angeles Society for Coatings Technology.

"Pigment Dispersions, Ecology and Economics"—Russell R. Koch, Universal Color Dispersions.

"Corrosion and a Complying System"—Golden Gate Society for Coatings Technology.

"Titanium Dioxide: Chemical and Physical Analysis Methods Used by the Research Center of SIBIT (Italian Society of Titanium Dioxide)"—Francesco Biglieri, Montedison, Milan, Italy. (Presented by Amleto Poluzzi, Technical Consultant, Milan).

Impact of Corrosion-I

"Corrosion: A Coating Manufacturer's Dilemma"—Dean M. Berger, Gilbert/Commonwealth.

"Sulfonate and Phosphate Chemistry to Improve Corrosion Inhibition and Adhesion"—W.A. Higgins, Lubrizol Corp.

"Application of Photogoniometry for the Characterization of the Reflectance Properties and Morphology of Coatings Systems"—Thomas H. Grentzer, Richard M. Holsworth, and Theodore Provder, Glidden Coatings and Resins Div., SCM Corp.

Color and Appearance

"What is SCAI?"—Dennis Osmer, CIBA-GEIGY Corp.

"Use and Misuse of Computers in Color Control"—Hugh R. Davidson, Davidson Colleagues.

"Instrumental Color Control—What's Down the Road?"—Ralph Stanziola, Applied Color Systems, Inc.

Mattiello Lecture

"Amino Resins for High Solids Coatings"—Werner J. Blank, Manager of Resin Products at the Stamford Research Center of American Cyanamid Co.

Impact of Corrosion-II

"Effect of Anti-Corrosive Pigmentation on the Performance of Vinyl Systems"—Thomas Ginsberg, Union Carbide Corp., Bound Brook, NJ, and John D. Keane and Joseph A. Bruno, Steel Structures Painting Council.

"Organic Coatings Failure Analysis"—Richard M. Holsworth, Glidden Coatings and Resins Div., SCM Corp.

"Examination of Weathered Coatings by Photoelectron Spectroscopy and Fourier Transform Infrared Spectroscopy"—Glenn Cunningham, PPG Industries, Inc. and Charles M. Hansen, Scandinavian Paint and Printing Ink Research Institute.

"Factors Affecting the Distinction of Image (DOI) of Painted Fiberglass Reinforced Urethane Rim (RRIM)"—Donald J. Hart, Polymers Dept., General Motors Research Laboratories.

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Please note that two papers, listed in the 1981 Annual Meeting program (August and September issues), were withdrawn by the authors and were not presented.

The papers were: "Short-Term Testing of Coatings: New Directions," by Raymond Tooke, of Micro-Metrics Co.; and "The Effects of Freeze-Thaw Cycles of Some Commercially Available Latex and Emulsion Paints on Molecular Weight and Molecular Weight Distribution by Gel Permeation Chromatography," by James A. Vance, of Vance Laboratories, Inc.

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Abstracts of Papers in This Issue

DESIGN OF WATERBORNE COATINGS FOR THE CORROSION PROTECTION OF STEEL. PART II: EVALUATION OF SOME CHEMICALS AS FLASH RUST INHIBITORS IN AN AQUEOUS AIR DRY COATING—New England Society for Coatings Technology

Journal of Coatings Technology, 54, No. 684, 63 (Jan. 1982)

Twenty-nine inorganic salts, 17 organic acid salts, 16 amines, 11 alkanolamines, three silanes, six imidazolines, and three miscellaneous chemicals were evaluated at four concentration levels in an aqueous coating for effect on flash rust resistance. Water immersion, and salt fog exposure tests were conducted to evaluate the additive's effects on coating performance. Ten inorganic salts, seven organic acid salts, one amine, two alkanol amines, and one imidazoline show promise as flash rust inhibitors.

FEASIBILITY OF USING ALKOXYSILANE-FUNCTIONAL MONOMERS FOR THE DEVELOPMENT OF CROSSLINKABLE EMULSIONS—T.R. Bourne, B.G. Bufkin, G.C. Wildman, and J.R. Grawe

Journal of Coatings Technology, 54, No. 684, 69 (Jan. 1982)

The feasibility of using alkoxysilane-functional monomers as a means of developing high integrity, crosslinkable emulsions was investigated. Using γ-methacryloxypropyltrimethoxysilane as the crosslinkable monomer, an evaluative survey was conducted in which the reaction conditions and ingredients used to effect emulsion polymerization were optimized in an effort to prevent excessive hydrolysis of the Si—O—C bond and to achieve emulsions with adequate colloidal stability. While the optimization study was successful in providing model emulsions with good colloidal stability, the reaction conditions obtained were not suitable for suppressing the hydrolysis–condensation reaction of the trimethoxysilane functionality. Thus, the resulting emulsions exhibited a considerable degree of premature crosslinking as indicated by the formation of an 87% acetone insoluble polymer.

To overcome the impasse associated with the facile hydrolysis of the Si—O—C bond, several vinyl-type monomers containing more sterically hindered alkoxysilane functionality were investigated. Using swelling ratio, percent insolubles, and intrinsic viscosity measurements to monitor the extent of crosslinking which occurred as a function of time, the various alkoxysilane substituents were found to resist hydrolysis according to the approximate order: trimethoxy $\simeq$ dimethoxy $<$ triethoxy $<$ triisopropoxy $\ll$ diethoxy.

The diethoxy-functional emulsion displayed excellent resistance to premature crosslinking as indicated by an initial swelling ratio value of >100, an initial intrinsic viscosity of 1.29, a percent insolubility of 39.5, and by the ability to form highly coalesced films. In comparison with a 100% poly (ethyl acrylate) control, films of a 95/5-ethyl acrylate/γ-methacryloxypropylmethyldiethoxysilane copolymer emulsion demonstrated increased gloss, superior water resistance, a 6.5-fold increase in tensile strength, a 1.2-fold increase in elongation, and an 8.9-fold increase in solvent resistance.

NEW APPROACHES TO NON-TOXIC ANTIFOULING COATINGS FOR SHIP-HULL PROTECTION—N.A. Ghanem, et al.

Journal of Coatings Technology, 54, No. 684, 83 (Jan. 1982)

Fouling of ship hulls is demonstrated as a problem of worldwide importance. It is shown that the current commercial methods of fouling protection are based upon the use of toxic ingredients in the so-called antifouling coatings. These ingredients must leach out or release slowly in the surrounding water. The longer a ship stays in an enclosed area, the higher toxicity leach or release is required particularly in fouling-rich regions. This in turn creates pollution problems affecting fish and other living inhabitants of the marine environment. Intensive studies on copper in the seas showed high enough concentrations in dissolved form, in suspension and in sediments, to cause alarm. Therefore, a need emerged to work on systems of coatings which would prevent fouling attachment by principles other than toxin leaching or release. The paper presents two such systems which have demonstrated some success in preventing attachment in marine regions of high fouling intensity. A preliminary mechanism of repellency is suggested in each case.

MEASUREMENT OF SOLUBILITY AND SOLUBILITY PARAMETERS FOR SMALL ORGANIC SOLUTES IN POLYMER FILMS BY INVERSE GAS CHROMATOGRAPHY—J.E.G. Lipson and J.E. Guillet

Journal of Coatings Technology, 54, No. 684, 89 (Jan. 1982)

A method has been developed that gives fast, reproducible results for infinite dilution solubility parameters of polymers, and the solubility of small organic probes at infinite dilution in polymers. This method, using inverse gas chromatography, studies interactions with polymers in the solid phase. Solubility parameters and solubilities are reported for poly(ethylene-vinylacetate), 40% w/w vinylacetate, with both polar and nonpolar organic probes.

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GUIDE FOR AUTHORS

INTRODUCTION

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

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

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

The JOURNAL OF COATINGS TECHNOLOGY has first rights to the publication of papers presented at the Annual Meeting of the Federation and at local and regional meetings or symposia of the Constituent Societies. These papers, and others, submitted for publication, must be approved by the JCT Editorial Review Committee, which has authority in all matters affecting the acceptance or rejection of papers and other technical material. Manuscripts not accepted for publication will be returned to the author.

MANUSCRIPT COPIES

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

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

ROON FOUNDATION AWARD PAPERS: Seven copies of the manuscript must be sent to the Chairman of the Roon Awards Committee. For complete details, see the "Roon Awards" section of the January 1982 JCT.

MANUSCRIPT PREPARATION AND STYLE

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

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

Title

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

Authors

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

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

Abstract

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

Presentation Data

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

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

Text

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

Metric System

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

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

Tables

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

Illustrations

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

Nomenclature

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

Equations

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

Summary

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

Acknowledgment

If used, it should follow the summary.

References

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

(1) Wilkinson, R.F., "Uses for Water-Soluble Trimellitate Resins," *Official* DIGEST, *35*, No. 457, 129 (1963).

(2) Woo, J.T.K. and Heinert, D.H., "Coatings from Vinyl Isocyanate Monomer," JOURNAL OF COATINGS TECHNOLOGY, *49*, No. 632, 82 (1977).

(3) Hobden, F.W., *J. Oil & Colour Chemists' Assoc., 41,* 24 (1958).

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

OTHER INFORMATION

Galley proofs will be sent to the author for checking about six weeks prior to publication.

Reprints may be purchased in quantities of 100 or more. Authors will receive quotations.

Each author will receive a complimentary copy of issue in which his paper is published.

Copies of this Guide for Authors are available from the
Federation of Societies for Coatings Technology
1315 Walnut St., Philadelphia, Pennsylvania 19107

heubach

Improved Health and Safety at Work without Loss of Efficiency

HEUCOPHOS ZPO
HEUCOPHOS ZPA
HEUCOFLOW M 10
HEUCOMIN 5

heubach

HEUCOPHOS ZPO
HEUCOPHOS ZPA

New A
Pigme
Indus

New Anticorrosive Pigments on Phosphate Base

In a test the new HEUCOPHOS-Pigments have been compared with high quality zinc chromates and zinc phosphates.

Test Conditions:

Sand blasted sheet metal was coated to 50 ± 5 micron dry film thickness and then weather exposure tests were done.

Pigmentation:

40 vol. % Anticorrosive Pigment
25 vol. % Barium sulphate
25 vol. % Talcum
10 vol. % Titanium dioxide

Binding Agents:

Alkyd resin and Epoxy Esters
In order to guarantee the comparability of the pigments the free binding agent Q = PVK/KPVK has been held constant.

Results:

In the salt spray test better results were achieved in both binding agents for HEUCOPHOS ZPO and ZPA compared to zinc phosphate and same results compared to zinc chromate. In the Kesternich test ZPO and ZPA exceed zinc chromate and zinc phosphate in both cases. The good test results are based on the special analysis, the exactly defined particle size distribution as well as on the optimal pigment surface of ZPO and ZPA pigments. These facts combined with the binding agents lead to effective adhesive and inhibitory complexes on metal substrates.

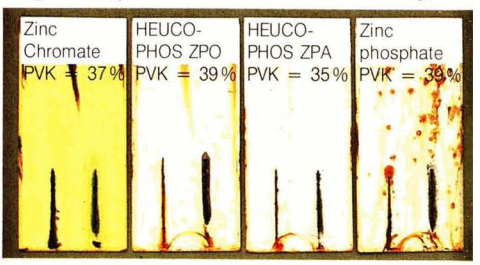
Alkyd resin	Zinc Chromate	HEUCO-PHOS ZPO	HEUCO-PHOS ZPA	Zinc Phosphate
Salt spray test	80	70	80	40
Kesternich test	20	70	70	40

▲▼ Rating Numbers: 100 = very good, 0 = bad ▲▼

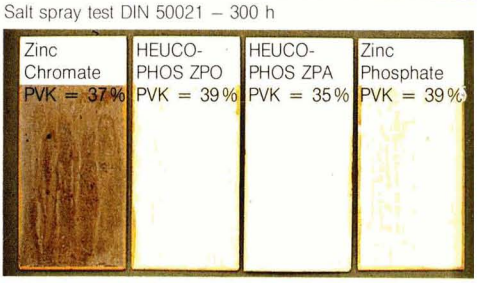
Epoxy Esters	Zinc Chromate	HEUCO-PHOS ZPO	HEUCO-PHOS ZPA	Zinc Phosphate
Salt spray test	90	90	75	35
Kesternich test	20	80	85	60

Resume of the criterions for review of protective effect according to DIN 53209, 53151, 53167

Aklyd resin, modified wood oil – tall oil – oil length 41%

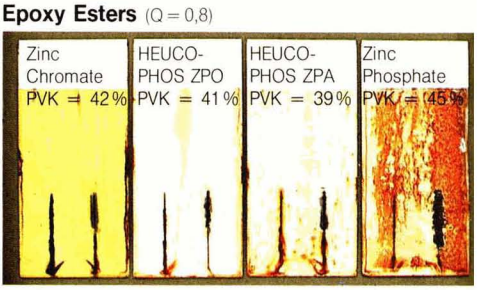


Salt spray test DIN 50021 – 300 h

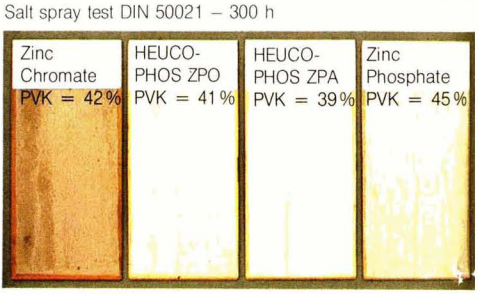


Kesternich test DIN 50018 1.0 S-10 cycles

Epoxy Esters (Q = 0,8)



Salt spray test DIN 50021 – 300 h

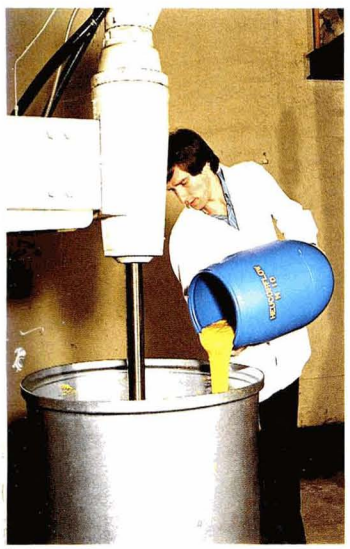


Kesternich test DIN 50018 1.0 S-10 cycles

orrosive
or Higher
Hygiene

HEUCOFLOW M 10

Zinc Chromate Paste, free of binding agents



HEUCOFLOW M 10 zinc chromate paste eliminates the former industrial hygienic stress as the zinc chromate no longer exists in respirable form.

HEUCOFLOW M 10 zinc chromate paste is an alternative to zinc chromate in powder form without any risks and an immediate replacement.

HEUCOFLOW M 10 zinc chromate paste is free of binding agents, has a 75 % pigmentation and with it's 23 % share of solvents it can fit into existing zinc chromate recipes without any problem.

HEUCOFLOW M 10 zinc chromate paste shows a Grindometer fineness of below 15 microns for dissolver handling.

Technical Data:

COMPOSITION		HEUCO-FLOW M 10
ZINC CHROMATE M 10	± 1 %	75
Aromatics	%	23
Montmorillonites	%	2
Density of Paste	g/cm³	2
Grindometer Fineness	µm	15

COMPOSITION		ZINC CHRO-MATE M 10
CrO_3	%	43,5
ZnO	%	39,0
K_2O	%	10,0
Cl	%	0,02
SO_4	%	0,03
wsl. CrO_3	g/100 cm³/10 g	0,08
Conductivity	m S/cm	1,8
Density	g/cm³	3,5

Reply Card

Please send me a 500-g-sample each of

- ☐ HEUCOPHOS ZPO
- ☐ HEUCOPHOS ZPA
- ☐ HEUCOFLOW M 10
- ☐ HEUCOMIN 5
- ☐ general information on the Heubach-Group

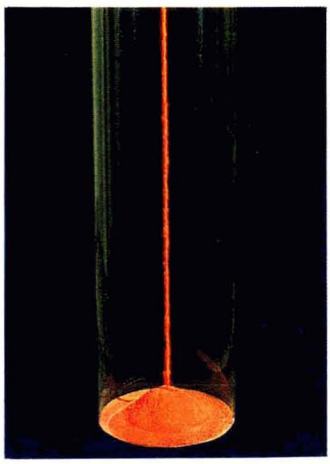
Remarks: _____

heubach

Red Lead non-dusting

The way to meet OSHA's 50 µm lead exposure limit

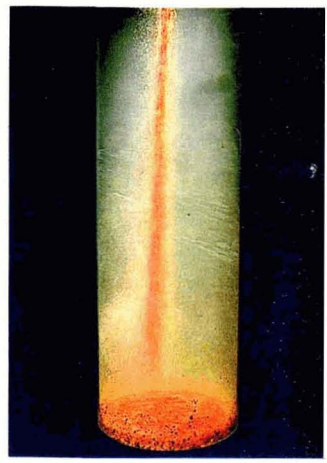
HEUCOMIN 5



HEUCOMIN 5

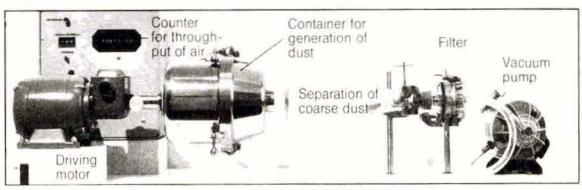
TECHNICAL DATA		Red Lead	
		HEUCOMIN	HIGH DISP.
Dusting Properties	mg/100g	< **5**	> **100**
PbO_2	%	> 33,5	> 33,5
Pb_3O_4	%	> 96,0	> 96,0
Density	g/cm³	9	9
Bulking volume	g/ml	1,4	1,4
Tamped volume	g/ml	2,6	2,6
Loss on ignition 750° C	%	0,8	–
Residue on Sieve 63 µm	%	0,1	0,1
Ø particle size (DZV)	µm	0,7	0,7
Oil Absorption	g/100 g	5,0,	5,5

DZV = central value of volume distribution acc. to electronic microscope



Red Lead High Dispersive

Equipment for Dust Measurements



Technical Description:

Stricter industrial hygienic regulations will in future prohibit the use of dusting red lead. As the paint industry cannot dispense with red lead, dusting red lead qualities will be replaced by non-dusting qualities, e.g. HEUCOMIN 5.

The dusting properties of HEUCOMIN 5 are reduced by 95 % compared with conventional red lead. The handling and anticorrosive properties are identical with high quality red lead HD-types so that a direct replacement without modification of recipes is possible.

Name _____

Company + Company Address

_____

_____

_____

_____

Reply Card

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Heubachstraße 7

D-3394 Langelsheim 1
West Germany

Dr. Hans Heubach GmbH & Co. KG
Heubachstraße 7
D-3394 Langelsheim 1, W. Germany
Telephon (0 53 26) 5 20
Telex 09 57 726 (heuba d)

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505 Consumers Rd., Suite 403
Willowdale, Ontario M2J 4V8
Telex: 06-986 685
Teleph.: 416-492-8606

Ariz./Cal./Colo./Ida./Mont./Nev./N.M./ Ore./Ut./Wash./ Wyo.:
The Sieflor Corporation
Central Federal Bldg., Suite 304
10850 Riverside Drive
North Hollywood, Calif. 91602
Telex: 18-2628 sieflor
Teleph.: 213-980-5596

Md./Va./N.C.:
The A.B. Kohl Sales Co.
8765 Mylander Lane,
Towson, Maryland 21204
Telex: 8-7483
Teleph.: 301/828-1900

New:

George C. Brandt, Inc.
1010 Jorie Boulevard, Suite 364
Oak Brook, Illinois 60521
Teleph.: 312/323-7228

Jesse S. Young Co., Inc.
P.O.Box 275, 1229 Broadway
Hewlett, New York 11557
Teleph.: 212/291-4344

Over 5700 Registrants Attend Annual Meeting And Paint Show in Detroit

A total of 5774 registrants attended the 1981 Federation Annual Meeting and Paint Industries' Show at Detroit's Cobo Hall, October 28–30; the turnout was significantly higher than for the 1971 event in the Motor City when registration totaled 4130.

Included in the attendance were several hundred participants from the National Paint and Coatings Association Annual Meeting, held October 26–28 at the Detroit Plaza Hotel, who were accorded complimentary registration on the opening day of the Federation activities.

The registrants were treated to three days of technical presentations keyed to the theme, "Challenge, Change and Opportunity," as well as the exhibits of 177 raw material and equipment manufacturers who took part in the largest Paint Show ever.

The technical program, under the direction of Chairman Tom Miranda and his Steering Committee members, featured concurrent sessions on a variety of coatings topics. Among the featured presentations were the Keynote Address by Dr. John R. Thomas, President, Chevron Research Co., who spoke on "Energy Resources for the Next Decade," and the Mattiello Lecture by Werner J. Blank, Manager of Resin Products, Stamford Research Center, American Cyanamid Co., who discussed "Amino Resins for High Solids Coatings."

The sessions, which addressed both theoretical and practical considerations, were well attended and well received throughout. Particular interest was shown in the three-hour Manufacturing Committee-sponsored seminar on Dispersion Technology, which generated an enthusiastic and free-wheeling question-and-answer period.

In the exhibit hall, meanwhile, the aisles were crowded as registrants toured the displays and viewed the latest in product, equipment, and services for the coatings industry, and talked shop with exhibitor technical people.

Attendees were impressed by both the number of exhibits and the quality of the displays; the exhibitors, for their part, were generally enthusiastic about the number and quality of the registrants.

At the Federation Luncheon, on Friday, October 30, approximately 300 registrants were on hand for presentation of the Heckel Award and the C. Homer Flynn Awards for outstanding exhibits in the Paint Show (see accompanying Awards story). Guest speaker was Dr. Gustave Trautz, Detroit-area humorist, who presented an amusing commentary on "The Influence of Man Power and Woman Power in Today's World."

By all accounts it was a most successful event and the Federation is indebted to the members of the Detroit Society for their contributions, particularly those who served on the Host Committee under the direction of Jose Benavides. Special thanks are also due Mrs. Fred (Rosemary) Boehle, Mrs. Walter (Lorraine) Stuecken, and Mrs. Jose (Lorraine) Benavides and their committee members for their work on the spouses' program of activities.

The Federation expresses its appreciation to them and to all who contributed their time and talents to help make the 1981 Annual Meeting and Paint Show a success.

President William H. Ellis and wife, Bea (center), opened the 1981 Paint Show with traditional ribbon-cutting ceremony. Looking on are (left to right): President-Elect Howard Jerome and wife, Gene; Chairman of the Paint Industries' Show Committee Deryk R. Pawsey; Host Committee Chairman Jose G. Benavides; Marjorie Boyce and Treasurer A. Clarke Boyce; Rose Borrelle and Executive Vice-President Frank Borrelle; and Bonnie Johnson and Treasurer-Elect Terryl Johnson

Sid Lauren, of Coatings Research Group, Receives 1981 Heckel Award

Sidney Lauren, Executive Director of Coatings Research Group, Inc., Cleveland, OH, was honored by the Federation of Societies for Coatings Technology with the 1981 George B. Heckel Award for his many years of dedicated service to the Federation and industry. The presentation was made at the FSCT Annual Luncheon on October 30, in Detroit.

The award plaque is presented each year to the individual whose contribution to the general advancement of the Federation's interest and prestige have been outstanding.

Mr. Lauren, a member of the Cleveland Society, is a past member of the Federation Board of Directors. He is also a former Chairman of the Federation's Technical Advisory Committee and Delegate to the Scientific Committee of the National Paint and Coatings Association.

He is an Honorary Member of the New York Society and, in 1966, received that Society's PaVac Award for his "outstanding contribution to the protective coatings industry."

Mr. Lauren has given numerous lectures to the technical and trade groups of the coatings, plastics, and building materials industries, and has published more than 30 papers in these fields.

He is also a member of the Steel Structures Painting Council, the American Chemical Society, the American Association for the Advancement of Science, and the Cleveland Association of Research Directors.

Armin J. Bruning Award

Established in 1962 in honor of Armin "Joe " Bruning, pioneer in the application of color science to the paint industry, this award is for "the most outstanding contribution to the science of color in the field of coatings technology."

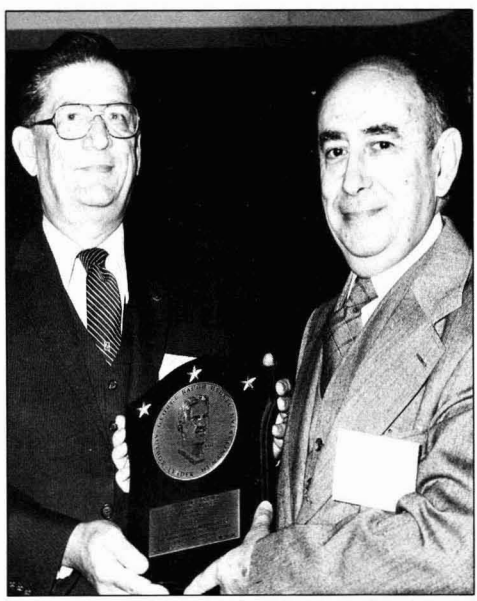
The 1981 award plaque was presented to Ralph Stanziola, founder, Executive Vice-President and Technical Director of Applied Color Systems, Inc., Princeton, NJ, for his presentation, "Instrumental Color Control—What's Down the Road?" Mr. Stanziola, a graduate of the Philadelphia College of Textiles and Science, began his career in Research and Technical Service for the Dyes Division of the American Cyanamid Co. He then joined Davidson and Hemmendinger, Inc. as Technical Representative and General Sales Manager, and later for Kollmorgen Color Systems Division which acquired Davidson and Hemmendinger, Inc.

Mr. Stanziola is currently President of the Manufacturers Council on Color and Appearance and is a board member of the Inter Society Color Council. For the past 15 years, he has lectured at the summer courses in color technology offered at the Rensselaer Polytechnic Institute and at the Philadelphia College of Textiles and Science. Mr. Stanziola is the author of numerous articles pertaining to color technology in the industry and is currently one of the editors of Color Research and Application.

Roon Foundation Awards

These awards, established by Leo Roon, Director of the Roon Foundation, and administered by the Paint Research Institute, are for the best technical papers entered in the competition and submitted for presentation at the Federation's Annual Meeting by individuals associated with the organic coatings industry.

FIRST PRIZE ($1,000)—"Factors Affecting Metal Marking"—Dr. Leslie A. Simpson, BTP Tioxide Limited, Cleveland, England.



Sidney Lauren (right) accepts the 1981 George Baugh Heckel Award from Stanley LeSota, Heckel Award Committee member

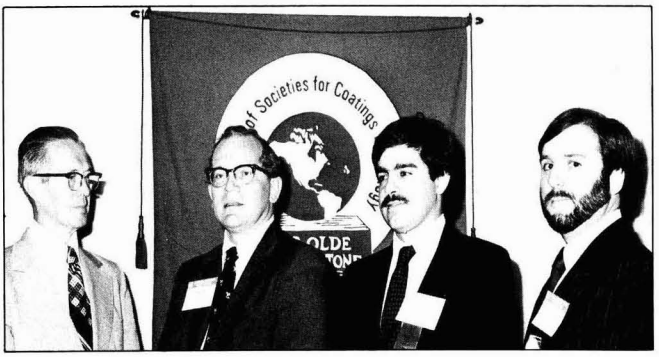
Darlene Brezinski, Roon Awards Committee member presents First Prize ($1000) to Dr. Leslie A. Simpson for his presentation, "Factors Affecting Metal Marking"

Ralph Stanziola (right), of Applied Color Systems, Inc., is presented with the Armin J. Bruning Award by President Ellis

President Ellis awards Hugh Davidson (right) of Davidson Colleagues, with the Dry Color Manufacturer Award Certificate

President Ellis presents the 1981 Mattiello Memorial Lecturer Werner J. Blank with a certificate of appreciation for his presentation, "Amino Resins for High Solids Coatings"

Material Marketing Associates Award was presented by MMA Awards Committee Chairman Terryl Johnson (left) and Ren Ridolfi (right), of Materials Manufacturing Associates, Inc., to Robert A. McNeill for the Los Angeles Society



Albert Seneker (left), Chairman of the A. F. Voss/American Paint Journal Awards Committee, with winners (left to right): Dean Owen Harper, accepting for Louisville Society; Farrokh Malihi, accepting for Cleveland Society; and Andrew Dervan, accepting for Detroit Society

A.F. Voss/American Paint & Coatings Journal Awards

These cash awards are presented by the *American Paint & Coatings Journal* for the most constructive papers by Constituent Societies of the Federation in connection with the research, development, manufacture, or application of the industry's products, or of the raw materials entering into their fabrication.

FIRST PRIZE ($200)—"Reclaiming the Energy Value of Coatings Wastes Through Pyrolysis"—Louisville Society (John Ballard, Kurfees Coatings, Inc., Chairman of the Technical Committee).

SECOND PRIZE ($175)—"Characterization of Functional Latexes for Autodeposition"—Cleveland Society (Mike McElroy, Glidden Coatings & Resins Div., Chairman of the Technical Committee).

THIRD PRIZE ($125)—"Kinetics of Thermal Dissociation of Blocked Isocyanate Crosslinkers"—Detroit Society (Pangiotic I. Kordomenos, Ford Motor Co., Chairman of the Technical Committee).

MMA Awards

Established in 1975 by Materials Marketing Associates, these cash awards and plaques are for notable achievements by Constituent Societies of the Federation, other than Society papers presented at the Federation Annual Meeting.

Class A competition ($350) was won by the Los Angeles Society, for the contribution to the coatings industry derived from the 1981 Western Coatings Societies Symposium hosted by the Society.

DCMA Award

This award is presented for the best paper prepared on any aspect of the science or usage of color, use of colorants, or their behavior, which is presented to the Federation. The award is presented by the Dry Color Manufacturers' Association.

The 1981 Award was won by Hugh R. Davidson, of Davidson Colleagues, Tatamy, PA, for his paper, "Use and Misuse of Computers in Color Control." This paper was presented at the Symposium on Color and Appearance Instrumentation, in Louisville, KY, March 24-26.

The Manufacturing Committee Seminar on Dispersion Technology was moderated by Fred K. Daniel, of Daniel Products Co. (left). Panel members included (seated left to right): Leo Dombrowski, of Chicago Boiler Co.; Mike Fujimoto, of The Sherwin-Williams Co.; Ray Pineiro, of Daniel Products Co.; and James W. White, of Hockmeyer Equipment Corp.

Ernest T. Trigg Awards

These awards are for the two Secretaries of Constituent Societies of the Federation who furnish to the JOURNAL OF COATINGS TECHNOLOGY the most interesting reports of Society meetings and discussions following the presentations of papers at those meetings.

FIRST PRIZE ($100)—L. Lloyd Haanstra (Ameritone Paint Co.), Secretary of Los Angeles Society.

SECOND PRIZE ($50)—Sara Robinson (Inland Leidy), Secretary of Piedmont Society.

Program Committee Awards

These awards are presented to individual members of Societies who present Society papers at the Annual Meeting in the best form and manner.

FIRST PRIZE ($100)—Dean Owen Harper, (University of Louisville), Louisville Society.

SECOND PRIZE ($50)—Robert Athey (Swedlow, Inc.), Los Angeles Society.

Cargill, Inc. Receives Special Citation At 1981 Paint Show in Detroit

Cargill, Inc., Chemical Products Div., Minneapolis, MN, was cited recently for having been an exhibitor for 40 years in the Paint Industries' Show.

A plaque commemorating the occasion was presented to Cargill, Inc. by the Federation during the 46th Paint Show.

This brings to 10 the number of exhibitors so honored by the Federation. In 1975, 40-year plaques were presented to Cities Service Co., Rohm and Haas Co., and Union Carbide Corp.; in 1976 plaques were presented to Reichhold Chemicals, Inc. and Tenneco Chemicals Inc.; in 1977, Hercules, Incorporated received a plaque; and Ashland Chemical Co., Neville Chemical Co., and Spencer Kellogg Div., Textron Inc., were honored in 1979.

Six Exhibitors Win Paint Show Awards

Atlas Electric Devices Co., Chicago Boiler Co., Kenrich Petrochemicals, Inc., Penn Color, Inc., Rohm and Haas Co., and Sherwin-Williams Co., Chemical Div., were recipients of the C. Homer Flynn Awards at the 1981 Paint Industries' Show of the Federation of Societies for Coatings Technology, held October 28-30 at Cobo Hall in Detroit.

These annual awards are for outstanding exhibits in the Show on the basis of technical excellence, educational value, attractiveness, and novelty. The awards are divided into three categories: Raw Material Suppliers (single, double, 3-5, and 6-plus booth exhibits), Equipment Manufacturers, and Service Industries.

The prizes (engraved plaques) were awarded as follows:

RAW MATERIAL SUPPLIERS

Single-Booth Exhibit—Sherwin-Williams Co., Chemicals Civ., Coffeyville, KS (7 years in Show).

Double-Booth Exhibit—Kenrich Petrochemicals, Inc., Bayonne, NJ (6 years).

Three-to-Five Booth Exhibit—Penn Color Inc., Doylestown. PA (9 years).

Six-or-More-Booth-Exhibit—Rohm and Haas Co., Philadelphia, PA (46 years).

EQUIPMENT MANUFACTURERS: Chicago Boiler Co., Chicago, IL (22 years).

SERVICE INDUSTRIES: Atlas Electric Devices Co., Chicago, IL (39 years).

Recipients of the 1981 Paint Show Awards were: Left to right (Front row) Richard Saskiewicz, of Rohm and Haas Co.; Ray Metzinger, of Atlas Electric Devices Co.; and John Wiff, of Cargill, Inc., who accepted a plaque commemorating Cargill's 40th year of participation in the Paint Show. (Back row) William Miller, of Sherwin-Williams, Chemicals Div.; Al Krumholz, of Chicago Boiler Co.; Edgar Putnam, of Penn Color, Inc.; and Jeff Buda and Dave Buskar, of Kenrich Petrochemicals, Inc. Paint Show Awards Committee Chairman Deryk R. Pawsey is at far right

Program Awards for best presentation of Society papers were presented by Horace Philipp (left), Chairman of Program Awards Committee, to Dean Owen Harper (center), of Louisville Society and Robert D. Athey, Jr. (right), of Los Angeles Society

Paint Research Institute

PETER V. ROBINSON RE-ELECTED PRESIDENT OF PRI FOR 1981-82

Peter V. Robinson, of Glidden Coatings and Resins Div., SCM Corp., Strongsville, OH, has been re-elected President of the Paint Research Institute of the Federation of Societies for Coatings Technology, 1981-82.

Other officers elected to serve are: Vice-President—C. Malcolm Hendry, Consultant, of Houston, TX; Secretary—Charles A. Kumins, of Sherwin-Williams Co., Cleveland, OH; and Treasurer—Terryl Johnson, of Cook Paint & Varnish Co., Kansas City, MO.

The remaining Trustees are: Darlene Brezinski, of DeSoto, Inc., Des Plaines, IL; Royal A. Brown, of National Paint & Coatings Association, Washington, D.C., Philip Heiberger, of the duPont Co., Philadelphia, PA; Ruth Johnston-Feller, Consultant, of Pittsburgh, PA; Colin Penny, of Hampton Paint Mfg. Co., Hampton, VA; and Percy Pierce, of PPG Industries, Inc., Allison Park, PA.

Dr. Raymond R. Myers, University Professor at Kent State University, Kent, OH, continues as Research Director of PRI.

1981 Paint Show Exhibits

The 1981 Paint Industries' Show of the Federation of Societies for Coatings Technology was held at Cobo Hall, Detroit, October 28–30. With 177 exhibitors, it was the largest show in Federation history.

As a continuing service to JCT readers, we present (in the following pages) a description of the products and services which highlighted the exhibits of exhibitor companies. These are reprinted exactly as published in the Federation's "Paint Show Program," which was given to all registrants at the convention.

Any requests for information from the exhibitor companies should be sent to the JCT office (1315 Walnut St., Philadelphia, PA 19107). All inquiries will be forwarded.—Ed.

ACETO CHEMICAL CO., INC.
Flushing, NY 11368

The company is offering a wide range of chemicals for the coatings industry. These include titanium dioxide, organotin compounds, anti-skinning agents, electrostatic spray paint additives, UV photoinitiators, and aziridine-based chemicals.

AIR PRODUCTS AND CHEMICALS, INC.
Allentown, PA 18105

Emphasized is the company's broad line of Surfynol nonionic surfactants which produce significant performance improvements in various water-based systems. Live demonstrations show the many benefits that these products bring to coatings formulations, including excellent coverage over oily surfaces and defoaming. Performance results of Surfynol GA, a product specifically designed as a grinding aid for organic pigments, are also shown.

ALUMINUM CO. OF AMERICA
Pittsburgh, PA 15219

The exhibit features aluminum pigments for automotive finishes, painted wheels, mobile home roof coatings, maintenance paints, and aluminized asphalt roof coatings. Technical personnel are available to assist visitors and provide specification and product data for all aluminum powder and flake grades.

C. M. AMBROSE CO.
Redmond, WA 98052

Equipment on display includes a new version of the company's PF9BP and PF5—light liquid machines filling by volume. Also displayed are machines filling by weight to complete filling requirements for all products.

AMERICAN HOECHST CORP.
Somerville, NJ 08876

The booth contains a complete display of organic pigments for automotive, industrial, and trade sales applications. Specific displays include lead-free pigment replacements and in-plant aqueous tinting dispersions.

APPLIED COLOR SYSTEMS, INC.
Princeton, NJ 08540

The exhibit features the ACS-550M computer color control system, a multiterminal, multitasking system which allows operators to perform color matching and correction routines as well as production and inventory control functions simultaneously. Demonstrations of CHROMA-PAC™ color control software packages and production/correction control programs which feature computer generated batch ticketing, and raw material, finished goods and jobs-in-progress reports can be seen.

ARMSTRONG CONTAINERS, INC.
Westchester, IL 60153

The exhibit features the company's line of coating containers in all sizes from ¼ pint through tall gallons and introduces their new, improved one-gallon plastic paint container.

ASHLAND CHEMICAL CO.
Industrial Chemicals & Solvents Div.
Columbus, OH 43216

On display is a complete line of solvents, exempt solvents, and specialty chemicals for paint formulations. Information about the company's computerized solvent reformulation service for paint manufacturers and about the 59 bulk plants located in major market centers is also available.

ATLAS ELECTRIC DEVICES CO.
Chicago, IL 60613

Featured is the all new Ci65 Controlled Irradiance Xenon Arc Weather-Ometer, along with the UVCON™ Fluorescent UV/Condensation Weathering Tester, the UV2 Mini-Uvcon, Color-Chex Color Matching Booth, and the Atlas Panel Rak.

B.A.G. CORP.
Dallas, TX 75228

The exhibit includes flexible, semi-bulk material handling containers for shipping and storing dry, flowable solids. (Available in tailored sizes from 8-80 cu ft.) Auxiliary equipment for loading and handling is also available.

BASF WYANDOTTE CORP.
Parsippany, NJ 07054

The exhibit contains a broad line of products for the architectural, industrial, and automotive markets. These products encompass a wide color range of dyes, pigments, and dispersions.

BELTRON CORP.
Farmingdale, NJ 07727

Booth display introduces a new, automatic paint and stain filling machine with electronic, ultrasonic fill height control, providing high sustained accuracy and operational simplicity. This new generation filling system has only one wearing part, can be run by an inexperienced operator, and cleans up in less than two minutes in a can using minimum solvent.

BLACKMER PUMP DIV.
Dover Corp.
Grand Rapids, MI 49509

Products exhibited include the company's XLW Abrasive Liquids pump. This pump has been manufactured with wear-resistant parts and has been designed to handle abrasive liquids such as paints and inks. Other pumps for solvents, resins, and varnishes are also on display.

BRINKMANN INSTRUMENTS, INC.
Westbury, NY 11590

Featured is the Mini Spray Dryer for research work on preparation of new or revision of old formulations of pigments and dyes. It is applicable for small lab runs, and features easy cleanup and minimal turn around time. Space consumption is only 2 × 2 × 3'. This is the only model available on the market.

BROOKFIELD ENGINEERING LABORATORIES, INC.
Stoughton, MA 02072

The company is exhibiting a complete line of instrumentation for the measurement and control of viscosity. Featured is a cone and plate viscometer for the measurement of paint and paint products at defined shear rates less than 1 Sec^{-1}.

BUCKMAN LABORATORIES, INC.
Memphis, TN 38108

The exhibit features the latest development of nonmercurial fungicides and bactericides for coatings preservation, as well as nonlead nonchromate corrosion inhibitors for metal coatings. Personnel are available to discuss formulations and application. The company is a manufacturer of microbiocides, corrosion inhibitors, dispersants, defoamers, flame retardants, and catalysts.

BYK-MALLINCKRODT CHEM PROD GmbH
Melville, NY 11747

The company's wetting and dispersing agent, Anti Terra VP-202, with anti-sag properties is displayed as used in an automotive primer. The use of VP-341 to improve aluminum pigment orientation in an automotive topcoat and facilitate substrate wetting in a clear automotive topcoat is displayed. Three panels, each using one of three new defoamers (Byk 065, Byk 070, and VP-020) are displayed. Byk VP-155, a unique polymeric dispersant is featured. The display of instruments includes the Dynometer and a line of gloss meters, featuring the new Pocket Gloss.

CABOT CORP.
Cab-O-Sil Div.
Tuscola, IL 61953

The thixotropic properties of Cab-O-Sil and its applications as an anti-sag, anti-settling agent in high-solids coatings is illustrated. Technical literature, specifications, and information on the use of Cab-O-Sil in water-reducible coatings are available.

CAPRICORN CHEMICALS CORP.
Secaucus, NJ 07094

This exhibit introduces Lanco products, particularly micronized waxes (PP, PE, PTFE, amide and polyamide waxes), wax dispersions, paint additives (anti-floats, anti-bubble agents, thickeners, flushed carbon blacks, and other specialties).

CARGILL, INC.
Chemical Products Div.
Minneapolis, MN 55440

New high-solids, water-reducible, and powder-coating resins are introduced. The booth features industry advances in fast air-dry high-solids systems, and air-dry water-reducible resins with excellent salt and humidity resistance. Eleven coating areas suggest end uses and show actual coated parts. "A Helping Hand" is given through our formulary, technical brochures, and technical sales-service people available to the coating industry.

CDI DISPERSIONS
Newark, NJ 07114

The exhibit includes information on a comprehensive line of pigmented dispersions in a variety of vehicle systems. Carbon black compounds and custom dispersions are a specialty and are tailored to customer's needs. Industries served include coatings, printing inks, plastics, textiles, foams, paper, building materials, and other areas of specialized applications.

CECOS INTERNATIONAL, INC.
Niagara Falls, NY 14302

The company invites you to discover, first-hand, our better systems for the management of chemical wastes in an environmentally sound manner. Work the $50,000 scale model of our Secure Chemical Landfill yourself! See our informative slide presentation. Technical environmental consultants are available for answers to specialized corporation needs.

CELANESE CHEMICAL CO., INC.
Dallas, TX 75247

Application technology for ultra violet and electron-beam cured systems for adhesives, inks, and coatings is displayed. Emphasis is given to the use of multifunctional monomers, in high-solids and water-borne systems, as possible solutions to energy conservation and environmental problems.

CELANESE PLASTICS & SPECIALTIES CO.
Louisville, KY 40208

While the exhibit features a broad line of coatings polymers, particular emphasis is given to water-reducible epoxies and curing agents for marine and industrial maintenance coatings, water-reducible acrylics for industrial baking and maintenance finishes and acrylated epoxies, and acrylics and urethanes for UV/EB curing applications. Displays, highlighting specific performance characteristics of these various resins, are also featured.

CEM CORP.
Indian Trail, NC 28079

The exhibit features a moisture/solids analyzer. Termed the Automatic Volatility Computer, the unit combines the latest developments in microwave drying and computer technology to provide a rapid and accurate method for solids determination in paints and coatings. The instrument is completely automatic and gives digital read-outs of solids or moisture to .01%. The unit is self-contained and can be located in-plant as well as in the laboratory.

CHEMICAL & ENGINEERING NEWS
American Chemical Society
Washington, DC 20036

The display features *Chemical and Engineering News*, a chemical newsweekly and the official publication of the American Chemical Society. C & EN is designed to perform a double, but related, function. It keeps readers informed of all of the news of the chemical world generally as it interrelates with the world at large, and of policies and activities of the ACS.

CHICAGO BOILER CO.
Chicago, IL 60614

The exhibit features the horizontal Dyno-Mills and "Red Head" small media mills. The various grinding media used with these mills are also displayed.

CLAWSON TANK CO.
Clarkston, MI 48016

On display is a complete line of portable shipping containers for storing, transporting, and processing liquid and dry materials. Included in the exhibit are the Jumbo Drum and new Jumbo Bin with a full line of accessories for custom applications. Also included are mixing tanks, processing tubs, and bulk storage tanks.

COLOR CORP. OF AMERICA
Div. of The Valspar Corp.
Rockford, IL 61101

On display are the merchandising aids utilized in the Color Studio Trade Sales Tinting Program, including the new architect program and completely new wood stain program for both solidtone and semi-transparent stains for both interior and exterior use.

COLUMBIAN CHEMICALS CO.
Tulsa, OK 74102

"Product Uniqueness" is the theme of this year's booth exhibit. Highlighted are Raven® industrial carbon blacks and Mapico® iron oxides for trade, industrial, and specialty coatings. Products for color, electrical, and rheological control are depicted.

COMMERCIAL FILTERS DIV.
Kennecott Corp.
Lebanon, IN 46052

The exhibit features Fulflo filter vessels and filter cartridges. A highlight of the display is the low cost, long life Fulflo resin bonded cartridge for paint and viscous fluid filtration (as high as 15,000 SSU). Bag filters and wound depth cartridges with appropriate vessels are also displayed.

CONTINENTAL FIBRE DRUM CO.
Stamford, CT 06904

The company is exhibiting their latest fibre drums designed especially for water-based paints and powder coatings, including samples of new Liquipak® drums with linings made of LDPE and aluminum foil for high moisture containment, modified copolymers for the packaging of harder to hold additives, and the more sophisticated polyester laminates for some products that still contain solvents.

COSAN CHEMICAL CORP.
Carlstadt, NJ 07072

A new organo biocide, COSAN 101, is highlighted this year. COSAN 101 is a liquid designed specifically for water-based systems and has a broad spectrum of activity against both gram positive as well as gram negative organisms. Personnel is available to discuss this product as well as the company's complete line of fungicides, driers, chemical specialties and catalysts.

CUSTOM CHEMICALS CO.
Elmwood Park, NJ 07407

The exhibit highlights a complete line of aqueous colorants available as fine powders or pourable paste. These colorants are designed to enable the coatings industry to meet stringent environmental regulations. Included in this color line is a shelf-stable, aqueous aluminum pigment concentrate for use in water-based or water-reducible paints or inks. The popular Mikrolour® pigment dispersions for industrial coating are also displayed.

DANIEL PRODUCTS CO.
Jersey City, NJ 07304

Additives for high-solids and water-thinned coatings and inks are featured. Examples are provided demonstrating improved substrate wetting with Dapro Interfacial Tension Modifiers, better dispersion with Disperse-Ayd pigment-dispersing agents, and increased resistance to marring and metal marking with Slip-Ayd® Surface Conditioners. Data are available on the use of Tint-Ayd Colorants in high-solids systems. Also featured are Dapro Foam Suppressors for water-thinned coatings.

DEGUSSA CORP.
Teterboro, NJ 07608

The exhibit features Aerosil® 200 for thixotropy and anti-settling of pigments, Aerosil® R972 for corrosion-resistant coatings and Flatting Agent OK412 for efficient flatting of clear and pigmented coatings.

DIAMOND SHAMROCK CORP.
Process Chemicals Div.
Morristown, NJ 07960

A product advance—Nopcocide N-40-D fungicide dispersion—is on display along with information on the company's full line of performance dispersants, defoamers, wetting agents, stabilizers and thickeners for paint systems. N-40-D is the new liquid form of Nopcocide N-96, the industry's leading nonmercurial fungicide. The exhibit also spotlights Nopcosperse 44 universal dispersant. A specialty which is gaining rapid market acceptance due to its efficiency over a wide range of formula variations. All these products demonstrate the division's problem-solving capabilities in coatings technology.

DIANO CORP.
Woburn, MA 01801

A division of Bausch & Lomb, Inc., the company is displaying systems for the measurement, formulation, and correction of color. The Match-Mate computer color matching system includes a Match-Scan spectrophotometer, the latest computer hardware and terminals from Digital Equipment Corp. and proprietary software. New routines on display include: Infrared measurement, job queuing, easier alignment of small samples and options for plotting. All previous features are retained including automatic loading, waste work-off, batching and limited add for production corrections.

D/L LABORATORIES
New York, NY 10003

"Consultants to the Industry" is the highlight of the display. The booth features examples of the services provided to the coatings, sealants, and plastics industry, including formulation, testing and evaluation, corrosion studies, inspection, industry and market surveys, market development, preparation of specifications and manuals, personnel training and legal assistance. Key personnel are available to discuss your ideas and problems.

DOMINION COLOUR CO. LTD.
Toronto, Ontario M8V 2E9

This exhibit displays a selection from the broad range of inorganic and organic color pigments for the coatings, plastic and graphic arts trades, as manufactured by the company. These pigments are sold by 20 distributors, worldwide. Highlights include nonlead alternatives, panels displaying color quality and durability, literature on specific pigments and their applications, technical personnel to participate in confidential discussions and recommendations. Representatives from our distributor network welcome their customers.

DOW CHEMICAL USA
Midland, MI 48640

This booth features the "Compliance Solvents—Methylene Chloride and 1, 1, 1-Trichloroethane" which are exempt from State Implementation Plans in most states. These solvents are used to make compliance paints and coatings and can generally be used with proven resins and equipment systems.

DOW CORNING CORP.
Midland, MI 48640

On display are a wide range of problem-solving silicone coatings, including newly developed high-performance, water-based silicone alkyds with low VOC levels. Other products shown include high-solids silicone resins, long-life silicone-alkyd maintenance paints, high-temperature silicone resins, and an expanded line of silicone paint additives to improve product performance and to solve production problems.

DRAISWERKE, INC.
Allendale, NJ 07401

The company, a manufacturer of mixing, wet grinding and dispersing machinery, presents its newest additions to its product line. These additions include continuous vacuum Perl Mills for grinding, dispersing and deaerating highly viscous, hard to grind and heat sensitive products, as well as a Direct Dispersion Mill which completely eliminates all pre-mixing and pre-dispersing. The highlight of the exhibit is a newly designed Perl Mill which promises to increase versatility and simplicity of mill operation.

DREW CHEMICAL CORP.
Specialty Chemicals Div.
Boonton, NJ 07005

New, unique technology in trade sales paint defoamers is featured at this booth. The new products exhibit outstanding results vs conventional nonsilicone defoamers. Results are highlighted in a visual presentation. In addition, the company's line of silicone products for industrial coatings, i.e., defoamers, flow control and levelling aids, and slip agents, are previewed. Marketing and technical specialists are available to discuss these products and answer questions regarding your specific needs. The company's Foam Control Film is available for showing.

DSET LABORATORIES, INC.
Phoenix, AZ 85029

The company is exhibiting its full line of technical weathering and diagnostic measurement services for the paint and coatings industry. These services include realtime and accelerated (Emmaqua® test method) weathering services as well as optical and physical property (impact, color, color difference, gloss, bending strength, etc.) measurement services. We can help you evaluate your products.

EASTMAN CHEMICAL PRODUCTS, INC.
Kingsport, TN 37662

Solvents for high solids and water-borne coatings and Texanol® coalescing aid are highlighted. Glycols for high solids and powder coatings, as well as cellulose esters for plastic coatings, CAB/polyester for lacquers and primer/surfacers, Weton wet automative coatings, and CAP for printing inks and overprints are exhibited.

EBONEX CORP.
Melvindale, MI 48122

Examples of areas where the company's line of specialty black pigments can be used to advantage are presented.

EIGER MACHINERY, INC.
Schaumburg, IL 60194

Exhibited for the first time in the USA are several models from the complete range of Eiger Motormills. This unique direct drive, horizontal bead mill is being used wherever the finest wet grinding and dispersing operations are required. On display are a 20 litre Production Motormill, a 1 litre Pilot Motormill and three of the unique world famous 0.05 litre, self-contained 'Mini' Motormills.

ELCOMETER, INC.
Birmingham, MI 48012

ELEKTRO-PHYSIK, INC.
Virginia Beach, VA 23455

This company, an internationally known manufacturer/distributor of portable coating thickness gages for measurement of coatings on ferrous and nonferrous substrates, is displaying the following gages: Mikrotest, Certotest, Minitest, Elektrotest, Porotest, Galvanotest, and the new pencil-type gage "Pentest." This gage is particularly excellent for quality control departments starting out fresh as it is economically priced. For more information on a free 14-day trial of these gages, come by the booth listed above.

ENCAPSULAIR, INC.
Wheeling, IL 60090

The booth updates the breakthrough in paint technology for the usage of Spindrift beads, a licensed product of Dulux Australia Ltd.® Featured are the new industrial usages for producing matte flat finishes as well as cost reduction. Update on the microvoid-containing beads in latex is available.

ENGELHARD MINERALS & CHEMICALS DIV.
Edison, NJ 08818

Introduced is a new thickening agent for asphalt coatings which provides excellent performance at minimal cost. It is suggested for use in automotive underbodies, and with sealants and roof coatings. Detailed information can be obtained from technical staff at the booth. The company is a pioneer in the development of performance products in Attagel® thickeners, Emtal® talcs and ASP® and Satintone® kaolin-based extenders for the paint and coatings industries.

EPWORTH MFG. CO., INC.
South Haven, MI 49090

This exhibit featues a new, laboratory, small-batch, media mill along with a cross-sectioned, production-size SWMill, designed to disperse hard to grind pigment and vehicle systems in an hour or less. Experts are on hand to discuss a full line of ball mills, mixers, sand mills, and media types.

FAWCETT CO., INC.
Richfield, OH 44286

On display are the company's air-operated mixers, stirrers, and accessories.

FEDERATED METALS CORP.
Subsidiary of Asarco, Inc.
New York, NY 10271

Information on the complete line of zinc dusts produced by the company for the coatings industry is available. Several quality control tests used to determine particle size are demonstrated. The regular, superfine, and ultrafine grades are on display for microscopic examination.

FEDERATION OF SOCIETIES FOR COATINGS TECH.
Philadelphia, PA 19107

Featured is a display of Federation publications and educational and training aids. Publications on display include "An Infrared Spectroscopy Atlas for the Coatings Industry," the "Paint/Coatings Dictionary," the "Glossary of Color Terms," the new edition of the "Pictorial Standards of Coatings Defects," the 27 booklets in the Series on Coatings Technology, the *Journal of Coatings Technology*, and the 1981 Membership Directory (Year Book). Federation slide/tape training programs are also displayed, along with the Color-matching Aptitude Test Set.

FILTER SPECIALISTS, INC.
Michigan City, IN 46360

Liquid bag-type filters are on display. Sizes range from miniature models to models with 3000 GPM capacity. Filter bags are available from 1—800 microns in a wide variety of shapes and sizes. Technical personnel are in attendance to help with any filtration applications or problems.

FREEPORT KAOLIN CO.
New York, NY 10166

Discover your friends at the Freeport Message Center. We the innovators of the Kaolin industry hope that you enjoy and benefit from the Federation convention. The telephone number in the message center is 964-6031.

FRICKE McCORMICK ENGINEERING
Granite Falls, WA 98252

On display is a Twin Filler/Closer with Lid Dropper. This machine measures by weight and fills by either gravity or pump, and will fill and close ¼ pt to 1 gal. Also shown is a new Semi-Automatic Volume Filler/only, which will measure by volume and fill by its self-contained piston pump. It fills sizes ½ pt to 1 gal. A deluxe Lid Closer for ¼ pt to 1 gal is exhibited. This machine is a roll-thru type closer, and an excellent support tool for different type fillers.

GAF CORP.
New York, NY 10002

"Coating Additives for Emulsion Polymerization and High-Solids Formulation" is the theme of this booth. A new emulsion polymerization brochure is introduced. The booth features surfactants for water-based coatings, specialty solvents, polymeric dispersants for solvent-based, high-solids coatings, and reactive monomers for UV/EB radiation curing technology. The following products are also featured: Alipal®; Blancol®; Butanediol; Gafac®; Ganex®; Igepal®; M-Pyrol®; Nekal®; Thickener® LN; and V-Pyrol®.

GARDNER LABORATORY DIV.
Pacific Scientific Co.
Bethesda, MD 20014

The company offers a wide selection of quality control testing instruments for the evaluation of color, gloss viscosity, and other physical parameters of coatings. Making its debut is the new Gardner Abrader for washability or abrasion-resistance testing. Also featured are the new XL-800 Series Colorimeters including the unique XL-825 Colorimeter System with a remote optical sensor that can be presented to samples of virtually any size. Also on display are the ICI Cone and Plate Viscometer, the complete line of Gardner Glossmeters and the New Colorgard II Light Booth.

GENERAL ELECTRIC SILICONES
Waterford, NY 12188

The company is exhibiting their high-solids coating resins, experimental water-borne resins, and high phenyl and high methyl silicone intermediates for modified polyesters.

GEORGIA KAOLIN CO.
Elizabeth, NJ 07207

The company introduces their new, unique TiO_2 extender pigment, Altowhite TE. An entirely new type of calcined aluminum silicate, Altowhite TE has low gloss characteristics with exceptional hiding power especially engineered for paint and coatings applications. The exhibit also features the company's complete line of calcined, delaminated, and hydrated aluminum silicate extender pigments for use in the paint industry.

W. R. GRACE & CO.
Davison Chemical Div.
Baltimore, MD 21203

Visit our booth for information on our full line of high-efficiency flatting agents for high solids, H_2O, UV, and conventional coatings.

GRACO INC.
Minneapolis, MN 55440

The exhibit introduces the MT80 manual colorant dispenser and the Colormatic semi-automatic dispenser. Also featured are the Auto Tint 2000 automatic colorant dispenser and the Auto Sperse high-speed paint mixer. The company manufactures a line of tinting equipment for accurate, repeatable dispensing at all levels of business.

GREGORY GROUP, INC.
Revolvator Industrial Trucks Div.
North Bergen, NJ 07047

Explosion-proof, UL approved, rider and pedestrian operated forklift trucks for use in hazardous environments in Class I Group D Division 1—gas and vapors, atmospheres, are featured. In addition, the exhibit includes displays of self-propelled, air-operated forklifts, to work in the most hazardous areas, as well as palletizers, coil cars, and electric-powered forklifts, designed to meet user specifications for special applications.

HALOX PIGMENTS
Pittsburgh, PA 15220

Corrosion resistant and tannin stain blocking pigments, free of lead and chromate, are featured. The pigments perform in water-emulsifiable, water-reducible and traditional solvent-thinned systems. Booth program demonstrates the use of the company's pigments in structural, maintenance, industrial, marine and tank coatings for metal protection. Strong emphasis is placed on coatings, formula recommendations and guidance which satisfy regulations pertaining to air quality, work practices, safe handling, transportation and disposal.

HARSHAW CHEMICAL CO.
Cleveland, OH 44106

Visit the "People Who Know Color" and sample our full palette of colorants for architectural, OEM and special purpose coatings. See our new reduced dust pigments as well as our spectrum of inorganic and organic dry color, and our aqueous and universal dispersions.

HARSHAW CHEMICAL CO.
Corrosion Test Equipment
Cleveland, OH 44106

On display is a bench-top sulfur dioxide corrosion testing chamber and a salt corrosion testing chamber.

HENKEL CORP.
Minneapolis MN 55435

The Resins Div. exhibit presents G-CURE® acrylic resins for gloss-retentive urethane coatings; Versamid® polyamide resins, the industry standards for industrial and maintenance coatings; Genamid® amidoamine resins for higher solids, higher build coatings; and resin systems for CARB compliance in water-borne and water-reducible coatings.

HERCULES INCORPORATED
Wilmington, DE 19899

The exhibit features nitrocellulose, Natrosol® hydroxyethylcellulose, and Pentrex™ rosin ester resins. A twice life-size drum symbolic of the commercial nitrocellulose drum appears modified to show all the extra features that accompany this product to the customer. New Pentrex resins are on display; and a solution of Natrosol B, pumped to show laminar flow, catches the observer's eye. Specialists are available to discuss Parlon® chlorinated rubber, Hercoflat® polypropylene texturing and flatting agent, Di-Cup® dicumyl peroxide, Vul-Cup® vulcanizing agent, Pulpex™ synthetic pulp, ethylcellulose, EHEC, and Pamolyn® fatty acids.

HIGHLAND LABORATORIES
Ashland, MA 01721

The company, a manufacturer of colorant dispensers for over 22 years, displays both manual and semi-automatic machines. Their products, used by approximately 60 different paint companies, have proven reliable, accurate, and durable at a moderate price. Additional information is available at the booth.

HILTON-DAVIS CHEMICAL CO. DIV.
Cincinnati, OH 45237

The theme of the exhibit is "The Extraordinary." Featured are a wide spectrum of uniform high quality colorants for the coatings industry. Highlighted are water-based dispersions and Trans-Oxides®. Literature on specific colorant systems is available.

HOCKMEYER EQUIPMENT CORP.
Harrison, NJ 07029

Featured is a demonstration of high-speed dispersion as it compares to low-speed agitation. The effects of speed and baffles are shown, as they relate to different viscosity products. All blade styles are available for inspection and discussion. Also featured is the improved design model 2L, 2 horsepower laboratory variable-speed discperser.

HOOKER CHEMICAL CORP.
Niagara Falls, NY 14302

Ferrophos® enhancer for zinc-rich protective coatings is featured. Ferrophos provides improved weldability and topcoatability while retaining full corrosion resistance. Developed as a partial substitute for zinc dust in zinc-rich primers, the enhancer also improves adhesion and conductivity.

J.M. HUBER CORP.
Havre de Grace, MD 21078

Featured are amorphous, precipitated silica and silicate pigments. Information on reducing RMC with functional spacer pigment, Zeolex® 80, in trade sales paint is available. Data on the company's universal flatting agent Zeothix® 95, for trade sales and industrial in both water-borne and oil-based systems and new, low cost silica thickening agent, Zeothix 265, are featured. Literature on several grades of calcium carbonate from the company's Calcium Carbonate Div., including new ultra-fine grade, Q-White, for use in water-based coatings, is available.

HUMBOLDT MFG. CO.
Sheen Instruments Ltd.
Norridge, IL 60656

This exhibit displays laboratory test equipment for paint and industrial coatings. Featured are such items as glossmeters, viscometers, hardness and adhesion and coating thickness.

HUNTER ASSOCIATES LABORATORY, INC.
Reston, VA 22090

The company is exhibiting their line of instrumentation which is directly related to the measurement of color and gloss of paints. This includes the D25-9 Microprocessor Colorimeter, and the D48 and D52 Glossmeters. The HunterLab D25-9 Tristimulus Colorimeter with batch correction programs stored on floppy diskettes offers the paint industry the means of quality improvement and cost reduction. Being introduced this year is the Series 500 SpectroColorimeter which is designed with the paint industry in mind.

IDEAL MANUFACTURING & SALES CORP.
Madison, WI 53704

The company is exhibiting the SA 120 fully pneumatic, semi-automatic filler/sealer which is adaptable from ½ US pints to one imperial gallon. Also on display is other filling equipment which the company manufactures.

INTERNATIONAL MINERALS & CHEM. CORP.
NP Div.
Des Plaines, IL 60016

This 40-foot display highlights the company's full line of chemicals for coatings, including NiPar S-30™ to protect your solvent system from weather, water, and corrosion; AMP-95, the all-purpose additive for coatings; BIOBAN® CS-1135, the nonmercurial in-can paint preservative; DMPA®, for superior film properties in water-reducible alkyd resins; TRIMET®, for high gloss, durability, and gloss retention in alkyd resins; and pentaerythritol, used to produce alkyd resins and fire-retardant coatings.

INTERSTAB CHEMICALS, INC.
New Brunswick, NJ 08903

Serving the paint and coatings industry since 1931, the company is featuring additives for water-reducible coatings. Also presented is literature on a complete line of driers, defoamers, wetting agents, biocides and anti-skinning agents. The company is a wholly owned subsidiary of Akzo Chemie, Amesfoot, the Netherlands.

ISC ALLOYS LTD.
Bloxwich, West Midlands, UK

Formulations, panels, and photographs show the corrosion resistance of Delaphos zinc phosphate and Delaville zinc dust primers. Delaphos 2 zinc phosphate is an easily dispersible grade meeting all the requirements of BS5193. Delaville zinc dusts are manufactured within strict particle size and impurity limits. Advanced processing and blending techniques provide products to meet customers individual requirements.

JOHNS-MANVILLE
Denver, CO 80217

The company's Celite® functional fillers, Micro-Cel® extenders, and fiber glass and yarn-wrapped filter cartridges are on display.

KENRICH PETROCHEMICALS, INC.
Bayonne, NJ 07002

The exhibit features field samples and data on the use of Ken-React® titanate coupling agents to replace metal chromates in polyamide-cured epoxy, increase productivity; improve pigment dispersion; reduce viscosity; increase sand loadings to epoxy flooring compounds; promote adhesion; lower bake temperatures; achieve high solids and solvent elimination; prevent corrosion; improve acid resistance; and increase scrubbability and prevent flash rusting in latex paint. Kenplast® ES-2 (cumylphenyl acetate), a nonmutagenic epoxy reactive diluent, is offered.

KTA-TATOR ASSOCIATES, INC.
Coraopolis, PA 15108

The company is exhibiting a comprehensive line of field coating equipment for ambient conditions, surface cleanliness and profile, film thickness and adhesion. Featured in the exhibit is a complete line of high-voltage pinhole and holiday detectors. KTA coatings consulting, failure analysis, laboratory testing and inspection services are also presented.

LABELETTE CO.
Forest Park, IL 60130

Several models of semi-automatic labeling machines, paint cans and aerosol cans, and 5-gallon pails are featured.

THE LENETA CO., INC.
Ho-Ho-Kus, NJ 07423

As manufacturers and suppliers of paint test charts and test equipment, the company presents its newly expanded line of "Spray Monitors" for spray paint testing, now available in black & gray, red & gray, and black & white color combinations. Also exhibited for the first time are "Metopac" metal hiding power panels designed for use with powder coatings. Catalogs and supplementary literature are available for distribution and the exhibit includes many of the products described therein.

LETICA CORP.
Rochester, MI 48063

On display is the company's new, all plastic, straight sided paint can. Also shown is their complete line of nestable plastic shipping containers.

LIQUID CONTROLS CORP.
North Chicago, IL 60064

In addition to a series of positive displacement meters, the booth features the series 1000 Electronic Liquid Batch Controller. The LC series 1000 Batch Controller is designed for interfacing with LC positive displacement meters and control valves to provide a remote electrically controlled, accurate, reliable and (when desired) repeating batching system. It's design flexibility enables the Liquid Batch Controller to be incorporated in most all meter systems regardless of origin.

LORCON CHEMICALS INC.
Dorval, Quebec, Canada H9P 2N9

The use of the company's JK 270 resin in a wide variety of applications is shown. These include emulsion systems and alkyd applications. Clears, stains, primers, industrial finishes and traffic paints are on display. Formulations to meet CARB requirements are illustrated.

3M COMMERCIAL CHEMICALS DIV.
Chemical Resources Div.
St. Paul, MN 55144

This booth features a broad range of epoxy curing agents, UV cure initiators, diluents, wetting agents and flow control agents. These materials are designed for high solids and 100% active epoxy systems.

MACBETH
Div. of Kollmorgen Corp.
Newburgh, NY 12550

The company is exhibiting their state-of-the-art Series 1500 Color Measurement System, an expandable series which, with user-selected software, has capability ranging from "simple" colorimetry to sophisticated spectrophotometry. Also on display is the SpectraLight Color Matching Booth, which enables you to match color using all three common light sources plus ultraviolet light. Munsell products on display include the Book of Color, Color Tree, and Farnsworth-Munsell 100 Hue Color Vision Test, in addition to color standards and tolerance sets.

MANCHEM INC.
Princeton Junction, NJ 08550

The exhibit features the role of metal organic compounds in the new coatings technologies for the '80's. New data is available on the stable, cost-effective curing of high-solids and water-reducible coatings conforming to CARB. Also noteworthy is information on nonsilicone water repellency agents for brick and wood.

MATTER MIXERS, INC.
Bluffton, IN 46714

Equipment on display includes the Model MR1, a one hp. small batch disperser with variable speed from 1100-9600 RPM, manual hydraulic lift, and a capacity range of one quart to five gallons; the Model MS10, a 10 hp. stand-mounted disperser with variable speed from 490 to 3600 RPM, manual hydraulic lift, and a capacity range of 30 to 175 gallons; and the Model ML laboratory mixer with variable speed and a capacity range of 100 milliliters to one gallon. Also shown are impellers designed for dispersing solids or liquids in liquid materials.

MEADOWBROOK CORP.
Subs. of T. L. Diamond & Co., Inc.
New York, NY 10112

Featured are high quality, zinc dust pigments produced at the company's West Virginia smelter. Included is its low micron, high metallic zinc dust.

MEARL CORP.
New York, NY 10017

The company's Pearl Pigments Div. displays high luster coatings based on nonlead, nonmetallic "metallic-like" pearl pigments. Also exhibited are new weather-resistant grades intended for long-term exterior exposure. The Franklin Mineral Products Div. displays advantages of high-quality, wet-ground mica in a variety of coating applications. Representatives of both divisions are available to provide technical assistance and discuss specific application needs.

MERCK & CO., INC.
Chemical Div.
Rahway, NJ 07065

The introduction of an important new product, TEKTAMER®38, is featured. The product is a new preservative and a major step forward in protection from microbial decomposition. Visit this booth and learn about TEKTAMER 38, the many other Merck preservatives, and the laboratory services available.

MGI INTERNATIONAL, INC.
Morris Plains, NJ 07950

Introduced are two new products to the firm's "Air Pollution Control" product line: the A-Par Mark IV Air Washer, designed to handle pollutants ranging in size from long strips of paper down to particles of fibers, with a variety of applications in industry for picking up powders, pigments and dust of various types; and the newly developed "Sound Enclosure," an easily relocatable booth substantially reducing dBA levels.

MICHIGAN INDUSTRIAL FINISHES
Detroit, MI 48211

On display is the Hydraustic Activator, designed for use along with sodium hydroxide as a paint and resin stripper. It promotes the effectiveness of the caustic to strip hardened automotive acrylics, polyester, alkyd, and phenolic resins, etc. It was initially designed for use in the reconditioned drum industry. The Hydraustic Activator is now being used in cleaning let down tanks, resin reactors, tankers, paint stripping and of course 55 gal metal drums.

MIDWEST CADO SYSTEMS CORP.
Broadview, IL 60153

On display is a twofold system designed to operate in both office and laboratory environments, simultaneously. The system will automatically prepare Material Safety Data Sheets. Among the highlights of the system are the creation of new formulas, optimizing formulas, PVC, VOC, and pigment binder ratio.

MINERAL PIGMENTS CORP.
Beltsville, MD 20705

Pictorial displays of vehicles and equipment where the inorganic chemical products are used including zinc phosphate, zinc chromate, medium and light chrome yellow, strontium chromate, and iron oxides. New anticorrosion products are exhibited. New color cards are available for distribution.

MiniFIBERS, INC.
Weber City, VA 24251

The company is introducing two new, technically advanced fibers, recent additions to their proven product line. New formulations are available in a wide variety of coatings. Experienced personnel demonstrate how SHORT STUFF® can enhance your future in the coatings industry.

MOBAY CHEMICAL CORP.
Pittsburgh, PA 15205

The exhibit features an extensive multi-projector, audio-visual theatrical presentation on the company's capabilities as a supplier of urethane coatings resins and specialty chemicals, organic pigments and iron oxide pigments to the paint and coatings industry. An associated product display features end-use applications of the chemicals and pigments.

MODERN PAINT AND COATINGS
Atlanta, GA 30328

Complimentary copies of the October Show Issue are being distributed at the booth. The Paint Red Book, the only directory in the coatings field, is on display, as are technical books of other publishers available from Communication Channels, Inc.

MOREHOUSE INDUSTRIES, INC.
Fullerton, CA 92632

The company has on display a new design, pressure sandmill, the M17-15 PX; a medium size, dual-shaft disperser with a tank; and a new, medium size, single-shaft disperser.

MYERS ENGINEERING
Bell, CA 90201

Latest developments in multi-shaft dispersers/mixers are on display. Factory and field engineers will answer questions on dispersion problems.

NALCO CHEMICAL CO.
Oak Brook, IL 60521

The theme for the exhibit is "Dynamic Dimensions in Coatings Additives." This theme aptly describes the firm's rapidly expanding line of innovative coatings additive products. These products include antifoams, thickeners, and dispersants. The focus of the exhibit is the new 2323 Rheology Modifier for latex paints. An audio/visual presentation describes the superior film build and leveling provided by the product.

NATIONAL PAINT AND COATINGS ASSOCIATION
Washington, DC 20005

Various aspects of NPCA's "Picture It Painted" promotional campaign are featured. Other Association activities are exhibited.

NETZSCH, INC.
Lionville, PA 19353

This exhibit features the company's automatic vertical John Mill. The mill is equipped with a ball charge variator and instrumentation to provide easy maximization of grinding performance such as throughput rate, particle size/color strength, gloss and transparency. The ball charge variator eliminates the need for the manual addition and removal of grinding media, while the instrumentation controls the speed of the product feed pump, keeping the grinding temperature constant and below its maximum limit.

NEUTRONICS, INC.
King of Prussia, PA 19406

The company, a manufacturer of oxygen analyzers, has designed an oxygen analyzer/inerting system which may be used in the manufacturing paint to ensure safe operation of equipment. This is accomplished by reducing the oxygen level in the paint mixing equipment to a level unable to support combustion. The system choices range from portable to fixed installations, which may be used to reduce hazards in mixing vessels, ball mills, storage, etc.

NEVILLE CHEMICAL CO.
Pittsburgh, PA 15225

This exhibit encompasses the company's wide range of petroleum hydrocarbon resins, Cumar® coumarone-indene resins and Unichlor® chlorinated paraffins. Of particular interest is technical information on the utilization of the firm's resins and chlorinated paraffins in coating systems and exempt solvents. Technical representatives are on hand to discuss the company's capabilities and products for the coatings industry.

NEW WAY PACKAGING MACHINERY, INC.
Hanover, PA 17331

The exhibit includes the Model EP Horizontal Roll Through Labeler set to handle gallon paint cans with bail ears. This unit will automatically time the container to match the label cutouts. As featured, the machine will include explosion proof motor, switch, and wiring and the company's pressurized lap paste system. An overhead manual feed chute is used to feed the labeler and the labeled cans are discharged onto the bailing shelf and end-load, hand-packer for manual insertion of (4) 1 gallon cans into an end open case.

NL CHEMICALS/NL INDUSTRIES, INC.
Hightstown, NJ 08520

The exhibit features both the economy and versatility of an entire range of titanium dioxide pigments, rheological additives, and anticorrosion pigments. A high-performance, pourable, thixotropic antisettling agent, MPA® 2000X additive, is highlighted. The greater versatility of RHEOLATE™ 1 liquid thickener in latex stains and water-reducible systems is shown. Improved corrosion resistance of coatings by using NALZIN® SC1 lead and chromate free corrosion inhibition pigment is also demonstrated.

NYCO
Div. of Processed Minerals, Inc.
Willsboro, NY 12996

The company is exhibiting data on NYAD® wollastonite and Wollastokup® surface-modified wollastonite. Technical data emphasizes wollastonite as a pH buffer in acrylic and PVA latex systems and as a stabilizer and gellation preventer in exterior latex paints containing zinc oxide. New data is available on wollastonite in metal and wood primers to aid salt fog resistance, nonblistering, and anti-corrosion. Technical staff is present for discussion.

OHIO PAIL CO.
Circleville, OH 43113

OMYA, INC.
Proctor, VT 05765

Omyacarb UF (ultra-fine) and Omyacarb F (fine) wet ground calcium carbonates are featured in the exhibit. New information is available on Omyacarb UF as an optimum spacer for titanium dioxide and its versatility in gloss, semi-gloss and flat trade sales and industrial finishes. Also displayed are specially treated carbonates—Omyacarb UF-T and F-T which have an organophilic surface characteristic, and Albarex which is a secondary anti-corrosion pigment and barytes replacement in maintenance coatings; Omyacarb dry ground carbonates produced in California; Vertal platy; asbestos-free talcs; and a new line of organic pigment dispersants.

OTTAWA SILICA CO.
Ottawa, IL 61350

Product samples, literature, and specifications are available for silica and kaolin pigment extenders. Special grades for texturizing as well as grinding media and abrasion-resistance testing sands are displayed. The company and its subsidiary, Texas Industrial Minerals, are exhibiting for the first time. The calcined clay operation located in Kosse, Texas was recently acquired from Dresser Industries. Ottawa Silica has been producing silica since 1900.

PAINT RESEARCH INSTITUTE
Philadelphia, PA 19107

Research projects sponsored by PRI are presented via slide/tape and graphically. FSCT members are asked to vote on preferred projects. PRI publications are available. A contest designed to test FSCT conventioneers knowledge of PRI is underway.

PENN COLOR, INC.
Doylestown, PA 18901

Innovation, advancement, and technical service in pigment-dispersion technology are highlighted at the exhibit. Along with quality dispersion lines which currently serve the coating, ink, and plastic industries, the company also features the latest advancements in water-borne and radiation-curable pigment dispersions.

PENNSYLVANIA GLASS SAND CORP.
Pittsburgh, PA 15235

The exhibit features information documenting the benefits of using both Min-U-Sil (micron-sized silica) and Supersil (custom-ground silica) in conventional and powder coatings.

THE PFAUDLER CO.
Rochester, NY 14603

Specialists are available to discuss the company's resin reactor systems, solvent recovery wiped film evaporator systems, and rotary piston paint fillers.

PFIZER, INC.
MPM Div.
New York, NY 10017

Information on the company's full line of color pigments and minerals for the coatings industry is available. Pferrisperse® cost saving pigment slurry is featured.

PLASTICAN, INC.
Leominster, MA 01453

POLYVINYL CHEMICAL INDUSTRIES
Wilmington, MA 01887

The exhibit features proven performance polymers: NeoCryl A-600 series, water-borne acrylics; NeoRez R-900 series water-borne urethanes which offer flexible, yet hard, films in both aliphatics and aromatics. Introduced are NeoCryl B-723LV a new exterior durable acrylic bead with superior metal adhesion; NeoRez R-966 and R-967 water-borne urethanes with unique hardness development; NeoCryl A-655 water-borne acrylic with superior adhesion to poorly prepared metals; and NeoCryl LE-800, a new high gloss, low temperature water-borne thermoset.

POTTERS INDUSTRIES, INC.
Hasbrouck Heights, NJ 07604

The company, a U.S. manufacturer of glass spheres, presents its A-Series spheres which are manufactured to precise specifications from high-quality, lead-free, soda-lime silica glass. The characteristics of these spheres provide the controls necessary for achieving precise results in a wide range of industrial and scientific applications including small media milling of magnetic tape coatings, pigments, herbicides, shoe finishes, dyes, varnishes and chemicals.

PPG INDUSTRIES, INC.
Pittsburgh, PA 15222

Lo-Vel® flatting agents for coil coatings, lacquers, clear finishes, textured finishes, vinyl, and furniture are featured. Also shown is Hi-Sil® 422 silica paint pigment for flat and semi-gloss latex interior paints, latex exterior paints, oil-based house paints, and traffic paints. Hi-Sil® T-600 synthetic thickener and thixotrope provides anti-sag action on vertical walls and keeps coarse particles in suspension in paints.

PREMIER MILL CORP.
New York, NY 10018

On display is the newly redesigned Supermill which is a horizontal media mill equipped with a unique improved automatic wash/flush system for easy product changeover and new electrical control logic for automated operation. A new updated 1.5 horizontal pilot plant unit is also featured along with its redesigned line of colloid mills (dispersers/homogenizers).

Q-PANEL CO.
Cleveland, OH 44145

On display is the QUV Weathering Tester which simulates the damage caused by sunlight and rain or dew. Sunlight is simulated by fluorescent UV tubes, and dew is simulated by direct condensation of water on the test panel. Advantages include fast, low-cost tests, conformance to ASTM practice, and comparability with over 1,000 standard QUV's now in service.

REICHARD-COULSTON, INC.
New York, NY 10010

This booth is designed to exhibit the application of several low cost natural iron oxide pigments in industrial and trade sales applications. These pigments include "Super Strength" Metallic Brown for primers, drum liners, and railroad finishes. A natural "Super Strength" Maroon Oxide for freight car paint and industrial finishes is also shown. Other natural oxides for the industry included in the display are Burnt Umbers for stains and Micaceous Iron Oxides for durable structural steel coatings. Zinc phosphate is shown for nontoxic rust inhibiting primers.

REICHHOLD CHEMICALS, INC.
White Plains, NY 10603

The exhibit emphasizes the company's latest developments in the area of environmental resins which include water-reducible and high-solids systems. Paint formulators will find this booth of special interest given the wide range of products shown, including alkyds, thermoset polyesters, uralkyds, copolymers, amino resins, epoxy resins and hardeners, and emulsions and phenolics. Also offered are additives and pigments for coatings and specialty compounds.

ROHM AND HAAS CO.
Philadelphia, PA 19105

Featured displays include: Rheology modifiers for improved gloss, flow and film build, products for both commercial and light duty maintenance; Rhoplex® acrylic emulsions for high-performance exterior paints, interior gloss and eggshell paints; high gloss enamels; and a new opaque polymer for improving the hiding properties of latex paints. The industrial area features: Acryloid® AT series high solids acrylic resins; Rhoplex WL series water-borne acrylics for ambient cure; Acrysol® WS-78 for high-performance, low-bake applications; and companion products including an emulsion for blending with water-reducible alkyds to reduce dry time along with products for roof mastics.

ROPER PLASTICS, INC.
Jerseyville, IL 62052

On display are a new container closing machine, which will close, label and stencil containers from one quart to six gallons; polyethylene shipping containers from one gallon to seven gallons with a broad range of covers and fitments; and "UN-KOVER" tools for opening industrial shipping containers.

RUSSELL FINEX, INC.
Mt. Vernon, NY 10550

The latest version of the Russell Finex 22 HighSpeed vibratory strainer, together with accessories covering the coatings industry are featured.

SANDOZ, INC
East Hanover, NJ 07936

The exhibit features SANDUVOR ALB 206, a specialty UV absorber for metallic paints. The benefits of this new UV absorber are shown in a special slide presentation. Also included are ARTILENE and SANOGRAN pigments for use in formulations of aqueous paints, a range of chrome-free shades utilizing SANDORIN Yellow 6GL and Yellow 2R LF along with a comparison of opacity between selected chrome and organic pigments, and acetosol solvent soluble dyes for wood stains and transparent lacquers.

SCA CHEMICAL SERVICES, INC.
Boston, MA 02109

This exhibit is designed to display the wide variety of treatment services offered by the company. Display is mostly four-color photography representing each of five EPA permitted facilities. The company is featuring its high-temperature, rotary kiln/liquid injection incinerator. The thermal capacity is 120,000,000 BTU's per hour, the largest of any known commercial incinerator for the destruction of hazardous wastes.

SEMI-BULK SYSTEMS, INC.
St. Louis, MO 63114

The exhibit introduces the Air-Pallet System, an effective, new method of packaging, handling, and shipping such powdered products as pigments, clays, carbon blacks, calcium carbonate, resins, silicas, and other materials. The Air-Pallet is a reusable container comprising heavy-duty PVC coated fabric, and incorporating a unique pallet with built-in fluidizing floor and discharge port. Since filling and unloading operations are completely enclosed, highly effective dust control is achieved. Systems are also available for automatic batch feeding directly into process.

SEWELL PLASTICS, INC.
Atlanta, GA 30336

The exhibit features the company's newly designed all plastic paint containers with the Sewell-Lok® closure. Sizes on display are one quart and one gallon.

SHAMROCK CHEMICALS CORP.
Newark, NJ 07114

This exhibit specializes in the accurate control of fine particle size to provide easily dispersible wax, polyethylene, and PTFE powders for improvement of mar and abrasion resistance in industrial finishes and printing ink. Technical people are on hand to discuss product application.

SHELL CHEMICAL CO.
Houston, TX 77002

"Partners for Success" is the company's theme in the exhibit which features the Epon related epoxy resins and a full line of coatings solvents. Featured are high-solids, powder coatings, water-borne coatings, and new computer technology which takes advantage of the company's depth of knowledge in solution theory. A computer program is demonstrated (live) which calculated evaporation of solvent blends of up to 10 cosolvents, taking into account effects of humidity on aqueous and other humidity-sensitive organic blends.

THE SHERWIN-WILLIAMS CO.
Coffeyville, KS 67337

The exhibit features new, lower cost MOLY-WHITE® corrosion inhibitive pigments for solvent and water-based coatings. Exposure results, technical literature, and formulating information are available. Specification and product data is available on a broad line of nodular and acicular ZnO's for use in exterior solvent and water-based coatings. Also featured is the use of MXDA (m-Xylylendiamine) and 1, 3—BAC [1, 3 Bis (aminomethyl)] cyclohexane to manufacture epoxy hardeners and low temperature cured epoxy coatings for engineering and construction applications. The exhibit also introduces a new UV radiation sensitizer DTX (dodecyl thioxanthone) for UV curing of pigmented systems.

SILBERLINE MANUFACTURING CO., INC.
Lansford, PA 18232

Puzzled about metallic finishes? A unique display of our Sparkle Silver® aluminum pigments is presented which will take you from the scintillating Sparkle of our Sparkle Silver 3622 to the glamorous sheen of our Sparkle Silver 7500. Our EternaBrite® leafing aluminum pastes are depicted to demonstrate, unquestionably, the superior qualities that no other leafing aluminum possesses. Technical staff are on hand to answer and discuss any facet of your metallic pigment puzzle.

S. J. CONTROLS, INC.
Long Beach, CA 90806

Electronic batching systems as well as clay slurry and titanium dioxide control systems are featured at the exhibit. An air-actuated diaphragm pump being used as a flow meter is on display along with many other metering devices.

SOUTHERN CLAY PRODUCTS, INC.
Gonzales, TX 78629

Featured is Claytone PS the company's new product designed for use in a broad range polyester system. Also exhibited are Claytone 40 and Claytone 34 products used for rheological control in paint systems.

SOUTH FLORIDA TEST SERVICE, INC.
Miami, FL 33178

A continuous slide presentation highlights an up-to-date look at 50 years of environmental testing and illustrates the company's complete facilities for conducting conventional exposures in Florida, Arizona, and Illinois, as well as a totally equipped laboratory for accelerated testing. Representatives are on hand to answer questions regarding capabilities and costs and to discuss research in test method development, correlation studies, and the company's PET Theory (Programmed Environmental Testing).

SPENCER KELLOGG
Div. Textron, Inc.
Buffalo, NY 14240

A new 35 mm slideshow illustrates the wide variety of applications where the company's resins are demonstrating excellence. Also in the booth are dozens of test panels of the latest products including water reducibles, high solids, urethane lacquers, 2-component products, oil seed products and general resins.

STANDARD CONTAINER CO.
Fairfield, NJ 07006

The exhibit features the company's fully integrated line of metal paint cans and plastic and metal pails. It also introduces "Plastite"—tomorrow's one gallon plastic paint can for today's water-based paints and processing lines.

STEEL STRUCTURES PAINTING COUNCIL
Pittsburgh, PA 15213

The SSPC announces its completely new edition of the *Steel Structures Painting Manual.* Volume 1 deals with "Good Painting Practice" as applied by the leading technologists in virtually every major supplier and user industry. Volume 2 presents an entire new set of SSPC "Systems and Specifications," covering choice of generic types of protective coatings, surface preparation, application, maintenance painting, and safety. Also illustrated are SSPC lab and field studies on: alternative nontoxic pigmentations; nonpolluting high-solids and waterbase coatings; surface preparation profile; new methods of surface preparation; and painting of weathering steels. Participation of FSCT members in 20 SSPC committees and in SSPC membership is also illustrated.

SUN CHEMICAL CORP.
Pigments Div.
Cincinnati, OH 45232

Background panels illustrate the company's expanded line of Phthalocyanine Blues and Greens and its pigment dispersions. Free standing units provide examples of the company's complete product line. Side attraction includes professional pool-playing exhibition. Technical literature on specific pigments and systems for coatings, as well as current environmental legislation affecting the industry, is available.

SWECO, INC.
Los Angeles, CA 90051

The firm demonstrates its new high-speed separator, capable of screening solids from heavy, high-viscosity liquids including latex coatings, and iron oxide slurries. A 30" diameter unit is shown in operation, and a 48" diameter unit is also available.

SYSTECH CORP.
Xenia, OH 45385

This firm, specializing in providing technical services for solid and hazardous waste management, features a service by which they recycle combustible liquid wastes for use as supplemental fuels. The display describes the process, the detailed waste analysis services provided, and a discussion of the legal, economic, and environmental advantages of the service.

SYSTECH LIQUID TREATMENT CORP.
Xenia, OH 45385

The company, which specializes in the comprehensive management of hazardous liquid waste, has on hand information concerning its unique, integrated process of treating this problem.

TENNECO CHEMICALS, INC.
Piscataway, NJ 08854

The exhibit features a lead-free industrial color system in addition to illustrative information and display material on all varieties of the company's colorant dispersions and chemical additives for the coatings industry.

THIBAUT & WALKER CO., INC.
Newark, NJ 07105

The centerpiece of the display is Parcryl® 900, the latest addition to the company's broad line of 100% acrylic emulsions. The entire line of Parcryl products offers mechanical stability, water resistance, and wet adhesion. Complementing this newest introduction is the company's full line of Super Alkyds®, Super Thanes® (oil-modified urethanes), Parco® vinyl acrylic copolymer emulsions, concentrated varnish stains, and other specialty products.

THIELE ENGINEERING CO.
Minneapolis, MN 55435

TOKHEIM CORP.
Meter Div.
Fort Wayne, IN 46801

The exhibit features industrial liquid meters. Designed for paint products and related chemical liquids, meter sizes are available for flow rates from 0.2 to 750 GPM. Accessories available include automatic temperature compensators, pulsers, flow rate indicators, flow control valves, direct and remote mounted preset control units, ticket printers, and air eliminators and strainers.

TROY CHEMICAL CORP.
Newark, NJ 07105

The company's entire technical staff is present to discuss all types of coatings and microbiological problems. Products featured include Polyphase Anti-Mildew, the nonmercurial mildewcide which is demonstrating remarkable effectiveness in wood preservative stains; Troysan 364, the plant sanitizing agent; and Troysan 98-C, a versatile and unique pigment wetting agent. Visitors are particularly invited to discuss problems in the areas of foaming and cratering and problems in the formulation of water-reducible industrial paints.

UNION CAMP CORP.
Wayne, NJ 07470

The exhibit features UNI-REZ polyamide resins, tailor-made for high-solids and for weatherable epoxy coatings. UNI-REZ polyamide resins are derived from trees—the renewable, natural resource grown in the USA.

UNION CARBIDE CORP.
Danbury, CT 06817

The exhibit features materials for conventional coatings, industrial finishes, and trade paints. New opportunities for coil, wood, and product finishes are presented. Special emphasis is given to cost/performance opportunities of Ucar Acrylics for trade paints. The Captain's 16th Annual Putting Contest is being held—with golf pro Johnny Pott giving tips on Wednesday.

UNION CHEMICALS DIV.
Union Oil Co.
Schaumberg, IL 60196

The exhibit features the company's broad line of AMSCO/RES® emulsion polymers, solvents and chemicals for use in both water- and solvent-based coatings. In addition, dart contests are run daily, with prizes offered to the winners.

UNION PROCESS INC.
Akron, OH 44313

Featured is fine grinding and dispersion equipment for batch, continuous, and circulation processing. Attritors are available in a variety of sizes from laboratory to production models. Production units can be built to meet specific requirements. Attritor benefits include shortened processing times, consistent particle size results, reliable temperature control, easy maintenance and operation, energy efficiency, and low wear.

UNIROYAL CHEMICAL CO.
Naugatuck, CT 06770

The exhibit features Polywet® dispersants and surfactants, curatives for epoxies and urethanes, antioxidants and stabilizers for the paint industry, used to improve color acceptance, dispersion gloss, long-term aging, and polymer strength. An opportunity is offered to participate in the design of new products for paint formulations.

UNITED CATALYSTS, INC.
Louisville, KY 40232

The company is exhibiting the Tixogel line of organo clays for use in the coatings industry. Literature describing the products and applications is available.

UNITED STATES MOVIDYN CORP.
Chicago, IL 60610

The exhibit takes a new and novel approach to defoamers. It features "Mr. Bubbles," a unique creator of bubbles. Mr. Bubbles has been featured on NBC's "Real People" and his bubbles are in "Ripleys Believe It or Not!" His presentation is given every half hour during the show. The company's chemists are on hand following each presentation to answer any technical questions on their lines of defoamers.

UNIVERSAL COLOR DISPERSIONS
Lansing, IL 60438

Introduced are brand new V line Color Decks and Formula Books for industrial, marine, and maintenance coatings. Over 300 colors are available from 14 colorants, with the potential of greater than 2000 color combinations. Unlike any other system available, up to 32 ounces of colorant can be incorporated where deep colors are required. Hundreds of panels are on display showing the broad vista of colors available and physical performance properties in numerous resin systems.

UNIVERSITY OF DETROIT
Detroit, MI 48221

The exhibit features a self-supporting display unit, capable of housing both photo transparencies and a back screen projector. The form incorporates the above uses and creates a "Plastic," flowing structure. It displays the coatings activities at the University of Detroit.

UNIVERSITY OF MISSOURI-ROLLA
Rolla, MO 65401

In-plant training programs can be arranged. Information on Coatings Technology Short Courses and Seminars and UMR's undergraduate coatings science program is available.

UNIVERSITY, NORTH DAKOTA STATE
Fargo, ND 58105

Information about coatings program at North Dakota State University is available.

UNIVERSITY OF SOUTHERN MISSISSIPPI
Hattiesburg, MS 39401

The University of Southern Mississippi offers the B.S., M.S., and Ph.D. degrees in Polymer Science. Information is available about the University, the Polymer Science program, and the upcoming Water-Borne and Higher-Solids Coatings Symposium. Coatings scholarship and fellowship applications are available at the booth.

R. T. VANDERBILT CO., INC.
Norwalk, CT 06855

Featured is Vantalc 6H, a high-purity, platy, hydrous magnesium silicate pigment. It is a superfine grade exhibiting high brightness and oil absorption. Effective for gloss control of coatings, it has a 90 dry brightness rating and 6.0 Hegman fineness. It is useful in industrial coatings where film smoothness and pigment suspension are important.

VORTI-SIV DIV.
M & M Machine, Inc.
Salem, OH 44460

On display is the recently introduced, enclosed and more efficient, gyratory Vorti-Siv, as well as two other gyratory screening and straining machines. These models have American Standard nuts, bolts, and threads, and also can be produced in the metric system. Vorti-Siv has complete rebuilding and machine shop facilities, and a complete stock of parts for the older Lehmann Vorti-Siv.

WACKER CHEMICAL CO.
c/o Henley & Co., Inc.

Applications for HDK fumed silica are displayed, with particular emphasis toward the paint industry. Technical literature and staff are available.

THE WARREN RUPP CO.
Mansfield, OH 44901

The exhibit contains two operating displays of SandPIPER double-diaphragm, air-powered pumps, one demonstrating the ability to pump highly viscous materials and the other pumping pipe-size solids. Also on display are cutaway models of V.I.P. Teflon-equipped, corrosion-resistant SandPIPER, plus other models.

WAUKESHA DIV.
Abex Corp.
Waukesha, WI 53186

The company is exhibiting its newly introduced line of peristaltic type hosepumps. The Hosepump is a new pump option for tough applications. It has only one moving part, no product seals, and can run dry. It is available in (6) sizes, with flow rates to 330 gpm and pressures to 220 psi. Also being exhibited are the company's line of rotary positive displacement pumps.

WEATHERING RESEARCH SERVICE CO.
Homestead, FL 33032

Outdoor exposure testing in sub-tropical south Florida, featuring a slide show of weathered samples, is highlighted. On display are actual paint, plastic, and fabric samples showing various degrees of weathering. Technical personnel are available to discuss and advise on money saving outdoor exposure programs.

WELLCO PRODUCTS/ITASCO INDUSTRIES
Summit, IL 60501

Itasco Industries, a division I.W.I., Inc., is exhibiting its new, bulk liquid portable shipping tank designed specifically for the paint and coatings industry. The new tank is D.O.T. 57 approved (flammable liquids) or it can be supplied as a nonflammable container either lined or unlined. The new tanks are available in 275, 325, 460 and 525 gallon sizes. The Wellco Division of I.W.I., Inc. is exhibiting its new Wellcojet and Gyrojet high-impact, tank-cleaning spray nozzles and information is available on complete tank-washing systems and cleaning and stripping compounds.

WILDEN PUMP & ENGINEERING CO.
Colton, CA 92324

On display are air-operated, double-diaphragm pumps for viscous, abrasive, corrosive sludges, slurries, and liquids, available in four sizes, and six wetted materials including polypropylene/kynar. Five diaphragm materials, including Teflon, which are used to transfer shear-sensitive paints and latexes, solvents, pigments, additives, inhibitors, liquid and dry powdered resins, can be seen.

WITCO CHEMICAL CORP.
New York, NY 10017

The booth features the first single-package, self-crosslinking (cures at room temperature) aqueous urethane dispersion that can be formulated into high-performance protective finishes for metal, wood and plastic materials. The product development, called Witcobond W-240, is based on new urethane coating technology and is expected to have considerable impact on the use of urethane finishes by industry. Other Witcobond urethane latex coating bases exhibited include dispersions for top finishing difficult-to-adhere substrates, light-stable frothable latices, energy-efficient binders, cationic durable coatings and aromatic general-purpose coatings for porous surfaces.

ZORELCO LTD.
Zormco Corp.
Cleveland, OH 44125

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Federation of Societies for Coatings Technology

60TH ANNUAL MEETING
Federation of Societies for Coatings Technology
1922 1982
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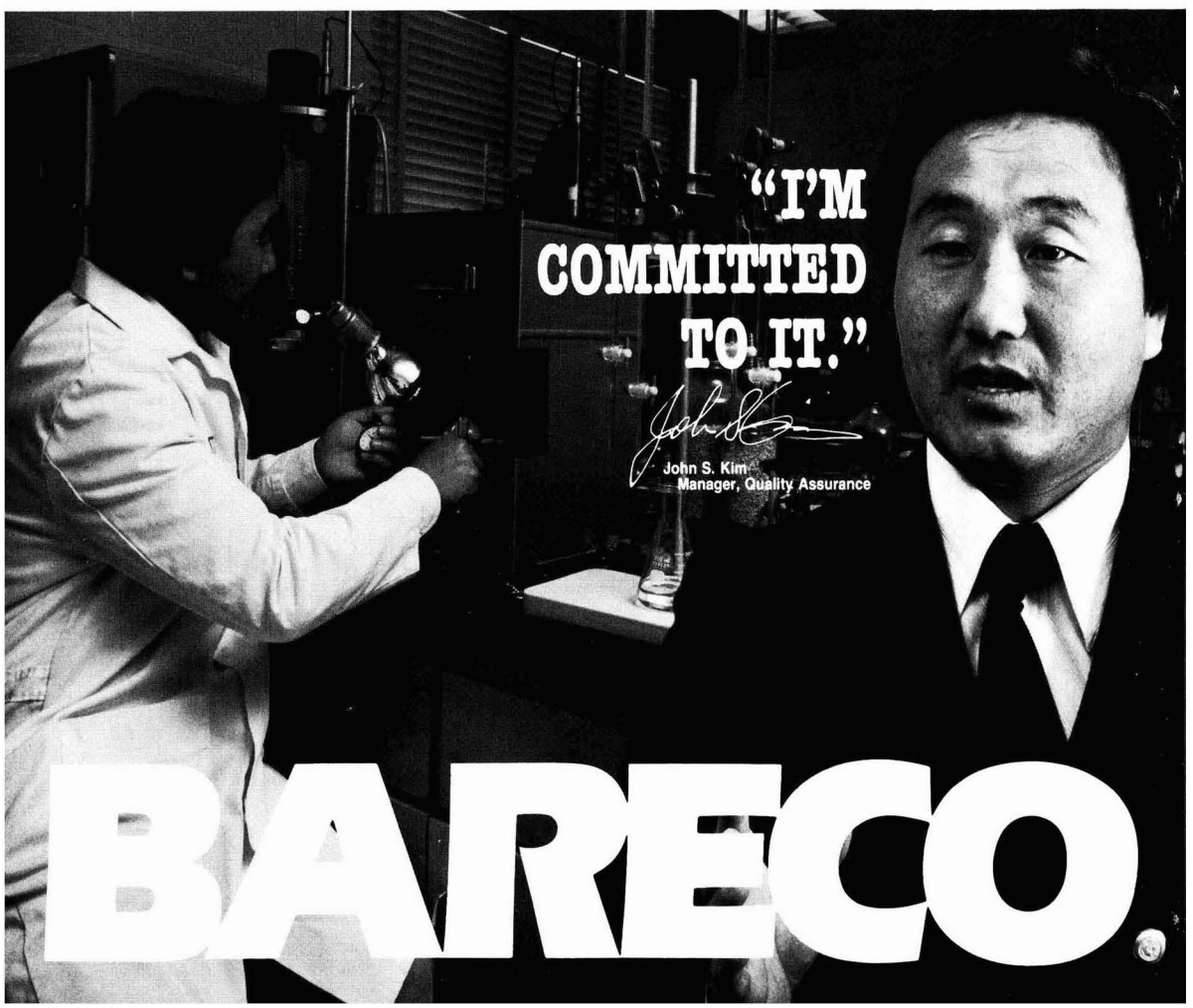

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Fall 1981 Board of Directors Meeting

Thirty-five members and 34 guests attended the Fall Meeting of the Board of Directors of the Federation of Societies for Coatings Technology, on October 27, 1981, in Detroit, MI.

The following were in attendance:

Officers

President ..... William H. Ellis
President-Elect ..... Howard Jerome
Treasurer ..... A. Clarke Boyce

Society Representatives

Baltimore ..... Alex Chasan
Birmingham ..... Roy Ingleston
Chicago ..... John T. Vandeberg
C-D-I-C ..... William Mirick
Cleveland ..... Fred G. Schwab
Dallas ..... Carlos Dorris
Detroit ..... Harry B. Majcher
Golden Gate ..... A. Gordon Rook
Houston ..... Willy C.P. Busch
Kansas City ..... Terryl Johnson
Los Angeles ..... Gerald L. West
Louisville ..... Joseph A. Bauer
Mexico ..... Antonio Pina
Montreal ..... Horace Philipp
New England ..... Charles Aronson
New York ..... S. Leonard Davidson
Northwestern ..... Lowell Wood
Pacific Northwest ..... Deryk R. Pawsey
Philadelphia ..... John A. Stigile
Piedmont ..... Gary Marshall
Pittsburgh ..... Edward Vandevort
Rocky Mountain ..... James E. Peterson
Southern ..... Berger Justen
St. Louis ..... Herman Lanson
Toronto ..... Kurt F. Weitz
Western New York ..... Eugene LeVea

Other Members

Ruth Johnston-Feller ..... Pittsburgh
Elder C. Larson ..... Houston
Hugh W. Lowrey ..... C-D-I-C
John J. Oates ..... New York
Colin D. Penny ..... Baltimore

Guests

Prof. Andre Toussaint, President of the Federation of Associations of Technicians in the Paint, Varnish, and Printing Ink Industries of Continental Europe (FATIPEC).

Donald J. Morris, President of the Oil and Colour Chemists' Association.

Nicholas Harkness, representing the Oil and Colour Chemists' Association of Australia.

The following Past-Presidents of the Federation: Newell P. Beckwith, William Dunn, Neil S. Estrada, J.C. Leslie, Michael W. Malaga, Robert W. Matlack, James A. McCormick, Amos T. Montanye, Martin E. Schleicher, Carroll M. Scholle, and Howard G. Sholl.

These incoming Society Representatives: John Folkerts (St. Louis), Norman Hon (Kansas City); Bob McNeill (Los Angeles); Saul Spindel (New York); Lee Sveum (Northwestern); and Dan Toombs (New England).

Dr. Raymond R. Myers, Research Director of the Paint Research Institute.

Adrian Adkins, of the Golden Gate Society; Taki Anagnostou, of Detroit; Peter Decker, of Southern; Sheila Drake, of Detroit; John Fitzwater, of New England; Peter Hiscocks, of Toronto; Tom Keene, of Cleveland; Stanley LeSota, of Philadelphia; Sid Levinson, of New York; Richard Max, of New York; Thomas J. Miranda, of Chicago; Harry Scott, of Cleveland; and Helen Skowronska, of Cleveland.

Staff

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

Mr. Borrelle called the roll of members and reported all present except Milton A. Glaser, of Chicago.

A moment of silence was observed in memory of three Federation Past-Presidents who died during the year: Herbert L. Fenburr, of CDIC; Edwin L. Gott, of Southern; and Arthur E. Stauderman, of Louisville.

The report of the Spring 1981 Board of Directors meeting was approved as published in the August 1981 JOURNAL OF COATINGS TECHNOLOGY.

Mr. Borrelle reported that the following members would retire from the Board of Directors after this meeting: Charles Aronson—four years of service; S. Leonard Davidson—six years; Milton A. Glaser—two years; Ruth Johnston-Feller—two years; Herman Lanson—three years; Colin D. Penny—two years; Gerald L. West—three years; and Lowell Wood—16 years. Also, that Treasurer-nominee Terryl Johnson had served nine years.

President Ellis introduced Prof. Andre Toussaint, Donald J. Morris, and Nicholas Harkness. Each spoke briefly and extended greetings to the Federation from their organizations.

President Ellis announced that Society Representative Tony Pina had been elected President of the Mexico Paint and Ink Manufacturers Association for 1982.

Reports of Officers And Staff

PRESIDENT ELLIS

My goal as President this past year has been to help the Federation serve well the needs of its members. Successes and problems have been both large and small. We have gratefully accepted the successes and, I believe, solved most of the problems. The only credit I personally can accept, however, is for enlisting the competent Committee Chairmen who have conducted the Federation activities efficiently and effectively.

The role of the Federation, as I see it, is to coordinate the activities of individual Societies, to sponsor projects too large for local groups, and to provide a forum for the exchange and dissemination of information.

The major forum is certainly the Annual Meeting and Paint Show, which this year is once again bigger and better than ever. It will provide the greatest concentration of new technical information available anywhere. There are many other important activities underway, which are detailed in the reports of the Committee Chairmen.

Although I shall not repeat information that the other reports contain, there are a few activities worth special illumination. One is that the Paint Research Institute is being reorganized from within and is being surveyed from without. These efforts will undoubtedly revitalize the organization and help it to become more effective. A second significant area is the growth and importance of international relationships. The International Coordinating Committee is finishing its third year of existence. The "debugging" has almost been completed, and the group is now a working organization that is planning and producing some worthwhile projects.

The Federation continues to be financially healthy. The income and expenses appear to be consistent with budget predictions. The investments last year were transferred from a Pittsburgh bank to a Philadelphia bank. Concurrently, the investment portfolio was changed to return a much higher interest yield. The annuity and insurance plan for the Federation Staff was also changed to another company and greatly improved.

Since the Spring Meetings, Bea and I have continued to represent the Federation at a variety of meetings in the United States and other countries: the Biennial Oil and Colour Chemists' Association Conference in Bath, England; the Birmingham Paint Club Executive Committee and Club meetings in Birmingham, England; the Host and Executive Committee meetings in Detroit; the Annual Meeting of the Canadian Paint and Coatings Association in Vancouver; and the Annual Meeting of the Asociacion Nacional de Fabricantes de Pinturas Y Tintas, A.C. and the Mexico Society in Acapulco.

As my year in office approaches an end, I look back with much satisfaction. The demands have been heavy, especially the travel schedule—but the psychological rewards have been much greater. I thank all of you for this opportunity to serve and for the invaluable experience. I also want to express my sincere appreciation to the outstanding staff, the Executive Committee, the Board of Directors, and all of the various committee members for their superb performance and help. I turn over the reins with absolute confidence to those who will succeed me and offer my continuing support and assistance whenever it is needed.

WILLIAM H. ELLIS,
President

PRESIDENT-ELECT JEROME

Travel for your President-Elect has been at a minimum since our last meeting. The summer months are reserved for planning and committee organization. I did attend the Kansas City–St. Louis Joint Meeting and had the opportunity to meet with both Executive Committees. I also participated in the Executive and Host Committee meetings and was a guest speaker at the Chicago Society business meeting.

The selection of 1981–1982 Committee Chairmen has been completed. I thank those who have accepted committee assignments. These are busy people who still can find the time to pursue and develop Federation activities for the benefit of us all.

I must also extend my personal thanks to the staff for their fine cooperation during the year. They execute their duties in an efficient and businesslike manner. I hope I never take them for granted.

The past year has been busy but I look forward with enthusiasm to a year that I feel sure will be busier and even more exciting.

HOWARD JEROME,
President-Elect

TREASURER BOYCE

This past year has given me the opportunity to meet many old acquaintances and to make many new friends. In my travels I have found a strong nucleus of members involved in many meaningful programs contributing to the successful operation of this fine organization.

This year I have been directly involved in the following on behalf of the Federation:

(1) Finance and Executive Meetings.
(2) Visits to the Cleveland, Toronto and Montreal Societies.
(3) Spring meetings.
(4) Joint Paint Industry Coordinating Committee Meeting in Washington.
(5) Three P.R.I. Trustees meetings as Treasurer and Trustee. The endeavors of the present Trustees to improve P.R.I. are most encouraging.
(6) Host Committee Meeting with Detroit Society.

Copies of the operating statement for the first three quarters of the year show we are within budget and barring any unforeseen circumstances will end the year within budget.

My sincere thanks to Mr. Ellis, Mr. Jerome, and the Federation staff for their cooperation, patience, and guidance in carrying out my duties as Treasurer. I look forward to my next two years and visitations with many Societies.

A. CLARKE BOYCE,
Treasurer

EXECUTIVE VICE-PRESIDENT BORRELLE

The theme of the Annual Meeting is appropriate because, in 1981, several Federation activities will have been touched by Challenges, Changes, and Opportunities—and most contributing to another good year for the Federation.

Publications

JCT: One significant change is the earlier release of the JCT. Subscribers now receive their issues three to four weeks earlier than heretofore—and during the month stated on the cover. This was accomplished by advancing all closing dates and publishing two summer issues simultaneously, or very near that. Bob Ziegler and Dick Gross are to be commended for this achievement.

Advertising income is on target. Production and mailing costs continue to climb and overall volume is being held in check in order to stay close to the budget. Editorially, there is an ample supply of technical manuscripts.

Thanks are extended to the Publications Committee (Tom Miranda, Chairman) and the Editorial Review Board for their good services during the year. A constructive meeting of the Publications Committee was held this Spring in the Federation office.

The current circulation of the JCT is: 8,763 (U.S.—6,483; Canada—819; and other countries—1,461). There are 6,541 member subscribers and 2,222 non-members. Overseas subscriptions have declined.

U.S. Postal Regulations require that the assessment for membership subscriptions to the JCT be at least half of the rate for non-member subscriptions ($20.00). Therefore, the Federation's income statement has been changed to show 67% ($10.00) of membership dues allocated to JCT income. (It had been 50%). Regulations also require that members be made aware of this allocation. The following statement now appears in the JCT: "Annual dues for Active and Associate Members of the Federation is $15.00. Of this amount, $10.00 is allocated to a membership subscription." We have requested the Societies to include this statement on their annual dues invoices. Many have done so and we thank them for their fine cooperation.

Year Book: The 1981 edition was published in late February and, of course, we are now challenged to repeat that release date (at least) next year.

Series on Coatings Technology: Sorry to say, but there will be no opportunities to publish new units this year. Titles of manuscripts in preparation are: Statistics for the Coatings Industry, Simplified Chemistry for Coatings Technologists, and Inorganic Zinc Rich Primers.

CDIC Society has redone Unit 6 (Solvents). 5 (Alkyd Resins) is being revised by Dr. H. Lanson, of St. Louis. Chicago Society is rewriting 17 (Acrylic Resins).

We need authors to rewrite 4 (Varnish Technology), 7 (White and Extender Pigments), 8 (Inorganic Color Pigments), 19 (Vinyl Resins), and 20 (Epoxy Resins). Are there any persons out there in Federationland willing to accept these writing challenges?

Special Publications: All of the special publications have been great opportunities for the Federation. Sales of the Dictionary and the Infrared Book are about 3,500 and 1,500, respectively. The Pictorial Standards Manual and the Glossary of Color Terms are also doing well.

Other Services

Color-Matching Aptitude Test Set: The second production (400 sets) of the 1978 edition has been completed by Munsell Color Co. The first production (300 sets) will be exhausted by year's end.

Audio-Visual: New this year were "Introduction to Resin Operations" by Toronto and "The Setaflash Tester" by Birmingham. In the works are "Hiding" by Kansas City and "Batch Operated Mini-Media Mill" by New York.

Membership: Now that staff has a word processor, one of our new services will be letters of welcome to new members of the Federation. The activities and literature brochures will accompany the letters. We also plan congratulatory letters to 25-year members.

New membership applications, changed to include the dues allocation statement mentioned previously, were mailed to the Societies this summer.

Annual Meeting and Paint Show

Detroit was considered to be a challenge as a convention city this year. Obviously, there has been a change of opinion because those who go to the Motor City will have the opportunity to see the largest Paint Show in Federation history:

	1981	1980
Net square feet, paid	38,186	34,350
Net square feet, comp	980	—
	39,166	34,350
Number of exhibitors	177	141

The importance of the Paint Show as an effective marketing medium is evident in the number of new exhibitors this year: 29. Show income is well in excess of the budget.

If demand for housing is a barometer, we will also have a very good attendance in Detroit. Rosemary Falvey, Convention & Meetings Manager, has spent many telephone hours responding to every imaginable request for hotel placement and relocation. Accommodations had to be assigned to properties in Dearborn and at the airport.

The exhibit brochure for the 1982 Paint Show will be distributed at the Exhibitors' Reception in Detroit. The floor plan for the 1983 Show in Montreal is being studied.

Dr. Miranda and his Program Committee deserve commendation for the interesting and informative presentations lined up for the Annual Meeting.

We also thank the Host Committee (Jose Benavides, Chairman) for their important role in another successful AM&PS.

Paint Research Institute

In addition to its existing duties, staff now serves as Minutes Secretary at PRI Trustee meetings, except any held during the AM&PS. Tom Kocis, Director of Field Services, served as coordinating secretary of the Past-Presidents' Ad Hoc Committee on PRI.

Officer/Staff Visits

Officer/Staff visits to the Societies during the 1980–81 year were to: the Virginia and Memphis Sections; Philadelphia; Baltimore; Toronto; Mexico; West Coast Symposium; Southern; CDIC; Piedmont; Cleveland; Chicago; Kansas City; Dallas; Detroit; Pacific Northwest Symposium; Montreal (50th anniversary); and the joint St. Louis–Kansas City meeting. We thank them for giving the "Federationers" the opportunity to meet with their Executive Committees and to participate in the evening meetings.

The visitation schedule for 1981–82 was mailed to the Societies on August 26.

Society Officers Meeting

The fifth Society Officers meeting (in Denver, during the Spring Meetings) was very successful. This annual orientation session—a great learning opportunity for future Society Presidents—is one of the Federation's best investments in its future.

Committees

At my request, the Executive Committee has appointed the Director of Field Services to the Roon Awards and Mattiello Lecture Committees as a permanent, non-voting, coordinating member. Staff assistance will help the Chairmen direct the work of these committees and improve their communications.

Tom Kocis' work with the Corrosion, Educational, Manufacturing, and Technical Advisory Committees will be reviewed in his report.

Staff

Members of the staff are: Rosemary Falvey; Kathryn Ferko; Dick Gross; Linda Hanratty; Tom Kocis; Lorraine Ledford; Jane Paluda; Dorothy Robinson; Mary Sorbello; Kathy Wikiera; and Bob Ziegler. I thank them for their good work and contributions to a successful year.

On behalf of staff, sincere thanks to President Ellis, the other officers, Board members, and committee chairmen for their cooperation and service throughout the year. It was a pleasure to have had the opportunity to serve them.

Frank J. Borrelle,
Executive Vice-President

DIRECTOR OF FIELD SERVICES KOCIS

Committee Liaison

Educational: Development of Correspondence Course on Science and Technology of Surface Coatings is behind schedule and continues to lag. University of Southern Mississippi authors have been hampered by personnel changes, which has left them short-handed and increased their faculty workload.

Course, which consists of two textbooks, was to be available beginning September 1981; however, only six chapter drafts have been submitted to date of the total of 27 chapters in Volume I. Authors have reaffirmed their intent to continue with the project and expect output will improve as result of recent additions to staff. Nevertheless, considering the number of chapters yet to be completed in Volume I, earliest availability of the course would probably be September 1983.

Society Educational Committee members were hosted by the Federation at a meeting in Kansas City on June 26.

One of the principal topics discussed was promoting and publicizing careers in coatings. Although the Educational Committee has been working on a script and slides for an A/V program which could be used by Society members when contacting students at the high school level, there was agreement that promotion activities on a much broader scale are needed, and the group recommended that a Federation Ad Hoc Committee be formed to address this need.

Several booklets from Federation Series on Coatings Technology are being revised and updated (#5—Alkyd Resins and #17—Acrylic Pigments are currently undergoing revision; #6—Solvents has been revised and reviewed and should be available in a new edition in the near future). Assistance is needed for revising and updating booklets #4—Modern Varnish Technology, #7—White Hiding and Extender Pigments, #8—Inorganic Color Pigments, #19—Vinyl Resins, and #20—Epoxy Resins.

Three new booklets for the series are in various stages of production: Zinc-Rich Coatings; Statistics for the Coatings Industry; and Simplified Chemistry for the Coatings Industry.

Technical Advisory: Project suggestion for Society Technical Committee work, involving cooperative effort with PRI Mildew Consortium, has generated much interest (12 Societies have committed to taking part), and is now ready to get underway. A small quantity of an acrylate polymer to which a fungicide (pentachlorophenyl) has been anchored is now available for producing and testing paint systems; additional quantities of the polymer will be available shortly to accommodate all the Societies who wish to take part. Colin Penny chairs the TAC Subcommittee coordinating the project.

The program is significant because it offers the opportunity for Societies to work with a product of PRI research while, at the same time, providing a needed service for the Consortium effort.

Manufacturing: Committee, being expanded under new Chairman, will hold an organizational meeting in conjunction with AM in Detroit.

Corrosion: Efforts continue to develop liaison with coatings-related organizations to monitor and report on work they are doing. Committee will meet in conjunction with AM to develop program for coming year.

Program: Close contact has been maintained with the Program Committee and speakers for the Annual Meeting in Detroit, and arrangements have been accommodated for onsite needs. Theme of "Challenge, Change, and Opportunity" attracted a goodly number of paper submissions, and all indications point to an excellent lineup of technical presentations.

Meanwhile, the Program Committee for the 1982 Annual Meeting in D.C. will hold an organizational meeting in conjunction with the 1981 AM in Detroit, to develop a theme and suggest general topics for session presentations. The Committee will hold a follow-up meeting in early December to solidify planning and assign responsibilities.

Audio/Visual Programs

New York Society's Manufacturing Committee presentation on "A Batch-Operated Mini-Media Mill" has been added to Federation A/V library. The program will be on display at the Federation booth in Cobo Hall.

Production nears completion on the Kansas City Society presentation on "Hiding Power of Paints," which will be added to the Educational Committee's Training Series on Test Methods.

Miscellaneous

Assistance provided in arranging for, attending, and reporting on PRI Ad Hoc Committee meeting in Chicago, August 13 and 14 . . . Annual update of "Talks Available to Constituent Societies" was completed and distributed . . . Reports on Society educational and technical activities were compiled and edited for publication in JCT.

Thomas A. Kocis,
Director of Field Services

Amendments To By-Laws

Adopted

The following amendment to the By-Laws was passed for first reading at the Board of Directors meeting on May 15, 1981, and was adopted at the October 27, 1981 meeting.

Article VI—Annual Meeting

WHEREAS By-Laws Article III, Sect. B, Sub Para. (1) k specifies that at least two Board meetings be held each year and

WHEREAS By-Laws Article VI deals with only the Annual Meeting, be it

RESOLVED that By-Laws Article VI be amended as follows:

"ARTICLE VI—MEETINGS"

"A. Time, Place, and Program

(1) The Spring Meeting of the Federation Board of Directors shall be held in the second quarter of the year, the exact time and place to be determined by the Board of Directors. This meeting shall include the presentation of reports by Officers and Committees, and a business session.

(2) 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, at which shall be presented reports by Officers and Committees; the presentation of annual awards; the induction of new officers; and a 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 sessions of the Federation Board."

* * * * * * * *

Society Business

CONTRIBUTIONS TO PRI

During the meeting, contributions to the Paint Research Institute were presented by the CDIC, Kansas City, New England, St. Louis, and Toronto Societies. They were gratefully acknowledged by President Bill Ellis.

EQUAL VOTING AND OFFICE-HOLDING PRIVILEGES

At the Fall 1980 Board meeting, the Pittsburgh Society requested the By-Laws Committee to present an amendment which would extend equal voting and office-holding privileges to all Federation members, regardless of class of membership.

The By-Laws Committee presented this amendment for first reading at the Spring 1981 Board meeting. It was defeated.

Upon motion by Mr. Davidson, seconded by Mr. Vandevort, and approved, the By-Laws Committee was instructed to prepare the enabling resolution to re-introduce this proposal for first reading at the Spring 1982 meeting.

SOUTHERN SOCIETY CONSUMER GUIDE TO TRADE PAINT QUALITY

A color-proof copy of the brochure (Consumer Guide to Trade Paint Quality: Latex Interior Flat Paint) was included in the meeting folder sent to members of the Board on October 10.

At the meeting, the following report was read by Mr. Justen:

"There has been a great deal written about the concern all of us have for the decreasing level of quality of coatings products. There are many who do not agree that, in fact, there has been a lowering of quality or even that we should concern ourselves with this question. They argue that the Industry will make what the consumer wants to buy. More than likely both positions are correct. All of us have seen very low quality "paint" in the discount houses—and people buying it, so obviously there is a market for it. On the other end, we all know of the pressure from our own companies to somehow take a few cents out of our RMC to meet the intense competition in the market place *and*, of course, maintain the same level of quality.

"The Southern Society feels that whatever your position on the issue, we must concern ourselves with the question since it is our Industry and perhaps for many of us, our very own existence. Our decision, therefore, was not to argue the question or talk of standards, but to accept the problem and approach it from the consumer's side. Our decision was to educate—not legislate.

"Early in 1981 the Southern Board of Directors approved a project to look at the question from two considerations. First, our concern was for the consumer's inability to understand what to look for in deciding between the various levels of quality available. Second, our feeling was that, given the opportunity to discern for himself what these criteria were and what they would mean to him, the consumer would be open to the suggestions and advice from the paint company, or their dealer, to consider and purchase the higher quality product. We felt we could do this by developing a 'Guide for Paint Quality.'

"Thus, on March 5, 1981, a Technical Sub-Committee was set up consisting of Peter Decker, John Dawson, Thad Broome, Don Morgan, Ed Hill, David Kelly, Jack Weitz, and Lewis Davis. Our objectives (with the guide) were as follows:

- "To give the consumer a perspective on the normal range of quality available in a class of trade paint products by way of a pictorial example and brief description.
- "To educate the consumer on significant quality criteria and the potential trade-offs between high and low quality products so that he will have an awareness of the limitations of the lower quality products.

"Our feelings and our project were greatly reinforced on March 12, 1981 with the Keynote Address at the Southern Annual Meeting by Charles W. Finegan of Havco Paints. He submitted that the most serious challenge facing our Industry today is not technical, financial, marketing, or even environmental pressures. The real challenge is the Paint Industry's lack of a quality recognition factor by the consuming public. Larry Thomas, Executive Director of the NPCA, was recently quoted as saying that the Paint Industry is not faced with a bad public image. 'The problem,' he states, 'is that we have no image at all in the public mind.'

"With the backing of the Southern Society and the awareness and concern from everyone in our Industry for quality and our public image, the Technical Sub-Committee met extensively for over five months to develop a guide that concentrated on interior latex wall paint and covering five criteria. The five were: Hiding (wet & dry); Stain & Stain Removal; Washability/Durability; Spreading Rate; and Applicator Choice & Quality.

"With the completion of the initial printing, for which the Federation contributed $1500.00; the Guide, along with our test formulations, test methods, and other pertinent data, were sent to the Technical Directors in the Society. Following that, a select number of retail stores received our brochures in a consumer/merchant test to gauge and evaluate the effectiveness and viability of the pamphlet. The results from both are being compiled.

"The Society's recommendation is that the Federation consider funding a volume printing of the pamphlet. A countertop display for the pamphlet should be developed and both advertised and made available to the Federation members and independent retail outlets on a cost basis. The Society is prepared to undertake any additional part of this, as needed by the Federation, and requests, if adopted, permission to be the lead Society in introducing this at our Annual Meeting in Savannah, March 10-12, 1982."

Following the presentation by Mr. Justen, the Board of Directors approved the following actions:

(1) That the Board of Directors endorse the concept of the Southern Society's Consumer Guide to Trade Paint Quality.

(2) That the Southern Society be commended and congratulated for their fine work.

(3) That up to $1,500 appropriated for printing additional copies of the brochure so that they can be mailed (by the Federation office) to the Boards of Directors of the 26 Constituent Societies. An accompanying letter is to request comments and suggestions from the Societies by a specified deadline date.

(4) That the Southern Society's Consumer Guide be referred to the Federation Executive Committee for appropriate action and a further report to the Board at the April 30 meeting.

Paint Research Institute

PRESIDENT ROBINSON

The Board of Trustees of the Paint Research Institute continues to restructure the operations of the Board to bring it more in-line with the needs of the next decade. Final documents concerning Project Selection, Project Management, Project Evaluation, and Job Description, Research Director, were submitted by individual Trustees and adopted as Research Management Policies of PRI by the full Board.

The concept of a five-year plan for PRI has been explored and working groups have been assigned to develop and report on five components of a five-year plan. These components are: (1) a scientific or basic research component, (2) a technological or applied research component, (3) a public relations component, (4) an educational component, and (5) an income/expenditures component. It is too early to report on the scientific and technological components. Currently, a major element of the public relations component is the creation of an improved PRI booth for the Paint Show. Beyond that, arrangements have been made for the President of PRI to prepare a PRI report suitable for video recording for subsequent circulation to local Societies and other interested parties. The education component is receiving attention, both from the point of view of providing simplified abstracts of PRI scientific activity and to consider what PRI can do to assist in the updating of paint industry technical personnel. The income/expenditures component has been developed for the first two years and shows a significant increase in both expenditures and income needed.

The Trustees believe that the consortium approach to the solution of industry problems represents a good method for investigating broad problems of concern to the paint industry. In addition to the Mildew Consortium, consortia on high solids, aqueous, and corrosion resistant coatings are being developed. A proper methodology for the establishment of consortia is being studied.

The President of PRI met with the Chairman of the Research Subcommittee of the Scientific Committee of NPCA. Preliminary discussions explored conditions under which PRI could receive the approval and support of the Scientific Committee of NPCA. New approaches to fund raising are also being considered, although it is recognized that this is a most difficult issue. A proposal has been received from the editorial staff of *American Paint Journal* to increase the publicity available to PRI in that journal. The proposal was well received by the Trustees.

Three members of the Board of Trustees of PRI resigned from the Board during the current year. Replacement of these valued Trustees by Trustees of equivalent stature is essential and it will be difficult.

Although the mechanisms for accomplishing PRI goals are changing, the overall objective should remain the same. PRI should carry out studies on behalf of all of the paint industry and should produce results which are of benefit to all of the paint industry according to how each member of the industry wishes to use them.

PETER ROBINSON,
President

[*Mr. Robinson had intended to add other comments in person at the meeting. However, bad weather in the east prevented him from flying to Detroit.— Ed.*]

RESEARCH DIRECTOR MYERS

Projects active in the mildew consortium have resulted in the publication of Dr. Zabel's in vitro assay method for mildew growth and the transfer of the activity on a contract basis to Dr. George Hollis, of Memphis State University. As mildewcidal polymers become available in test quantities from Dr. Pittman they are subjected to the new assay as standard procedure. These polymers are then made into latex paints and tested both in vitro and on test fences by members of the consortium.

Colin Penny, representing the Federation's TAC, attends sessions of the steering committee and is party to decisions made regarding the test protocol. Small quantities in some instances have prevented the complete protocol from being followed, but TAC activity is expected to start with the receipt of the next batch of latex made with pentachlorophenyl acrylate.

The consortium's mission has expanded slightly to include programmed release of fungicide, instead of release only when the coating is attacked. Hydrolytic attack is the triggering agent rather than enzymatic attack, which has been shown by our researchers not to occur to a significant extent. Where we once thought a zone of inhibition should be confined to the painted surface, we now think that a zone reaching out a finite distance is more desirable. Under these conditions one must accept a finite lifetime of the fungicide.

Alternatives to killing fungi continue to be explored. Dr. Donald Siehr, of Rolla, studies the development of black pigment as an adjunct to the rebuilding of cell walls by protoplasts. An electron microscopy grant has started under Dr. Richard Crang that will reveal the action of various fungicides.

In one area of compliance coatings the two grants on aqueous coatings have been phased out and a new program will be fashioned by our aqueous program manager, Dr. Edward Glass. He will emphasize synthesis as a result of soundings made of users of aqueous coatings.

In the second area of compliance coatings we expect grant proposals in response to our encounter session. Timing is critical because the program manager has just been selected. He is Dr. Philip Weiss, formerly Director of Polymer Research for General Motors.

Corrosion control by coatings took a step forward with the publication of our first commissioned critical survey. Dr. Henry Leidheiser, of Lehigh University, wrote this opus for us on the highly specific topic of the role of inhibitors; he then submitted two proposals based on ideas contained in the survey. Because there are no plans to start a consortium in corrosion control, funding for projects in this area will be sought individually, rather than as part of a managed program.

The PRI symposium on stability and stabilization mechanisms of coatings netted about $3,000. One of the purposes of the symposium was to provide an educational service, and in this sense it succeeded. A second, less obvious, reason is to provide ideas for planned or existing consortia. In this case the session on research ideas provided at least one worthy of incorporation in the compliance coatings consortia.

PRI Fellows

During the past few contemplative months regarding the future course of PRI the point was made that the education of Fellows who later enter the industry was an important role for us. Consequently, we asked a select group of former Fellows to speak at the Annual Meeting on a contribution they made to the industry after graduation.

Titles of the various talks vary widely in their adherence to the theme. Some cover a specific piece of research; others are more widely representative of a team effort. All of the speakers were invited with the knowledge that they project well, and the session should be worth attending. Don't expect continuity from one lecture to another.

Publications

Publication of PRI proceedings has increased. In the past 12 months these papers have appeared in the JCT:

No. 140. Peter Robinson, "New Directions—The Paint Research Institute Research Program for the 80's," JCT, *53*, No. 672, 47-51 (1981).

No. 141. Raymond Myers, "Report of the Research Director," JCT, *53*, No. 673, 21-31 (1981).

No. 142. Raymond Myers, "High-Solids Oligomer Research, a Prospectus," JCT, *53*, No. 675, 29-32 (1981).

No. 143. R. A. Zabel and W. E. Horner, "An Accelerated Laboratory Procedure for Growing *Aureobasidium pullulans* on Fresh Latex Paint Films," JCT, *53*, No. 675, 33-37 (1981).

No. 144. K. S. Raju and R. R. Myers, "Drying of Amine-Neutralized Poly(acrylic acid) and Related Copolymers," JCT, *53*, No. 676, 31-39 (1981).

No. 145. Henry Leidheiser, Jr., "Mechanism of Corrosion Inhibition With Special Attention to Inhibitors in Organic Coatings," JCT, *53*, No. 678, 29-39 (1981).

No. 146. Roy A. Brown, "PRI's Ongoing Research to Overcome the Problem of Mildew Defacement of Painted Surfaces," JCT, *53*, No. 679, 29-30 (1981).

No. 147. Charles C. Yeager, "Mildew Research by Consortium," JCT, *53*, No. 680, 47-50 (1981).

Zabel's paper is a terminal effort—the last of two proceedings and several papers in journals other than JCT written since his grant started in 1976. Myers' paper was a sequel to one published on a model system (not a coating) in *Ind. and Eng. Chem.* Brown's and Yeager's summaries round out the picture of the mildew consortium. The others have been referred to in other contexts.

Raymond R. Myers,
Research Director

Report of Ad Hoc Committee On Paint Research Institute

In response to continued and frequent expressions of concern regarding the performance and effectiveness of the Paint Research Institute, the Federation Board approved formation of an Ad Hoc Committee to conduct a study of PRI.

The Committee (composed of Federation Past-Presidents: James A. McCormick—Chairman, Newell P. Beckwith, Neil S. Estrada, Milton A. Glaser, and John J. Oates) was directed to pursue a comprehensive, in-depth examination of the role of the Paint Research Institute in addressing the research needs of the coatings industry, to evaluate current efforts of PRI in that regard, and to make suggestions and recommendations for improving those efforts.

In carrying out its directive, the Ad Hoc Committee met with personnel representing a wide cross-section of the industry.

Initial discussions were held with Federation members in visits to Constituent Societies, and a Preliminary Report was submitted to the Board on May 15, 1981, based on a consensus of member views expressed in survey responses from 24 Societies.

Subsequently, Committee members met with PRI Trustees (past and present), technical directors of coatings firms, researchers who have worked on PRI grants, and representatives from academia, other research organizations, and industry supplier firms.

In summary, those interviewed were in general agreement that communications, project selection and management, and interpretation of research results are major problem areas that adversely affect the PRI image and which must be improved.

There is an appreciation of the fact that PRI's activities are seriously hampered by: (1) Lack of a full-time Research Director, and (2) Inadequate funding. It is recognized that substantially more funding will be required to adequately support a meaningful research effort. There is, nevertheless, a strong belief that more funding could be attracted if the results of PRI-sponsored research were perceived as yielding more positive results for the industry.

It should be stressed that those interviewed expressed overwhelming support for the basic concept of PRI and Federation-sponsored research. It should also be noted that the PRI Board of Trustees is currently engaged in implementing changes to improve administrative functions, as well as restructuring procedures for project selection and control, and upgrading the communications effort.

This report, accordingly, reflects the considered judgment of the Ad Hoc Committee, based on the evaluation of accumulated input from a variety of industry perspectives, and with due recognition of changes being implemented.

Recommendations

Based on its findings, the Ad Hoc Committee on the Paint Research Institute offers the following recommendations:

Objectives (Suggested Revision): To advance the knowledge and application of the sciences related to the technology of coatings through research:

(1) To determine the technical opportunities and needs of the coatings industry.

(2) To develop, finance, and conduct the indicated research through grants, fellowships, contracts, and other suitable means.

(3) To interpret and communicate to the industry the results of such research through publications, seminars, and regular meetings with the membership.

(4) To develop educational activities to upgrade the technical capabilities of Federation members and to help train people for the coatings industry.

Communications: An overwhelming number of those interviewed pointed to shortcomings in communications as a major factor contributing to PRI's negative image. As one of those responding put it, "PR is the key issue with PRI."

The following actions are suggested to address the basic communications needs in keeping the membership and the industry informed.

The Paint Research Institute should:

(1) Review project reports for current technical implications by *paint* chemists, *for* paint chemists.

(2) Report regularly to Societies by communiques, bulletins, newsletters, A/V presentations, visits by PRI communications representative, etc.

(3) Interpret research papers for understanding by bench chemists. Interpret from the viewpoint of practical possibilities of the research conducted.

(4) Encourage input on project selection from individual Society members, the Society Technical Committees, Federation Technical Advisory Committee, the NPCA Scientific Committee, and others in the coatings and related industries.

(5) Provide for PRI Trustee representation on FSCT Technical Advisory Committee, and vice versa.

(6) Establish a PRI Speakers' Bureau.

Management and Control: There is widespread feeling that, inasmuch as PRI is the research arm of the Federation, there should be closer participation of the Federation in PRI activities. There is also a perceived weakness in organization and a need for sound management practices in operating PRI.

Implementing the following would assist in this regard:

(1) Appoint the Federation Immediate Past-President and representative of Federation Technical Advisory Committee to serve as members of PRI Board of Trustees.

(2) Direct the Federation Immediate Past-President to report to FSCT Board of Directors on PRI activities.

(3) Balance the composition of the PRI Board of Trustees between management and research or development personnel.

(4) Emphasize the importance of monitoring programs and issuing regular reports in language comprehensible to paint chemists.

Relocation/Research Director: In assessing the various areas of PRI's operations, it is apparent that there is a growing need for closer, day-to-day management and liaison with the Federation.

To address these needs, the following are suggested:

(1) Establish the Research Directorship as a full-time position.

(2) Transfer the PRI base of operations to Federation headquarters, in the interests of efficiency and economy.

There should, however, be a university base for PRI for purposes of prestige, academic contacts, sophisticated equipment, professional library, etc.

Project Selection: Complaints about project selection have been many and varied, and over the years have been most critical of so-called "blue sky" research that seemingly has no relevance. However, the Committee has ample evidence that the current PRI Board of Trustees is addressing the problem and agrees with the guidelines already being implemented for project selection, management, and evaluation.

Basic vs. Practical Research: In the recommended revisions of the Paint Research Institute "Objectives," the Committee suggests that PRI interpret the results of its research. This would include presentation of possible practical implications of both the aims and results of PRI projects.

Many have urged that PRI shift emphasis from theoretical to "practical" research, e.g., undertaking a project on some aspect of waste disposal. The Ad Hoc Committee has considered these suggestions but concludes that "practical" research projects, as such, are not compatible with the objectives of PRI.

The Committee, however, fully agrees with the need for "practical" investigations and strongly recommends that consideration be given to reactivating the Practical Projects Committee, to study needs, develop projects (perhaps in conjunction with the Technical Advisory Committee), and solicit Federation funding as required.

Other Considerations

Contract Research: It has been suggested that an available option is to assign project work to commercial research organizations.

Such organizations would offer the potential for more precise control over project work, but would also be more expensive and less likely to produce breakthroughs compared with work done at universities. Additionally, having commercial research staff working on projects would eliminate the spin-off benefit, currently enjoyed, of PRI investigators subsequently being employed in the coatings industry.

Name Change: The Committee discussed at length the pros and cons of changing the name of the Paint Research Institute. A number of suggestions for such a change were submitted by those interviewed, and these were reviewed.

It was concluded that there is some justification for a name change, and the Committee suggests that the Federation Board of Directors consider doing so, e.g., changing the name to Coatings Research Institute, to conform to Federation of Societies for *Coatings* Technology.

Funding: The Committee studied the funding problem, noting the recent trend of diminishing financial support for PRI. This is not a circumstance which can be easily overcome, nor readily addressed. In the relatively short time available to the Committee, no major recommendations were developed.

The Committee feels that when the PRI Board of Trustees has completed and fully implemented the new procedures for project selection and management, and effectively interprets and communicates results, this will create a receptive atmosphere for the development of increased financial support for PRI.

Meanwhile, the Committee urges all parties presently contributing to PRI to at least maintain the current level of financial support. Some Societies, it is noted, have deferred or dropped financial support for PRI. The Committee urges these Societies to reconsider their position in this regard, in view of the changes underway at PRI. Although the total of the funds provided by the Societies is not likely to be a major factor in overall financing, the interest, involvement, and financial commitment of the Societies is very significant from the point of PRI morale.

Education: The Committee reviewed suggestions for PRI programs which would provide the membership the opportunity for technological updating. One such program might involve establishment of a cadre of instructors to conduct special sessions of from one-day to two-week duration.

The Committee agrees there is a very real need for such formal programs, but that this effort should represent a minor part of the PRI objectives. Such programs, the Committee feels, are more appropriately the responsibility of, and subject to action by, the Federation Educational Committee.

PRI could and should offer all possible assistance to the Educational Committee for any such programs, but the latter should plan and conduct these programs.

Liaison With NPCA Scientific Committee: The Committee strongly recommends that PRI encourage the support of the National Paint and Coatings Association's Scientific Committee, whose members have expressed their interest and willingness to assist in the research effort.

Participation in PRI activities by the Scientific Committee makes available additional research expertise to assist in recommending and selecting projects, evaluating and interpreting results, as well as promoting PRI projects to the industry and soliciting funds for their support.

* * * * * * * * *

Research is as vital today as it was when PRI was founded almost a quarter century ago, and commitment to its support continues to be a prime concern of the Federation. The Committee believes that the efforts currently underway to reorganize PRI have had a positive impact already. If such progress continues, and if, in addition, serious consideration is given to the conclusion and recommendations in this report, then PRI can only grow in the esteem of the industry it is committed to serve.

The Committee wishes to extend its sincere appreciation to all those who cooperated in this study.

JAMES A. MCCORMICK,
Chairman

[*Following the presentation of the Ad Hoc Committee report, the Board of Directors approved the following actions:*

(1) That the Ad Hoc Committee report be accepted (signifying only its receipt and placement in the record).

(2) That the Ad Hoc Committee be discharged, with thanks from the Federation.

(3) That the report be referred to the Federation Executive Committee for appropriate action.]

[The members of the Ad Hoc Committee are currently preparing statements concerning their report. These will be published in a future issue of the JCT.—Ed.]

Nominations And Elections

The following slate of candidates for Federation Office (1981–82) was presented by Nominating Committee Chairman Elder C. Larson at the Spring 1981 meeting of the Board of Directors:

President-Elect—A. Clarke Boyce, of the Toronto Society (Nacan Products Ltd.). He is currently Treasurer. One-year term.

Treasurer—Terryl Johnson, of the Kansas City Society (Cook Paint & Varnish Co.). One-year term.

Executive Committee—Horace Philipp, of the Montreal Society. (Sherwin-Williams Co. of Canada Ltd.) Three-year term.

Board of Directors (Members-at-Large)—Stanley LeSota, of the Philadelphia Society (Rohm and Haas Co.); and Helen Skowronska, of the Cleveland Society (Consultant). Two-year term for each.

Board of Directors (Past-President Member)—Elder C. Larson, of the Houston Society (Two-year term).

Mr. Chasan nominated Colin D. Penny, of the Baltimore Society, for a two-year term on the Board of Directors.

There being no other nominations from the floor, the Secretary was instructed to cast one ballot for the uncontested elections (President-Elect, Treasurer, Executive Committee, and Past-President on the Board of Directors).

A secret vote was held for the two positions on the Board of Directors as Members-at-Large. The winners were Mr. LeSota and Ms. Skowronska and they were duly elected to those posts.

Review of Actions Of Executive Committee

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

The actions of the Executive Committee, at its meeting of September 11, 1981, are listed below.

All were approved by the Board of Directors.]

That the Federation's First Half Statement of Income and Expense be accepted.

That the Paint Research Institute's First Half Statement of Receipts and Disbursements be accepted.

That Dr. Thomas J. Miranda be reappointed Technical Editor of the JCT, 1981–82.

That the Federation Pension Plan Trustees in 1981–82 be the then President-Elect, Treasurer, and Executive Vice-President.

That the First Quarter budget for 1982 be set at one-quarter of the 1981 budget, for operational purposes only.

That the Federation continue to pay (in 1981–82) certain transportation expenses (round-trip air coach fare from home city to meeting city) as follows: (1) To all members of the Board of Directors and Executive Committee who attend their meetings, except any held in conjunction with the Annual Meeting; (2) To specified members of Federation committees to attend their meetings (those held during the Annual Meeting excluded), but only when funds to cover these meetings have been appropriated by the Executive Committee; (3) to Past-Presidents of the Federation who attend the Board of Directors meeting held during the Annual Meeting.

That the Federation continue to pay (in 1981–82) the complete travel expenses (within the budget) of Federation officers and the Immediate Past-President on matters of official Federation business. Also, that the Executive Committee deem it appropriate and in the best interests of the Federation that spouses accompany the officers on certain Executive Committee-approved travel during the year at the expense of the Federation.

That the Federation provide a long-term disability income insurance plan for six members of staff, at an annual premium of about $3,600. *(Approved on condition that a set of qualifications be established and reported to the Board at the next meeting).*

Further, that the Investment Committee review the two stated options of funding the plan and present an evaluation and recommendation to the Finance Committee.

That the By-Laws Committee prepare an enabling resolution, to propose a change in By-Laws IV, A, (2) so that Nominations will be published in the August JCT, rather than July.

That the Federation appropriate $1,500 to the Southern Society for the preparation of 400 color proof copies of a brochure, "Consumer Guide to Trade Paint Quality: Latex Interior Flat Paint."

That the incoming President appoint an Ad Hoc Committee to study ways to promote career opportunities in the coatings

industry. *(Approved with the understanding that key leaders from educational and industry circles will be included on the committee).*

That, beginning in 1982, Retired Federation Past-Presidents and their spouses be given complimentary registration to the Annual Meeting and Paint Show.

That, in order to provide continuity and service to the Mattiello Lecture and Roon Award Committees, the Federation Director of Field Services be appointed a permanent non-voting coordinating member of these committees.

That the rental rate for space in the 1982 Paint Show be increased from $8.50 to $10.00 per sq. ft.

Old Business

CORRESPONDENCE COURSE

The Correspondence Course on Surface Coatings Science and Technology (sponsored by the Federation and prepared and administered by the University of Southern Mississippi) has been underway since the summer of 1979 when the joint agreement was signed by the two parties. According to the agreement, Part I of the course was to be made available to the industry in September 1981.

Because of many unforeseen problems experienced by the university, progress in writing the 27 chapters of Part I has been slow . . . so slow that the university is unable to predict any date of completion. Therefore, the Federation's Executive Committee passed the following resolution at its September 11, 1981 meeting:

> "Because it does not appear that the Correspondence Course will be ready within a reasonable length of time, a letter be drafted (by the Federation attorneys) terminating the contract with USM and further, that USM furnish an accounting of the monies paid by the Federation and a return of any which have not been expended. The letter will go out over the signature of the Federation President after approval by the Board of Directors on October 27."

When called for a vote, the Board of Directors disapproved that action of the Executive Committee, defeating it.

The Board did approve that the Federation continue its Correspondence Course agreement with the University of Southern Mississippi with the objective of completing Part I at no additional expense to the Federation. Further, the Board instructed the Executive Committee to meet with USM Correspondence Course leaders for the purpose of discussing the future of this project and its intended completion.

New Business

FEDERATION HONORARY MEMBERSHIP FOR PAST-PRESIDENT S. LEONARD DAVIDSON

S. Leonard Davidson, a Past-President of the Federation (1970-71) and the Golden Gate and New York Societies, had been proposed by the New York Society for Federation Honorary Membership. As specified in Standing Rules II, the Secretaries of each Society and the Board of Directors were advised of the nomination.

A secret ballot was taken and, by unanimous vote, the Board of Directors elected Mr. Davidson a Federation Honorary Member.

Committee Reports

CORROSION

The Corrosion Committee has not met and has been inactive since the last report was submitted to the Board of Directors in May 1981, and published in the August 1981 issue of the JCT.

The next meeting of the committee is scheduled for October 28, during the Federation Convention. It is anticipated that discussions will include an update from Richard Max, regarding the results of the contacts he has made with various other coating related organizations in order to establish a liaison. Additionally, the chairman will report on the results of his efforts to both broaden the base of the committee and also involve others in Federation activities.

A report of this meeting will be presented to the Board at its Spring 1982 meeting.

SAUL SPINDEL,
Chairman

DEFINITIONS

We continue to collect new definitions and additions to the Bibliography. Following our present style, we will supplement the definitions with additional information with a "Note: . . ." after the definition. It is this supplement that will make the next edition more encyclopedic. We continue to look for contributions for these "Notes."

We are also recruiting experts to work on the weaker parts of our Dictionary, such as iron oxide pigments and reagent constants.

A talk on the writing of the P/C Dictionary will be given at the ASTM Committee on Terminology seminar next June.

STANLEY LESOTA,
Chairman

EDUCATION

There have been, generally, three major emphases by the Education Committee during 1981. Foremost has been the encouragement of efforts, at the Society level, to enroll more students in the universities that have coatings courses. To that end, Societies participate in the school science fairs in their areas. Several Societies have special Education Nights, when they invite local high school science teachers to a special meeting to acquaint them with the opportunities for technical graduates in coatings. Some Societies provide scholarship money for students in the five universities that have coatings science courses.

The Education Committee is putting together a promotion program of career opportunities offered by the coatings industry. The plan is to provide this to Societies for their members to present to student groups. Copy for this has been circulated, and is now being revised for final approval by the Education Committee prior to submission to the Board of Directors. A series of slides to be used in conjunction with this will be compiled in the early part of 1982 for visual as well as verbal impact.

An excellent film on career opportunities in the coatings industry was produced in 1964. This film was reviewed by the Education Committee at its June meeting, and it was recommended that the film be released for use again.

A major project, the development of a good correspondence course, has bogged down due to personnel changes and severe time limitations at the University of Southern Mississippi. The

project is more than a full year behind the schedule set by USM and agreed upon by FSCT.

Revision of some of the out-dated booklets in the Federation Series on Coatings Technology is being done under the auspices of several Societies. This, coupled with some new subjects in preparation, should help to keep this work up to date and increase its usefulness.

Eastern Michigan University has become the sixth school to offer a specialized Coatings Science Course. It is interesting to note that, in the midst of the troubles of Michigan's automotive industry, the state recognizes the potentials of the Coatings Industry. We welcome this new school and congratulate the Detroit Society for its support of the program.

Enrollment in Coatings Courses seems to be up somewhat. Whether this is a sign of the times, a temporary phenomenon or a real, stable increase in interest in coatings science, remains to be seen. There are still more jobs than job seekers in the industry.

The general salary level of technical people in the coatings industry has been a problem in past years. Graduates of coatings courses are, generally, offered several job opportunities and those from coatings companies, while challenging, have frequently had lower pay offers than those from chemical or petroleum companies. It may be time to review the economics of the industry to see if, in fact, the technical people are being paid on a level equal to their contribution to the solutions of problems and the perpetuation of their companies.

JOHN A. GORDON,
Chairman

INTER-SOCIETY COLOR COUNCIL

The major projects of the ISCC delegation following the successful Symposium on Color and Appearance Instrumentation (SCAI) was to: (1) solicit and analyze feedback from participants; and (2) collect manuscripts of the papers presented for publication in the JOURNAL OF COATINGS TECHNOLOGY.

Most of our questionnaires (51%!) on SCAI were returned. These confirmed that our symposium was well-received, met the attendees' expectation, proved beneficial, and was viewed as a service to our industry. In addition, there were some considered comments and suggestions for future SCAI's. These should help the committee in planning for the next symposium, tentatively planned for 1983 or 1984.

Presently, we have received two manuscripts for review and are in the process of gathering other manuscripts presented at SCAI.

In addition, an overview of SCAI will be presented at the Annual Meeting, to acquaint Federation members and other industry personnel with our activities.

DENNIS OSMER,
Chairman

MANUFACTURING

The Manufacturing Committee will sponsor a seminar on Dispersion Technology at the 1981 Annual Meeting. Fred Daniel will moderate the seminar, which will present an assessment of the pros and cons of the most important types of dispersing tools—formulating approaches that will make the best of whatever machinery is available.

The Committee has been advised that the Pacific Northwest Society has discontinued their project on developing a Safety Data Sheet.

A reminder has been sent to Society Presidents and Manufacturing Committee Chairmen re. their cooperation in assisting with the Kansas City Society survey on filtration procedures.

Production on slide/tape programs continues. The New York Society program on "A Batch Operated Mini-Media Mill" has been completed and will be on display at the Federation booth in the Paint Show. The Kansas City and Houston Societies are working on revisions of their programs, "Sand Mill Operation" and "Cartridge Straining," respectively.

The Chairmanship of the Manufacturing Committee will be assumed by Richard Max, who has been most active with the Committee, and we will do our utmost to assist him.

DONALD J. FRITZ,
Chairman

MEMBERSHIP

As part of a continuing and constructive membership program, the names of approximately 300 prospects were sorted out from approximately 1,000 non-members who attended the 1980 Atlanta Convention. These were arranged by Society and distributed to the Society Representatives attending the Spring Board Meeting in Denver, Colo., for follow-up by Society Membership chairmen. The following is a list of those states and areas which contributed 10 or more attendees: CA—11, CT—12, FL—18, GA—53, IL—30, MA—13, MI—24, MO—13, NJ—47, NY—51, NC—10, OH—53, PA—28, SC—15, TN—14, WI—13, (UK)—25, Foreign—133, Mexico—30, Toronto—17. Of the foreign attendees, 42 were from Japan and 13 were from France. The remainder were from all over the world.

Many Societies have taken different approaches in their membership activities, depending on their ingenuity. For example, the Baltimore Society sent a form letter to potential members who attended the 1980 Atlanta Convention.

The New England Society distributed their first report to their members. The title of the report was "Revitalization, Growth and Participation", which describes what they have been doing to revitalize their organization. At the heart of the program was a well-planned questionnaire. Several Societies have adopted similar questionnaires, which have helped in programming and furnishing the names of members interested in being more active in various phases of Society activities.

A. GORDON ROOK,
Chairman

METRIC SYSTEM

There has been little recent activity on the U.S. scene. However, I am happy to report that considerably better progress was made in Canada. Three paint companies (Olympic Stains, Color-Your-World, and International Paints) have gone metric. No major problems were encountered in the conversion.

In addition it should also be reported that, according to surveys of the Metric Commission in the Canadian Chemical Industry, about 85% of all dollar sales are now in metric measure in this industry.

E. L. HUMBURGER,
Chairman

PROGRAM

With the theme of "Challenge, Change and Opportunity" the 1981 program was finalized and published. Presiding chairmen assignments were made and authors briefed on presentation procedure.

I attended a September meeting in Detroit with the Host Committee to review last minute details.

This year we have had some difficulty with the Roon Award Papers. The subject will be addressed at a meeting of the Publications Committee next Spring.

This is my final report as Chairman and I express my sincere thanks to the members of the Program Steering Committee and the Federation staff for their untiring assistance.

THOMAS J. MIRANDA,
Chairman

PUBLICATIONS

We have added a new member to the Editorial Review Board after an annual review of this select group. Herb Hillman, a dedicated member and editor of "Humbug from Hillman," will be retiring. He will be replaced by Dr. Darlene Brezinski.

Plans are underway to hold a joint meeting of the Publications Committee and the Editorial Review Board in Philadelphia next Spring.

A project headed by Vice Chairman Paul Guevin is underway. The objective is to prepare review examples and update the guidelines for reviewers.

The Annual Meeting papers have been reviewed. The Journal is now being published so that members received the JCT in the issue month.

Manuscript flow is still good.

THOMAS J. MIRANDA,
Chairman

TECHNICAL INFORMATION SYSTEMS

Members of the Technical Information Systems Committee (TISCO) continue to be responsible for the following: compilation of the contents of current technical coatings periodicals for publication in the JOURNAL OF COATINGS TECHNOLOGY under the heading of Technical Articles in Other Publications; and preparation of annual keyword/subject index to JCT.

TISCO member replies to the Activities Questionnaire mailed during the summer indicated an interest in all of the proposed projects, viz., preparation of Cumulative Index to JCT, e.g., a five-year index; preparation of subject bibliographies on broad or narrow topics of interest to the coatings industry, for JCT publication; preparation of an educational booklet on technical information for the Federation Series of booklets, or for publication in serial form in JCT.

In addition, committee members suggested the following new projects for consideration: compilation of list of available foreign language coatings dictionaries, both from the foreign language into English and from English into the foreign language; provision of assistance in preparation of review articles on analysis of coatings and polymers; organization and execution of plan for preparation and publication in JCT of monthly annual literature review articles on 12 pre-selected topics in coatings technology, with a different topic covered in each monthly review article in a given year.

TISCO members will next study these proposed activities in detail.

HELEN SKOWRONSKA,
Chairman

DELEGATE TO NPCA AND GOVERNMENTAL AGENCIES (ENVIRONMENTAL CONTROL)

Activity of the Environmental Committee and the Delegate has been limited since the last Board of Directors Meeting due to the holding pattern of the government with regard to Federal Regulations, especially those of the Environmental Protection Agency that regulate paint wastes generated by the coatings industry.

Despite this apparent lack of activity, EPA is concerned with the following items:

(1) Landfilling with "ignitible" wastes

(2) Listing of paint wastes

(3) Recycling of paint wastes

(4) Disposal of paint wastes that cannot be used for "Land Fill." The major problem is disposal of "liquid" wastes, due to lack of facilities for disposal.

(5) How to define "solid" and "liquid" wastes. When is a waste solid and when is it liquid and what do you do with those that are neither?

(6) Inspections for compliance with RCR regulations.

So, while all appears to be quiet on the "Regulation Front", it appears that anything can happen at any time and that the coatings industry should be aware of the possibility.

Among all the potential problems of Environmental Control, and we have only hit the highlights of waste, the industry must and should be aware of the possible activities of 50 legislatures who will act if the Federal Government does not. It is necessary that their activity be monitored. NPCA has led the industry to insure that the regulations that are issued are those with which we can comply. But they cannot do it all. Cooperation must be maintained with NPCA by keeping them informed as to what is happening in each state.

This is my last report to the Board of Directors. I am taking this opportunity to thank all the members of the Environmental Committee and the Federation Staff for their assistance and contributions.

S. LEONARD DAVIDSON,
Chairman

DELEGATE TO SSPC

No formal meeting was held during the early part of 1981. Instead, a special Steering Advisory Committee meeting was held to review and expedite the completion of the revision of Volume II, "Systems and Specifications".

Thirteen selected members attended the meeting. These included the following Federation members: Edward G. Bozzi, of New York; Marvin L. Caine, of Pittsburgh; Karl P. Karsten, of Pittsburgh; John D. Keane, of Pittsburgh; Sidney Lauren, of Cleveland; Sidney B. Levinson, of New York; and Kenneth B. Tator, of Pittsburgh.

Present SSPC Activities

Both Volume I "Good Painting Practice" and Volume II "Systems and Specifications" are being completely revised.

There are 20 SSPC Advisory Committees which meet once or twice a year. They advise and assist the SSPC staff in developing guides and consensus specifications for surface preparation, paint application, paints and paint systems, which are used throughout the world. About one third of those attending are members of the Federation.

SSPC is carrying out the following program of interest to our industry:

(1) Preparation of a data bank of performance data to computer-correlate the performance of the various generic types of coatings in a wide range of environments including bridges, SSPC exposure stations and accelerated exposure tests.

(2) Project PACE—"Performance of Alternate Coatings in the Environment". This is a systematic evaluation of the durability of coatings investigating new types of coatings, new raw materials and new methods of surface preparation. A copy of the report is available.

(3) Low-Solvent Coatings—An intense study has been made of prospective regulations and what is being done to meet these regulations through the use of water-base paints, high solids coatings or permissible solvents, e.g., chlorinated solvents. The use of non-toxic pigments has also been investigated. A report on this project is in preparation.

(4) Cooperation with the International Standards Organization and foreign colleagues to avoid differences in guides, standards and specifications.

(5) Surface Preparation—A report on surface cleanliness and profile has been prepared and is available. New methods of surface preparations have been investigated. A report is in preparation.

(6) A state-of-the-art survey of the special weathering steels and the effect of different environments.

(7) An investigation of the problems and solutions in the topcoating of zinc rich primers. A report based on five years of panel exposure is available.

The annual meeting of SSPC will be held in Pittsburgh in February 1982.

SIDNEY B. LEVINSON,
Delegate

Society Reports

Baltimore

Education Committee established a basic coatings course at Essex Community College and continues with its program of awarding scholarships . . . Technical Committee is concentrating on a project to investigate the selectivity of pigments under infra-red illumination . . . The Baltimore Mini Show will not be held in 1982, due to the Annual Meeting and Paint Show in Washington, D.C. . . . In cooperation with the Piedmont Society, the new Virginia section continues to operate under the auspices of the Baltimore Society.

Chicago

Technical Committee received the Union Carbide Award and the MMA Award for the IR Spectroscopy Book, and an American Paint Journal Award for the paper on "Renewable Resources for the Coatings Industry. . . . SYMCO was successfully conducted by the Education Committee, as was a basic training coatings course. Scholarships totaling $5000 were awarded to universities with teaching programs in coatings technology.

Cleveland

Manufacturing Committee presented "Pigment Dispersion—Formulating For and Utilization of Pigment Dispersion Equipment" symposium; attendance was 160. . . . Held the 24th Annual Cleveland Society Symposium, "Advances in Coatings Technology," attendance was 121 for four one-half day symposia. . . . Three $100 awards were presented by the Education Committee for the local science fair. . . . Planned and publicized coatings-related course at Kent State University at which nine society members served as lecturers . . . "Characterization of Functional Latexes for Autodeposition" was presented by the Technical Committee at the Annual Meeting . . . Society's "Award of Merit" was presented to Helen Skowronska and Fred Schwab.

C-D-I-C

To streamline and shorten business meetings, two procedures were adopted: (1) posting of minutes to replace the reading; and (2) including the first readings of new member applications in the monthly meeting notice.

Detroit

Began year with a 50% loss of membership due to economy . . . Sponsored the 6th Annual Focus Meeting on "Color and Appearance in Changing Times", attended by more than 200. . . . Held Joint Meeting with the Detroit PCA. . . . Sponsored, with the Detroit PCA and the Polymer Institute of the University of Detroit, the following courses: "Coating Laboratory", "Principals of Color Technology", and "Surface Coating Technology" . . . Also available at the University of Detroit is "Organic Polymer" course; four-year Bachelor of Science degree in Polymers and Coatings Technology was initiated at the University of Eastern Michigan. . . . Presented paper on "Kinetics of Thermal Dissociation of Blocked Isocyanate Crosslinkers" at 1981 Annual Meeting.

Golden Gate

"Safety and Government Regulations" conference presented by Manufacturing Committee . . . Paper on "Corrosion and a Complying System" presented by Technical Committee at the 1981 Annual Meeting . . . Four courses on basic and advanced paint technology and business aspects of the industry were offered by Education Committee, along with plant tour . . . Continued to maintain coatings library at Redwood City Library . . . Awarded three scholarships to college students of society's members.

Kansas City

Technical Committee planning paper for 1982 Annual Meeting . . . Discussed importance of Society's support to PRI.

Los Angeles

Paper on "Reactive Silane Modified Pigments" presented by the Technical Committee at 1981 Annual Meeting . . . Revised scholarship program, awarded two $2,000 scholarships . . . Education Committee continued coatings course at Los Angeles Trade Technical College, and sponsored polymer course at Cal State, Fullerton . . . Manufacturing seminar covered topics on hazardous waste disposal and solvent recovery, with 40 in attendance . . . Joined with the SCPCA to form Joint Regulatory Task Force, chaired by Jerry West, of Environmental Committee . . . 1981 WCST Symposium, chaired by Tony Rumfola, was held in Anaheim, CA, with 2,073 attending . . . $10,000 was presented to Pacific Northwest and Rocky Mountain Societies' scholarship funds.

Louisville

Held joint meetings with Louisville PCA . . . Average year's attendance at meetings was 70-75 . . . Participated as a member of Louisville Coatings Waste Disposal Association . . . Survey underway for new project on corrosion inhibitive pigments; interested in joint project with other societies and PRI Mildew Consortium to evaluate the mildew resistant resin in finished coatings . . . Education Committee sponsored "TC-224-Surface Coatings IV-Instrumental Analysis at University of Louisville, Speed Engineering School. . . . Presented paper on "Reclaiming the Energy Valve of Coatings Wastes Through Pyrolysis" at 1981 Annual Meeting.

Mexico

Increased manufacturing presentations to attract members in paint manufacturing operations . . . Established "BONAM-PAK award" with the National Association of Paint Manufacturers, ANAFAPYT, to be given annually to the authors of the three best articles written for the ANAFAPYT Journal . . . Considering "exchange program" as an award for members with outstanding contributions to committees, presentations, or publishing of original work; technical tour in the U.S., Canada, or Europe will be awarded. . . . Interested in having member speakers from other Societies . . . Supported and participated in a study of technical aspects of rating and evaluating paint quality; interested in exchanging ideas with other groups.

Montreal

Celebrated 50th Anniversary . . . Held annual Joint Symposium with Toronto Society . . . Subcommittees of the Technical Committee studied adhesion of semi-gloss latex paints and the rheology of sedimentation.

New England

Panel discussion featured paint quality . . . A "first" occurred in April when meeting was held in Western Massachusetts . . . Published booklet focusing on the history, purposes, and activities of the Society and Federation.

New York

Sponsored "Understanding the Basics of Coatings I and II" and a laboratory course for technicians. Discussed formation of a coatings center to sponsor courses in the Vocational High Schools . . . Technical Committee has been reactivated, forming four subcommittees: Utilization of Computers in the Coatings Industry; Modern Methods of Viscosity Determination-Correlation between Kinematic and Absolute Viscosity; Additives-Plasticizing versus Coalescing; and Biocidal Polymers in Paint . . . Manufacturing Committee will sponsor one-day symposium.

Northwestern

Urge continuation of educational efforts of FSCT Society Officers, and the Technical and Educational committee chairmen.

Pacific Northwest

Experienced increase in membership . . . Successful May symposium, with 266 in attendance; May 1982 Symposium to be held in Vancouver . . . Society's "Outstanding Service Award" presented to John A.J. Filchak.

Philadelphia

Technical Committee meetings continued with an average 25 attendees.

Pittsburgh

Awarded two prizes at local Science Fair. Participated in a PRI sponsored "High Solids Coatings" encounter session held at Kent State University . . . Technical Committee continued work on "Flash Point Measurement Error—Waterborne Coatings."

St. Louis

Held successful "Education Meetings" for local Chemistry teachers.

Toronto

Sponsored Joint Symposium with Montreal, with 132 in attendance. . . . Membership increased to 400 members as opposed to 263 members in 1980 . . . Attendance for the monthly manufacturing meetings averaged 20 persons . . . Co-sponsored a 20-week basic coatings course with George Brown College which featured guest lecturers; future courses will include more guest lecturers.

The next meeting of the Board of Directors will be held on Friday, April 30, 1982, at the Lenox Hotel in Boston

In Memoriam

We report with deep regret the passing of the following members during the last year:

Baltimore

DAVE ACKLEY—E. I. duPont
TOMMY G. B. RUSSELL—Athey Paint Co.

C-D-I-C

ROBERT ADAMS—Inmont Corp.
ELWIN C. EIDE—Retired (American Zinc Co.)
HERBERT L. FENBURR—Retired (Hanna Chemical Co.) Federation Past-Pres. (1967-68) and Honorary Member. PRI Past-Pres. (1970-73). Society Past-Pres.
CHRISTIAN J. VANDER VALK—Inmont Corp.

Dallas

C. M. (CHET) JEKOT—C & S Chemicals
OTTO KARL SIEPLEIN—Retired (Sherwin-Williams Co.)

Detroit

JAMES GARNER—Grow Group, Inc.
ROY E. GRAVES—Retired (Acme Paint Div. of Sherwin-Williams Co.) Society Past-Pres. & Honorary Member
ROBERT H. LALK—Dow Chemical Co.

Golden Gate

JACK HEYMES—Retired (International Paint) Society Past-Pres.
RALPH LEVINE—Vista Assoc.

Houston

D. W. (WES) SKILLERN—Retired (Thompson-Hayward) Society Charter Member

Kansas City

FORREST R. GROSS—Welco Mfg. Co., Inc. Society Past-Pres.

Los Angeles

CHARLES F. WILSTERMAN—Deero Paint & Chemical Co.

Louisville

ARTHUR E. STAUDERMAN—Retired (Schaefer Varnish Co.) Federation Past-Pres. (1938-39) and Honorary Member. Society Past-Pres.

Montreal

MAURICE E. BERUBE—Retired (Sherwin-Williams Co. —Canada)

New York

CLEMENT BELYEA—Retired (J. Lee Smith & Co.)
JOHN M. CALLAGHAN—Pfizer, Inc.
MORTON M. GRUBER—Retired (CIBA-GEIGY Corp.)
CHARLES A. MALIZIA—Retired (Dux Paints & Chemicals, Inc.).
THEODORE R. MULLER—A. D. M.
WILLIAM F. RENNE—Retired (Benjamin Moore & Co.)
CASPER SMITH—Smith Chemical & Color Co., Inc.
IRWIN Y. STRAUS—Dura Commodities

Northwestern

ELRY L. FLEISHER—Viking Paint Society Past-Pres.

Pacific Northwest

STEVE HOWELL—Reliance

Pittsburgh

C. O. (CHES) MCCAFFREY—Dar-Tech, Inc.

Rocky Mountain

C. ERNEST (ERNIE) JOHNSON—Retired (Kohler-McLister (Komac) Paint Co.) Society Founder

Southern

JOHN A. BRUSCHI—American Lacquer & Solvents Co.
EDWIN L. GOTT—Retired (The Gilman Co., Inc.) Federation Past-Pres. (1944-45) Society Founder & First President
M. M. (MAC) HEMPHILL—Southern Protective Products Co.
RALPH T. (HOP) HOPKINS—Retired (R. T. Hopkins Co.)
MRS. GRACE B. HUGHES—Retired Dozier & Gay Paint Co.)
EDWIN S. LUCAS—Reliance Universal, Inc.

Western New York

CARL L. SCHWENK—Spencer Kellogg Div., Textron, Inc.

CARROLL M. SCHOLLE,
Chairman, Memorial Committee

ROON FOUNDATION AWARDS 1982

Sponsored by

PAINT RESEARCH INSTITUTE

The Roon Awards are for the best technical papers (other than those by a Federation Society) submitted for presentation at the Federation Annual Meeting.

Papers to be considered for the competition must:

- Directly relate to the protective coatings industry.
- Be authored by individuals associated with the organic coatings industry (including raw material suppliers and educational institutions).
- Describe original work not previously published or presented.

$3,000.00 in Prize Money
Available to Winning Papers

Anyone wishing to enter this year's competition must advise the Roon Awards Committee Chairperson:

Dr. Darlene Brezinski
DeSoto, Inc.
1700 Mt. Prospect Rd.
Des Plaines, IL 60018
(312) 391-9000

by March 1, 1982; manuscript copies must be submitted by June 1, 1982.

The Awards will be presented during the 1982 Federation Annual Meeting, November 3, 4, and 5, in Washington, D.C.

For a copy of the principles governing the Roon Awards, write (or phone):

Federation of Societies for Coatings Technology
1315 Walnut Street, Philadelphia, PA 19107
(215) 545-1506

Raymond D. Stevens, Jr. Receives 1981 NPCA Heckel Award

Raymond D. Stevens, Jr., Chairman of the Board and Chief Executive Officer of Pratt & Lambert, Inc., Buffalo, NY, was named the 1981 winner of the George Baugh Heckel Award by the National Paint and Coatings Association at its 94th annual meeting, held in Detroit on October 26–28.

Mr. Stevens joined the Pierce & Stevens Chemical Corp. in 1951 following service in the U.S. Navy and graduation from the University of Pennsylvania's Wharton School of Finance. He served as Executive Vice-President of the corporation before being named its President in 1963 and Chairman of the Board in 1970. Pierce & Stevens became a subsidiary of Pratt & Lambert, Inc. in 1967, and Mr. Stevens became the company's Executive Vice-President. He was elected President and Chief Executive Officer in 1970, and Chairman of the Board in 1971. Mr. Stevens also serves as Chairman of the Board of United Paint Co., a subsidiary of Pratt & Lambert, Inc.

Serving three successive terms on NPCA's Board of Directors, Mr. Stevens was elected Vice-Chairman in 1977 and Chairman in 1978. He also participated for two years on the Joint Paint Industry Coordinating Committee.

Active in business and community affairs in his hometown of Buffalo, NY, Mr. Stevens is a Director of the First Empire State Corp. and its subsidiary, the Manufacturers and Traders Trust Co. He also serves as a Director of the Niagara Share Corp. and as a Trustee of the Buffalo General Hospital.

NPCA Industry Statesman Awards Presented at 94th Annual Meeting

The National Paint and Coatings Association honored six men with long and illustrious careers in the U.S. paint and coatings industry at its 94th annual meeting in Detroit.

Receiving the Association's Industry Statesman Award for "long and unheralded service to the paint industry" were: William R. Barrett, Sr., retired President and Chief Executive Officer of Inmont Corp., New York, NY; Frank E. Bolway, Jr., President of the D.H. Litter Co., Inc., New York; Jerome J. Crowley, Sr., Chairman of the Board for The O'Brien Corp., South Bend, IN; Robert H. Duzy, retired Senior Marketing Consultant for the Solvents and Intermediates Division, Union Carbide Corp., New York; William C. Lowrey, a Washington, D.C.-based lobbyist for the Shell Oil Co.; and Paul W. Neidhardt, Senior Division President of the Glidden Coatings and Resins Division, SCM Corp., Cleveland, OH.

The Industry Statesman Award is one of the highest honors presented by the paint industry. It is given to individuals who have made substantial contributions to the betterment of the industry and to their communities over a number of years. The awards were first presented in 1964.

William R. Barrett, Sr., a chemical engineer, was President of the Detroit-based Rinshed-Mason Co., an automative finishes Manufacturer, when the firm was acquired by Inmont in 1966. He served Inmont as an Executive Vice-President until his election as President. Mr. Barrett was NPCA's Treasurer, Vice-President, and a member of the Board of Directors and Executive Committee, and has served on several NPCA committees. He is a former member of the Board of Directors of the Chemical Manufacturers Association, and served as President of the Detroit Paint and Coatings Association.

Frank E. Bolway, Jr. joined D.H. Litter in 1934. He has participated on NPCA's Board of Directors and on several committees. After holding numerous offices with the New York Paint and Coatings Association, Mr. Bolway was elected as its President in 1973 and 1974.

Jerome J. Crowley, Sr., who joined The O'Brien Corp. following graduation from the University of Notre Dame in 1931, served as Advertising Manager, Vice-President, and President before being named Chairman in 1975. Semi-retired, he still maintains an active role in the corporation. Mr. Crowley is a past Regional Vice-President of NPCA, and has served on the Board of Directors, Executive Committee, and numerous committees and task forces.

Following service with the U.S. Navy, Robert H. Duzy joined the Union

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James H. Davis Is Elected President of NPCA

James H. Davis, of Porter Paint Co., Inc., Louisville, KY, was elected President and Chief Executive Officer of the National Paint and Coatings Association at its 94th annual meeting, held in Detroit. Also elected were: William D. Kinsell, Jr., Glidden Coatings and Resins, Div. of SCM Corp., Cleveland, OH, as Vice-President, and Charles J. Fisher, Reliance Universal Corp., Louisville, as Treasurer.

Regional Vice-Presidents were chosen from seven geographical zones: New England—Joseph S. Parker, Sterling-Clark-Lurton Corp., Malden, MA; Eastern—Edward C. Rabon, Charles Wagner Co., Inc., Philadelphia, PA; East Central—Joseph M. Walton, Jamestown Paint & Varnish Co., Jamestown, PA; West Central—Raymond H. Frederick, Reynolds Metals Co., Inc., Shawnee Mission, KS; Southern—N. Paul Pope, Jr., AZS Chemical Co., Atlanta, GA; Southwestern—Richard D. Williamson, Trinity Coatings Co., Fort Worth, TX; and Western—Clyde L. Smith, Ameritone Paint Corp., subsidiary of Grow Group, Inc., Long Beach, CA.

Elected to the Board of Directors for a one-year term was J.D. Porthouse, Carboline Co., St. Louis, MO. The following were elected for three-year terms: Richard V. Bretzer, Hydrosol, Inc., Burr Ridge, IL; Paul D. Dague, Jones-Blair Co., Dallas, TX; Irvin Ebaugh, Jr., Bruning Paint Co., Baltimore, MD; Horace S. Felton, Jr., Delkote, Inc., Penns Grove, NJ; John F. Gleason, Grow Group, Inc., New York, NY; C. Robert Hiles, Lilly Industrial Coatings, Inc., Indianapolis, IN; Edward M. Irving; Inmont Corp., Clifton, NJ; Gregory T. Parkos, Whittaker Corp., East Providence, RI; G. Roger Victor, Olympic Stain, Div. of Comerco, Inc., Bellevue, WA; G. William Harrison, Spencer Kellogg, Div. of Textron, Inc., Buffalo, NY; James D. Hembree, Dow Chemical Co., Midland, MI; and Lawrence Okun, Tenneco Chemicals Inc., Saddle Brook, NJ.

APCA Recommends Simplifying Clean Air Act

The Air Pollution Control Association in a position statement has recommended to Congress to maintain "the momentum . . . toward comprehensive and effective air pollution control" that has developed over the past decade under the Clean Air Act, and has offered suggestions for simplifying and streamlining the Act. The Association told the House Subcommittee on Health and the Environment, which is considering revisions of the Act, that the basic Clean Air Act is sound and does not require revisions. Implementation of the Act's parts will result in unnecessarily complex, time consuming, and costly procedures which tend to subvert the intent of the Act, according to APCA.

Along with offering suggestions for improving various parts of the Act, the Association also concentrated its testimony on the Act's most complex and controversial sections, "Prevention of Significant Deterioration (PSD)". Its purpose in the Act is to prevent ambient air that already is "clean" in certain areas, according to national standards, from becoming significantly dirtier as new industry is introduced into those areas. APCA feels the PSD is worthwhile in concept, but the regulatory process created to achieve it has become overly complex.

Specifically, APCA proposed that Congress allow new plants to be built in all but the most pristine areas if industry applied the principle of "best available (air pollution) control technology" (BACT). Construction in the "cleanest" areas, those designated "Class I" by the Act, would be further limited by a ceiling on the amount of new air pollution that could be introduced there. Presently, all clean air regions are governed by these ceilings, and anyone proposing to build a new plant must first apply for the right to emit a share of the remaining allowable pollution. According to APCA, this entire review process is too complicated and requires the evaluation of too many small plants.

APCA's recommendation on BACT would accomplish the same results without all of the statutory complexities of PSD as currently exist. The APCA position supports conclusions and recommendations of the National Commission on Air Quality (NCAQ), which studied the question in five different geographical regions across the country.

APCA believes that individual states should remain free to adopt alternative measures to "prevent significant deterioration" as currently provided in the Clean Air Act, and that Congress should periodically re-evaluate the program, perhaps every three years, to determine whether or not additional reforms are needed.

The APCA position statement called for similar reforms in the way states regulate all air pollution in accordance with federal standards. The mechanism for this process, SIPs or State Implementation Plans, is too inflexible in its present form, and has established an unnecessary administrative redundancy at the state and federal levels.

For example, the Association noted, the federal government must formally approve every minor revision that a state might want to make in its SIP program. These minor changes by the states should be allowable, APCA maintained, unless the federal government has specific objections. Major issues would be decided by negotiation between state officials and regional federal officials.

In addition to these procedural matters, APCA said the scientific community and the public at large should play a greater role in setting National Ambient

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WANTED:
Paint for Rusty Highway Bridges

Many highway bridges are repainted without sandblasting, and most bridges have some inaccessible areas which cannot be sandblasted. This leaves residues of mill-scale, rust, dirt, sodium chloride, sodium sulfate, and other impurities, over which the new paint must adhere and provide corrosion protection. We are making a survey for the U. S. Department of Transportation, to determine what coatings are available for repainting iron and steel highway bridges under such conditions, and what performance can be expected of them. If you have any commercial or development coatings for such conditions, and would like us to include them in our recommendations to DOT, please send the following information as soon as possible, to the extent that it is available:

Trade Name
Commercial Availability
Price
Chemical and Physical Properties
Function or Mechanism by Which It Works (Proven or Theoretical)
Surface Preparation Required or Preferred
Method of Application
Drying Time till Overcoating and till Use
Laboratory and Field Data on Performance
OSHA and EPA Considerations

Please send details as soon as possible to:

Rudolph D. Deanin, Principal Investigator
FHWA Project "Coatings for Non-Blast Cleaned Highway Metals"
University of Lowell
Lowell, Massachusetts 01854

Industry Statesman Awards Presented at Annual Meeting

(Continued from page 57)

Carbide-sponsored Organic Synthesis Fellowship, where he engaged in research in the evaluation of solvents, plasticizers, and related products in coatings applications. He held positions in the firm's Tarrytown and New York City facilities. Mr. Duzy was an active member of and manager of NPCA's Air Quality Task Force, and a member of an Industry Advisory Group to the Los Angeles County Air Pollution Control District.

William C. Lowrey, who received an Chemical Engineering Degree from the University of Alabama, has been employed by Shell for 33 years. He has served the firm as a lobbyist since 1964. Mr. Lowrey is a member of the NPCA Board of Directors and several of the organization's committees. He is a past Chairman of the Government Relations Committee of the Chemical Manufacturers Association.

Paul W. Neidhardt, a journalism graduate of the University of Illinois, joined the Glidden Co. in 1951, and was named Vice-President-Operations in 1960, and Executive Vice-President in 1966. Following the firm's merger with the SCM Corp., Mr. Neidhardt was elected to the SCM Board of Directors. He has served on NPCA's Board of Directors and Executive Committee, and was Vice-President of the Association in 1965.

Chemical Industry Urges Review of Clean Water Act

The Chemical Manufacturers Association has urged Congress and the Environmental Protection Agency to conduct a comprehensive review of the Clean Water Act to ensure that the 1972 law addresses the most significant remaining problems of cleaning and protecting the nation's waterways.

According to CMA, water pollution controls have accomplished more than expected, and the nation has made significant strides in cleaning and protecting the rivers, lakes, and streams. The law should reflect these improvements and focus on the remaining significant water problems. CMA feels that Congress needs to recognize that some objectives of the act cannot be achieved under current deadlines.

In a position paper prepared for Congress and the EPA, CMA detailed some of the more significant problems of the act, and recommended ways in which it can be improved to solve remaining pollution problems efficiently and expeditiously. Congress may bring the act up for re-authorization and review in 1982.

CMA noted that its recommendations are consistent with a December 1980 House subcommittee report to Congress which stated that there remains many factors, "both administrative and legislative in nature, which impede the effectiveness and efficiency of (the Clean Water Act's) program."

CMA recommended that Congress recognize, as the House subcommittee did, that technology-based treatment guidelines (known as Best Available Technology Economically Achievable—or BAT) cannot be developed by EPA in time for industry to meet the law's July 1, 1984 deadline. CMA therefore recommended, as has the House subcommittee, that the deadline be extended to July 1, 1987 to allow industry sufficient time to install controls after the BAT guidelines are established.

At the same time, CMA recommended that Congress and EPA determine if, and to what extent, the BAT requirements are needed since industrial treatment systems presently in use have been more effective in controlling pollution than expected.

CMA also urged Congress and EPA to require independent scientific review of data used to justify listing a pollutant as "toxic." Because of the act's "vague criteria" for classifying pollutants as toxic, CMA said, "EPA has in many cases classified pollutants as toxic on the basis of incomplete, inaccurate, or inadequately reviewed scientific data."

Although EPA is not now required to conduct cost-benefit analysis, the law requires that it consider many factors, including costs, in developing regulations. The association recommended that Congress require EPA to undertake cost-benefit analysis of its toxic strategy program, effluent guidelines, and other regulatory programs to determine whether the costs of the regulations are justified by the expected benefits to the environment.

Clean Air Act

(Continued from page 58)

Air Quality Standards (NAAQS). These standards should be set to "reduce risk to acceptable levels," with the prior understanding that no level of air pollution is completely safe for everyone who may be exposed.

The use of this risk analysis is especially appropriate for hazardous air pollutants, according to APCA. Pointing out that only four hazardous pollutants have been officially regulated to date, APCA stated that more realistic standards and more flexible deadlines would actually improve the control of hazardous pollutants.

EMU Seeks Used Equipment For Polymers/Coatings Lab

Eastern Michigan University, with the help of an Industrial Advisory Committee comprised of industry leaders and representatives of the Federation and the National Paint and Coatings Association is currently developing a four year curriculum leading to a B.S. Degree in Polymers and Coatings Technology.

Used but usable equipment of all kinds, including instrumentation, is needed in order to minimize the start-up costs involved in implementing this new program.

Donations are tax deductable up to 10% of your taxable income with a five year carryover.

Principals interested in donating equipment or other resources to this program are invited to contact:

John C. Graham, Program Coordinator
Eastern Michigan University
Department of Interdisciplinary Technology
Sill Hall Annex
Ypsilanti, MI 48197
(313) 487-1161

Proposed Amendments to Federation By-Laws

The following proposed amendment to the By-Laws of the Federation of Societies for Coatings Technology will be presented for first reading at the Board of Directors meeting on April 30, 1982, in Boston.

ARTICLE IV—NOMINATIONS AND ELECTIONS

WHEREAS the monthly publication date of the *Journal of Coatings Technology* has been advanced and this earlier publication date makes it impossible to meet this By-Law's requirement of reporting nominations for elective offices in the July issue, be it

RESOLVED that By-Laws Article IV, Section A, Paragraph (2) be amended as follows:

(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 August 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 August 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.

Comment: The By-Laws Committee recommends adoption.

EPA Withdrawal of Effluent Guidelines Could Spell Savings for Coatings Industry

The Environmental Protection Agency's (EPA) recent withdrawal of its proposed effluent guidelines could save the paint industry close to $50 million in operating costs and capital equipment the first year and up to $32 million annually thereafter, according to estimates by the National Paint & Coatings Association.

EPA announced its withdrawal of the proposed rules for the caustic and/or wastewater subcategory and the solvent wash subcategory for the paint manufacturing industry in the October 30, 1981 *Federal Register* following several years of effort by NPCA and its Water Quality/Waste Management Task Force.

Following EPA's notice, NPCA praised the Agency for weighing the proposed rule's minimal impact on the environment against the millions of dollars implementation of the rule would have cost the industry. The "zero discharge" standard proposed by EPA would have required process waste water containing even minute amounts of certain metals and organics to be drummed and landfilled rather than discharged to publicly owned treatment works.

NPCA's written comments on the proposal, which were accompanied by an independent consultant's report supporting NPCA's position, resulted in EPA's delay of the rules for more than a year. In the interim, NPCA cited the rule as an example of regulatory overkill in its response to Vice President George Bush's request for information on regulations which should be reformed. NPCA pointed out that the present critical shortage of landfill capacity, already exacerbated by hazardous waste regulations issued under the Resource Conservation and Recovery Act, would be further strained if EPA's proposed rules were adopted.

CMA Reports Industrial Energy Conservation

The Chemical Manufacturers Association has reported that 84 chemical companies have reduced their energy consumption an average of 23.4% per unit of output for the 12-month period ending June 30, 1981. The base year used to compare figures is 1972.

Companies regularly report their energy conservation figures to the Department of Energy on a calendar year basis through CMA. The aggregate achievement of those 84 voluntarily reporting shows that the industry is ahead of the 22.1% improvement reported to DOE as of December, 1980, with an energy saving for that period of about 826 trillion Btu.

Executive Committee of the Federation for 1981–82. Seated (left to right): President Howard Jerome, of Spatz Paint Industries, St. Louis, MO and President-Elect A. Clarke Boyce, of Nacan Products Ltd., Toronto, Ont., Canada. Standing (left to right): Immediate Past-President William H. Ellis, of Chevron Research Co., El Segundo, CA; Joseph A. Bauer, of Porter Paint Co., Louisville, KY; Fred G. Schwab, of Coatings Research Group, Inc., Cleveland, OH; Horace S. Philipp, of Sherwin-Williams Co., Montreal, Que., Canada, and Treasurer Terryl Johnson, of Cook Paint & Varnish Co., Kansas City, MO

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Design of Waterborne Coatings For the Corrosion Protection of Steel

Part II: Evaluation of Some Chemicals As Flash Rust Inhibitors In An Aqueous Air Dry Coating

New England Society for Coatings Technology
Technical Committee

Twenty-nine inorganic salts, 17 organic acid salts, 16 amines, 11 alkanolamines, three silanes, six imidazolines, and three miscellaneous chemicals were evaluated at four concentration levels in an aqueous coating for effect on flash rust resistance. Water immersion, and salt fog exposure tests were conducted to evaluate the additive's effects on coating performance. Ten inorganic salts, seven organic acid salts, one amine, two alkanol amines, and one imidazoline show promise as flash rust inhibitors.

INTRODUCTION

With the advent of water-thinned coatings for industrial and maintenance applications, unique problems have become apparent.[1-3] One of these occurs when using ferrous substrates; it has been termed flash rusting.[4,5] Flash rusting is the corrosion of a ferrous substrate that occurs during the drying process of an aqueous coating. The usual manifestation of this condition is the appearance of corrosion products (rust) on the surface of the paint after it has dried. While the phenomenon is not completely understood, nor the long term affects known, it is an objectionable property of water-thinned coatings. This phenomenon must be taken into account when designing water-thinned coatings for application to steel.

Typical water-thinned coating formulations contain a variety of materials in small amounts that may enhance their corrosive nature. If tap water is used, as is often the case, the water might possess inherent corrosive capabilities. Pure water, i.e., deionized water free from dissolved salts and gases, is not corrosive to steel. All natural waters contain some dissolved salts and gases, and depending on their type and concentration, can become very corrosive to steel.

Another factor influencing corrosive characteristics is pH; corrosibility is high at low pH. Amine stabilized coatings containing resins of acid functionality decrease in pH as the film dries and the basic amine volatilizes.

Part I in this series[6] reviewed the current hypothesis of corrosion and mentioned some materials that inhibit corrosion. It has been found that small amounts of certain inorganic salts or organic compounds added to water-thinned coatings eliminate flash rusting.[4,5] The amount of information available on flash rusting and the effects of chemicals on flash rusting is meager; thus, this study. Several papers[7-14] have reported that a variety of compounds (inorganic salts, amines and alkanol amines, acid salts, titanates, and imidazolines) were effective in corrosion inhibition. Several compounds of the types mentioned were examined for their ability to prevent flash rusting.

Presented by Maureen Lein at the 58th Annual Meeting of the Federation of Societies for Coatings Technology, October 30, 1980 in Atlanta, GA.

Table 1—Aqueous Acrylic Coating Formulation

Materials	Pounds
Rhoplex® WL-81 (41.5%)	1960.0
Tamol® 165 (23%)	86.4
Triton® CF-10 (100%)	11.2
Deefo® 806-102	16.0
Titanium dioxide (Zopaque® RCL-9)	1280.0
Grind the above with a high speed impeller at 4100 FPM for 20 min. At slow speed, let down as follows:	
Rhoplex WL-81	524.8
Water	944.0
Ethylene glycol monobutyl ether	400.0
2,2,4-trimethylpentanediol-1,3-monoisobutyrate (Texanol®)	40.0
Deefo 806-102	1.6
DC®-14	5.6
Ammonia, 26° Be (28%)	19.8
Total	5289.4
Formulation Constants	
pH	9.0
Viscosity, cps @ 25° C. 30 rpm, No. 2 spindle	700
Pigment volume concentration, %	25
Wt., %, non-volatile	44.6
Wt., %, dispersant on pigment	1.55
Wt., %, wetting agent of pigment	0.88

Rhoplex WL-81, Tamol 165, Triton CF-10	Rohm and Haas Company
Deefo 806-102	Ultra Adhesives, Inc.
Zopaque RLC-9	Glidden Div. SCM Corp.
Texanol	Eastman Chemical Products, Inc.
DC-14	Dow Corning Corp.

Because additives can affect the performance of coatings even after they have fully cured[2-5] salt spray and water immersion tests were also conducted.

MATERIALS AND METHODS

A white aqueous acrylic formulation was prepared by dispersing titanium dioxide with a high speed impeller in a portion of the acrylic vehicle, wetting agents, and defoamer, and let down with a solution containing more acrylic vehicle, coalescing solvents, a flow agent, and defoamer (see *Table* 1 for composition and formulation constants).

A 10% (w/w) solution of each chemical to be assayed for flash rust inhibition was prepared. The pH of each solution along with the solvent used for each of the chemicals evaluated is listed in *Table* 2. Samples of 0.5, 1.0, 1.5, and 2.0 g of each solution were weighed into polyethylene containers and transferred to individual 100 g portions of the white acrylic latex formulation under agitation by mechanical stirrer. Stirring was continued for five minutes.

Each coating was drawn down on a cold rolled steel (SAE 1010 low carbon, one quarter hard) panel using a 5 mil Bird applicator. For the flash rust test the panels were Q-Panel® Type R *(matte finish, ASTM D609-1B), and for the salt spray and water immersion tests the panels were Q-Panel Type QD (smooth finish, ASTM D609-3B).

For the flash rust test, the coated panels were conditioned for one hour in an enclosed hood at a relative humidity of 95% ± 3 and temperature of 76° F ± 4°, air dried at room temperature for 2 hr at 75° F and 45% relative humidity, then evaluated. The panels exposed to salt spray and water immersion were air dried at room temperature for a minimum of four weeks.

Water immersion testing was performed using aerated deionized water at a temperature of 100° F. Panels were evaluated for rusting and blistering after 120 hr immersion in accordance with ASTM D610 and D714. For salt spray testing, coated panels were scribed as in ASTM D1654, and tested as in ASTM B117. Overall rusting (ASTM D610) and blistering (ASTM D714) were evaluated, as well as rusting and blistering at the scribe (ASTM D1654) after 100 hr.

RESULTS AND DISCUSSION

The chemicals tested are listed in *Table* 2, along with the solvent used to prepare the solutions, and the solution pH. Measurement of the pH of the test paints after adding the solutions indicated the affect on final paint pH to be negligible.

The raw data indicate that some chemicals appear to promote flash rust, many appear to have no affect, and some improve the flash rust resistance of this coating. Because of the variations encountered with some of the effects and the difficulty in quantitatively interpreting the results, it was decided to discuss only those chemicals that made a significant improvement in the flash rust rating. Since the control generally rated 5 a significant improvement was considered a rating greater than 2 units above the control, i.e. a rating of 8 or better.

Table 3 lists the inorganic chemicals that showed superior flash rust performance.

All of the chromates and dichromates showed improved performance at the highest concentration. Ammonium chromate and dichromate, and sodium dichromate showed superior performance. They may perform even better at higher concentrations, but they have two drawbacks that must be considered: their tendency to yellow the film and their toxicity.

Sodium carbonate performs quite well as does sodium molybdate. However, their deleterious effect on the film's salt fog and water immersion resistance makes their use questionable.

Sodium nitrate, sodium nitrite, and potassium nitrite show excellent flash rust performance with only minor effect on salt fog and water immersion results. This group would appear to be the best of the inorganic salts tested.

Table 4 lists the organic nitrogen compounds that significantly improved the flash rust performance.

Tributylamine showed marginally improved flash rust resistance at the 0.1 and 0.15% levels and showed significant improvement at 0.2%.

The alkanol amines provided two candidates for flash rust improvement: N-aminoethylethanolamine (AEEA) and N,N-Dimethylethanolamine (DMEA). AEEA

* Flash rust testing was done initially on shot blasted (SSPC-SP, 5-63) panels. It was found that these panels used without shot blasting were equally sensitive to flash rusting. The acetates and inorganic salts were tested on shot blasted panels.

Q-Panel is a registered trademark of the Q-Panel Co.

Table 2—Chemicals Tested

Chemical	10% (wt) Solvent[a]	Solution pH	Trade Name
Ammonium Carbonate	W	8.9	
Potassium Carbonate	W	12.4	
Sodium Carbonate	W	12.2	
Ammonium Chloride	W	4.8	
Ammonium Chromate	W	7.8	
Potassium Chromate	W	9.9	
Sodium Chromate	W	9.7	
Ammonium Dichromate	W	3.9	
Potassium Dichromate	W	3.9	
Sodium Dichromate	W	3.4	
Ammonium Molybdate	W	7.4	
Potassium Molybdate	W	8.9	
Sodium Molybdate (dihydrate)	W	6.8	
Ammonium Nitrate	W	4.9	
Potassium Nitrate	W	7.0	
Sodium Nitrate	W	9.1	
Sodium Nitrate	W	9.4	
Ammonium Phosphate monobasic	W	4.0	
Ammonium Phosphate dibasic	W	8.4	
Potassium Phosphate monobasic	W	4.1	
Sodium Phosphate monobasic	W	4.0	
Ammonium Sulfate	W	5.5	
Potassium Sulfate	W	8.1	
Sodium Sulfate	W	8.2	
Potassium Tripoly-phosphate	W	8.3	
Sodium Benzoate/ Potassium Tripoly-phosphate 5.0% each	W	8.1	
Phosphate/Titanate	i-PA	6.8	Kenrich KR-55[d]
Phosphate/Titanate	i-PA	2.0	Kenrich KR-262[d]
Pyrophosphate/ Titanate	i-PA	2.7	Kenrich KR-238[d]
iso-Propylamine	W	13.0	
Oleylamine	i-PA	—	Adogen 172[k]
Tallowamine	EM/W	11.0	Adogen 170[k]
Diethylamine	W	12.8	
Di-iso-Propylamine	i-PA	11.1	
Di-n-Butylamine	i-PA	11.7	
Morpholine	W	11.9	
Triethylamine	W	12.2	
N-Methylmorpholine	W	10.5	
N-Ethylmorpholine	W	9.2	
Tributylamine	i-PA	9.6	
Ethylenediamine	W	12.5	
Diethylenetriamine	W	12.2	
Triethylenetetraamine	W	12.0	
Dimethylamino-pro propylamine	W	12.4	
Diethylaminopropyl-amine	W	12.4	
Ethanolamine	W	12.3	
N-Aminoethylethanol-amine	W	11.6	
2-Amino-2-ethyl-1-propanol	W	11.9	
Diethanolamine	W	11.3	
N-Methylethanolamine	W	12.1	
Triethanolamine	W	10.4	
N,N-Dimethylethanol-amine	W	11.5	
N,N-diethylethanol-amine	W	11.9	
N-Methyldiethanol-amine	W	10.8	
N,N-Diethylhydroxyl-amine	W	11.6	
2-Dimethylamino-2-methyl-1-propanol	W	12.2	
Lead Acetate	W	5.7	
Nickel Acetate	W	6.7	
Potassium Acetate	W	8.6	
Sodium Acetate	W	8.9	
Zinc Acetate	W	6.0	
Ammonium Benzoate	W	7.4	
Sodium Benzoate	W	8.2	
Lead Naphthanate	EB	7.1	Trokyd Lead[b] (24%)
Lead Naphthanate, WD	EB	7.2	Trokyd Lead[b] (24%)
Lead Octoate	EB	6.3	Trochem Lead[b] (24%)
Lead Neodecanoate	EB	6.7	Ten-Cem Lead[c] (24%)
Lead Tallate	EB	6.8	Lin-All Lead[c] (24%)
Lead Stearate, dibasic	EB/W	6.6	Hal-Lub[j]
Calcium Naphtha-nate, WD	EB	7.7	Troykyd Calcium[b] (4%)
Calcium Octoate	EB	7.6	Troychem Calcium[b] (5%)
Calcium Neodeconoate	EB	8.2	Ten-Cem Calcium[c] (5%)
Calcium Tallate	EB	7.5	Lin-All Calcium[c] (4%)
gamma-Aminopropyl-triethoxysilane	EB	10.5	Silane A-1100[e]
gamma-Mercaptopro-pyltrimethoxysilane	EB	9.9	Silane A-189[e]
gamma-Glycidoxypro-pyltrimethoxysilane	EB	4.3	Silane A-187[e]
Alkyl Imidazoline	W	10.4	Monateric 1000[f]
Oleate Imidazoline	i-PA	12.0	Monazoline O[f]
Tallate Imidazoline	W	11.8	Monazoline T[f]
iso-Stearate Imidazoline	i-PA	11.4	Monazoline IS[f]
"Modified" Imidazoline	i-PA	10.8	Monamulse CI[f]
1-Hydroxyethyl-2-oleyl Imidazoline	i-PA	10.4	Hodag C-100-0[g]
Aziridine, Poly-functional	W	8.7	CX-100[h]
2-Ethylhexylpoly-phosphoric ester acid anhydride	I-PA	1.5	Strodex MO-100[i]
Alkanolamide	W	9.7	Monalube 29-78[f]

(a) EB = Ethyleneglycolmonobutylether; i-PA = iso-Propanol; W = Water
EM = Ethyleneglycolmonomethylether
(b) Troy Chemical
(c) Mooney Chemicals
(d) Kenrich Petrochemicals
(e) Union Carbide
(f) Mona Industries
(g) Hodag Chemical
(h) Polyvinyl Chemical
(i) Dexter Chemical
(j) Halstab
(k) Ashland Chemicals

Table 3—Data Analysis[a]: Inorganic Salts.
Salts Which Give Significant Improvement in Flash Rusting Resistance (>2 unit improvement)

			Water Immersion				Salt Fog				
			Rusting		Blistering		Rusting		Blistering		
Salt	Level (%)	Flash Rust Rating	Rating	Qual. Effect[b]	Rating	Qual. Effect	Rating	Qual. Effect	Rating	Qual. Effect	Overall Qual. Effects
None	0	5	10	Control	F-8	Control	8/8	Control	F2/NE	Control	Control
Sodium Carbonate	0.10	8	2	—	MD-6-8	-	7/7	-	F2/NE	0	−4
	0.15	9	3	—	M-6	-	7/7	-	M2/NE	0	−4
	0.20	10	1	—	MD-8	-	8/7	0	NE/M2	0	−3
Ammonium Chromate	0.15	8	10	0	M-8	0	9/7	0	NE	0	0
	0.20	9	10	0	M-8	0	9/8	0	NE	0	0
Ammonium Dichromate	0.20	10	10	0	NE	0	9/8	0	NE	0	0
Sodium Dichromate	0.20	8	10	0	F-6	0	9/8	0	NE	0	0
Potassium Molybdate	0.10	8	10	0	M-8	0	8/7	0	M4/NE	0	0
	0.15	8	10	0	D-8	-	6/5	-	M2/NE	0	−2
	0.20	8	10	0	D-8	-	Fail	—	Fail	—	−5
Sodium Molybdate	0.20	8	10	0	D-8	-	7/7	-	MD-2/NE	-	−3
Potassium Nitrate	0.10	8	10	0	D-8	-	8/8	0	M6/NE	0	−1
	0.15	8	10	0	D-8	-	7/7	-	M4/NE	0	−2
	0.20	9	10	0	D-8	-	8/7	0	NE/MD-4	-	−2
Sodium Nitrate	0.05	10	10	0	F-8	0	9/7	0	NE/D-2	-	−1
	0.10	10	10	0	D-8	-	9/8	0	F-4/NE	0	−1
	0.20	10	10	0	D-8	-	8/7	0	F-4/NE	0	−1
Sodium Nitrite	0.05	8	10	0	M-8	0	8/8	0	F-2/NE	0	0
	0.10	8	10	0	F-8	0	9/7	0	NE/M-2	0	0
	0.15	10	10	0	D-8	-	9/8	0	NE/M-2	0	−1
	0.20	9	10	0	D-8	-	8/7	0	F-4/NE	0	−1
Pyrophosphate/Titanate	0.15	8	10	0	NE	0	9/8	0	F-4/M8	0	0
	0.20	9	10	0	NE	0	9/8	0	F-4/M8	0	0

(a) Flash rust, water immersion and salt fog resistance results were rated using ASTM D610: 10 = no rust. Blistering was rated using ASTM D714: F = few, M = medium, D = density, NE = none evident. The number signifies the blister size with 8 being the smallest and 2 the largest. Rust and blistering at the scribe were rated using ASTM D1654.
(b) For qualitative effect, 0 = same as control, + = improvement over control, - = worse than the control, — = much worse than the control. Overall Qualitative Effect is the sum of the +'s and −'s.

worked best at the lower concentrations. DMEA performed well at all concentration levels but had a drastic effect on the salt fog and water immersion performance at the higher levels.

The "alkyl" imidazoline was the only imidazoline that showed significant flash rust improvement. It also showed the best solubility in water. It gave only slightly inferior performance for salt spray.

The organic acid salts are listed in *Table* 5. The lead salts at high concentration are effective flash rust inhibitors. A minor effect on water immersion and salt fog performance is noted for lead octoate and lead stearate. Lead naphthanate, WD is a water dispersible version of lead naphthanate and out performs it, probably because of its better water solubility or dispersibility. The problem of lead toxicity and current laws regarding lead content must be considered in using the lead salts.

Table 4—Data Analysis[a]: Amines, Alkonolamines, Imidazolines.
Chemicals Which Give Significant Improvement Flash Rust Resistance (>2 unit improvement)

			Water Immersion				Salt Fog				
			Rusting		Blistering		Rusting		Blistering		
Chemical	Level (%)	Flash Rust Rating	Rating	Qual. Effect[b]	Rating	Qual. Effect	Rating	Qual. Effect	Rating	Qual. Effect	Overall Qual. Effect
None	0	5	10	Control	F-8	Control	8/8	Control	F2/NE	Control	Control
Tributylamine	0.20	8	10	0	NE	0	9/8	0	F4/NE	0	0
N-Aminoethyl-ethanolamine	0.05	9	10	0	F-8	0	8/7	0	F6/F8	0	0
	0.10	9	10	0	F-8	0	8/8	0	F4/F8	0	0
	0.15	8	10	0	F-8	0	7/7	0	F4/F8	0	0
N,N-Dimethyl-ethanolamine	0.05	8	10	0	NE	0	8/8	0	F6/F8	0	0
	0.10	8	10	0	M-8	-	8/8	0	F6/F8	0	−1
	0.15	8	5	—	D-6	-	8/8	0	F6/F8	0	−3
	0.20	9	4	—	D-6	-	8/8	0	F6/F8	0	−3
Alkyl Imidazoline	0.15	9	10	0	F-8	0	8/7	0	F6/F6	-	−1
	0.20	9	10	0	F-8	0	8/7	0	F6/F6	-	−1

(a) Flash rust, water immersion and salt fog resistance results were rated using ASTM D610: 10 = no rust. Blistering was rated using ASTM D714: F = few, M = medium, D = density, NE = none evident. The number signifies the blister size with 8 being the smallest and 2 the largest. Rust and blistering at the scribe were rated using ASTM D1654.
(b) For qualitative effect, 0 = same as control, + = improvement over control, - = worse than the control, — = much worse than the control. Overall Qualitative Effect is the sum of the +'s and −'s.

Table 5—Data Analysis[a]: Organic Acid Salts.
Salts Which Give Significant Improvement in Flash Rust Resistance (>2 unit improvement)

			Water Immersion				Salt Fog				
			Rusting		Blistering		Rusting		Blistering		
Salt	Level (%)	Flash Rust Rating	Rating	Qual. Effect[b]	Rating	Qual. Effect	Rating	Qual. Effect	Rating	Qual. Effect	Overall Qual. Effect
None	0	5	10	Control	F-8	Control	8/8	Control	F2/NE	Control	Control
Sodium Acetate	0.15	8	10	0	F-8	0	9/7	0	F2/NE	0	0
Ammonium Benzoate	0.10	8	10	8	F-8	0	7/6	-	M2/NE	0	−1
	0.15	8	10	0	NE	0	Fail	—	Fail	—	−4
	0.20	8	10	0	D-8	-	Fail	—	Fail	—	−5
Sodium Benzoate	0.05	8	10	0	M-8	0	8/7	0	M4/NE	0	0
	0.10	9	10	0	D-8	-	7/6	-	F4/NE	0	−2
	0.15	9	10	0	D-8	-	Fail	—	Fail	—	−5
	0.20	9	10	0	D-8	-	Fail	—	Fail	—	−5
Lead Naphthanate, WD	0.15	9	10	0	F-8	0	9/8	0	F2/NE	0	0
	0.20	9	10	0	NE	0	9/9	0	F2/NE	0	0
Lead Octoate	0.20	8	8	-	M-8	-	8/8	0	F2/F8	0	−2
Lead Stearate, dibasic	0.20	8	10	0	NE	0	6/6	-	F4/NE	0	−1
Calcium Octoate	0.15	8	10	0	F-8	0	9/8	0	F2/F8	0	0
	0.20	9	10	0	NE	0	9/8	0	F2/F8	0	0

(a) Flash rust, water immersion and salt fog resistance results were rated using ASTM D610: 10 = no rust. Blistering was rated using ASTM D714: F = few, M = medium, D = density, NE = none evident. The number signifies the blister size with 8 being the smallest and 2 the largest. Rust and blistering at the scribe were rated using ASTM D1654.
(b) For qualitative effect, 0 = same as control, + = improvement over control, - = worse than the control, — = much worse than the control. Overall Qualitative Effect is the sum of the +'s and −'s.

Calcium octoate appears to be quite effective at the higher concentration levels.

Sodium acetate shows good performance at the 0.15% level but was not effective at the other levels, and was especially poor for salt fog resistance. Sodium acetate should be used with caution, and should probably be carefully tested.

Ammonium benzoate and sodium benzoate are very effective at improving flash rust resistance; however, the film resistance to salt fog and water immersion falls off drastically with increasing levels. These materials should be used with careful attention paid to the effects of concentration. They may be effective in combination with other materials.

SUMMARY

The phenomenon of flash rusting with an aqueous coating on steel is a very real and objectionable phenomenon that can be reproduced in the laboratory under conditions of high humidity. Small amounts of certain chemicals to retard or eliminate flash rusting is demonstrated by the data given in *Tables* 3–5. Because of potentially bad side effects, notably the sensitization of the film to water and salt fog, care in selection and concentration must be taken in choosing a flash rust inhibitor.

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Feasibility of Using Alkoxysilane-Functional Monomers For the Development Of Crosslinkable Emulsions

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The feasibility of using alkoxysilane-functional monomers as a means of developing high integrity, crosslinkable emulsions was investigated. Using γ-methacryloxypropyltrimethoxysilane as the crosslinkable monomer, an evaluative survey was conducted in which the reaction conditions and ingredients used to effect emulsion polymerization were optimized in an effort to prevent excessive hydrolysis of the Si—O—C bond and to achieve emulsions with adequate colloidal stability. While the optimization study was successful in providing model emulsions with good colloidal stability, the reaction conditions obtained were not suitable for suppressing the hydrolysis–condensation reaction of the trimethoxysilane functionality. Thus, the resulting emulsions exhibited a considerable degree of premature crosslinking as indicated by the formation of an 87% acetone insoluble polymer.

To overcome the impasse associated with the facile hydrolysis of the Si—O—C bond, several vinyl-type monomers containing more sterically hindered alkoxysilane functionality were investigated. Using swelling ratio, percent insolubles, and intrinsic viscosity measurements to monitor the extent of crosslinking which occurred as a function of time, the various alkoxysilane substituents were found to resist hydrolysis according to the approximate order: trimethoxy ≃ dimethoxy < triethoxy < triisopropoxy ≪ diethoxy.

The diethoxy-functional emulsion displayed excellent resistance to premature crosslinking as indicated by an initial swelling ratio value of >100, an initial intrinsic viscosity of 1.29, a percent insolubility of 39.5, and by the ability to form highly coalesced films. In comparison with a 100% poly(ethyl acrylate) control, films of a 95/5-ethyl acrylate/γ-methacryloxypropylmethyldiethoxysilane copolymer emulsion demonstrated increased gloss, superior water resistance, a 6.5-fold increase in tensile strength, a 1.2-fold increase in elongation, and an 8.9-fold increase in solvent resistance.

INTRODUCTION

Advantages Associated With the Use of Alkoxysilane Compounds

Over the past decade, considerable attention has been given to the development of alkoxysilane-functional emulsions which yield self-crosslinkable coatings at low temperatures.[1] The growing interest in alkoxysilane-containing emulsions emanates, in part, from (a) the facile mode of crosslinking afforded by alkoxysilane groups, (b) the numerous beneficial effects resulting from the presence of silicone, and (c) the commercial availability of olefin-containing, trialkoxysilane monomers such as vinyltriethoxysilane (VTES) or gamma-methacryloxypropytrimethoxysilane (γ-MAPTMS).

While the primary role of the alkoxysilane moiety is to provide crosslinked segments at low temperatures, some of the secondary benefits associated with the use of either VTES or γ-MAPTMS have been greater abrasion resistance;[2-4] increased impact,[5,6] flexural,[7-9] tensile,[10,11] and shear strengths;[12,13] greater adhesion;[14-16]

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Table 1—Rate Constants and Activation Parameters For the Decomposition of $XCH_2CH_2Si(OR)_3$ at 25°C in water ($\mu = 0.1$ M)

Substituent X	Substituent R	$10^{-2}k_H$ (1 mole^{-1}s^{-1})	$10^{-3}k'_{OH}$ (1 mole^{-1}s^{-1})	$\Delta H^{\ddagger}_{OH}$ (kJ mole^{-1})	$\Delta S^{\ddagger}_{OH}$ (J mole^{-1}K^{-1})
Cl	Me 2	1.28	0 ± 8	−192 ± 30	
Cl	Et ..... —	0.0365	—	—	
Br	Me 1.2	1.35	0 ± 8	−192 ± 30	

and improved resistance to solvents,[17-19] water,[20-22] corrosion,[23] heat,[24,25] electrical stress,[26] and discoloration.[27] Much of the increased integrity provided by these siloxane derivatives arises from the formation of Si—O—Si crosslinks which result from the self-condensation of alkoxysilane groups.[28]

Crosslinking Reaction of Alkoxysilane Compounds

The mechanism by which alkoxysilane compounds self-condense has been examined in numerous studies over the past 30 years,[29-33] and the process is usually recognized as taking place through a two-step, hydrolysis-condensation reaction. A brief exposition of the possible mechanism and kinetics of the hydrolysis-condensation reaction is given in the following examples.

Under acidic or alkaline conditions, alkoxysilanes hydrolyze quite readily to yield a variety of cyclic and oligomeric products. However, by employing a suitable parent compound and reaction conditions, several silanol derivatives have been isolated and substantiated as the reactive intermediate in the hydrolysis process. For example, dimethylsilanediol was prepared in 65 to 78% yield by refluxing a mixture of 10 g of dimethyldimethoxysilane and 40 mL of distilled water for 10 minutes. While the resulting dimethylsilanediol was stable for several weeks in an evacuated glass tube at liquid nitrogen temperatures, the addition of trace amounts of hydrochloric acid, sodium hydroxide, sodium carbonate, sodium bicarbonate, or ammonia to a mixture of dimethylsilanediol in water resulted in the formation of polymeric oils.[34]

Besides the isolation of silanol intermediates, kinetic data are also available which provide some insight into the mechanism and variables associated with the hydrolysis of alkoxysilane compounds. For example, the rate constant for the hydrolysis of 2-chloroethyltrimethoxysilane has been found to vary considerably with changes in the pH of the hydrolyzing medium. The kinetic data ranged from approximately $k = 2 \times 10^{-3}$ min^{-1} at a pH of 3 to $k = 5.0 \times 10^{-1}$ min^{-1} at pH of 9 which suggests considerable variation in the mechanism of hydrolysis. Under alkaline conditions, the rate determining step presumably involved the formation of the silanetriol intermediate, i.e.,

$$(CH_3O)_3SiCH_2CH_2Cl \xrightarrow[\text{slow}]{k'_{OH}[OH]} (HO)_n(CH_3O)_{n-3}SiCH_2CH_2X \xrightarrow[\text{fast}]{} \text{products}$$

Table 2—Variation of the Rate Constants With Temperature for the Condensation Of Silicic Acid

Temperature (°C)	Initial Rate Constant $Kk_f \times 10^6$ in 1 m^{-1}s^{-1}
25	57 ± 6
30	38 ± 4
35	23 ± 3
40	38 ± 6
45	52 ± 7

The second-order rate constant, k'_{OH}, for the base hydrolysis of 2-chloroethyltrimethoxysilane was found to be 38 times faster than the rate constant for the base hydrolysis of 2-chloroethyltriethoxysilane which intimates that steric factors play a significant role in the rate of hydrolysis. The effects which certain steric factors have on the rate of hydrolysis for various alkoxysilane derivatives are presented in *Table* 1.

Under acidic conditions (pH of 3) the rates of hydrolysis of 2-chloroethyltrimethoxy- and 2-chloroethyltriethoxysilane were essentially identical. However, 2-bromoethyltrimethoxysilane was found to react approximately 13 times faster than the corresponding 2-chloroethyltrimethoxysilane. Moreover, the fourth mole of acid generated during the hydrolysis and decomposition of 2-chloroethyltrichlorosilane was liberated at the same rate as the acid liberated from the hydrolysis of the 2-chloroethyltrialkoxysilane derivatives. These findings support the conclusion that a common intermediate (2-halogenoethylsilanetriol) was formed during the hydrolysis step, i.e.,

$$(RO)_3SiCH_2CH_2X \xrightarrow{\text{fast}} (HO)_3SiCH_2CH_2X \xrightarrow{\text{slow}} \text{products}$$

Unfortunately, attempts to isolate the 2-halogenoethylsilanetriol were unsuccessful as extensive drying of the suspected intermediate yielded an insoluble powder.[35]

Thus, while the mechanism of alkoxysilane hydrolysis may vary in accord with the method of catalysis, the silanol derivative is generally accepted as being the most probable intermediate generated during the hydrolysis step. Once formed, the silanol intermediate is quite unstable and rapidly undergoes self-coupling to form the stable Si—O—Si bond. The kinetics of the silanol coupling reaction have been examined, and analogously with the hydrolysis step, the results indicate that the mechanism of the condensation step also varies with certain reaction variables. For example, under base catalysis the self-coupling reaction of (chloromethyl)-methylsilanediol has been found to follow third order kinetics, i.e.,

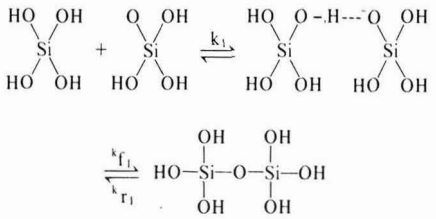
$$-\frac{d[SiOH]}{dt} = k_B[B][SiOH]^2$$

Using triethylamine as a catalyst, the self-coupling reaction seemed to be somewhat insensitive to the effects of steric hindrance but was enhanced by the presence of electron withdrawing groups. However, under acidic conditions the electron withdrawing and steric effects combined to cause a reduction in the rate of reaction.[36-38]

Similarly, under acidic conditions the self-coupling

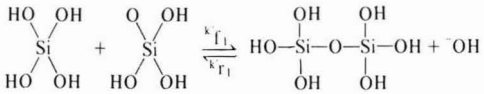
reaction of silicic acid, $Si(OH)_4$, was found to proceed according to third order kinetics[39,40] while under alkaline conditions the condensation reaction generally followed second order kinetics.[41-43] At a pH of 8.5, the rate of condensation of silicic acid varied considerably with the reaction temperature as shown in *Table* 2.

Arrhenius plots obtained from the previous kinetic data indicated the existence of a bimodal condensation process; one in the 25 to 35°C region with an activation energy of -16 ± 4 kcal/mole and the other in the 35 to 45°C region with an activation energy of 14 ± 4 kcal/mole. The reaction mechanism associated with the 25 to 35°C region (negative activation energy) involved the formation of a hydrogen-bonded intermediate which allowed the reactants to be held in close proximity so that formation of the silicon-oxygen bond could occur through the displacement of a hydroxyl group.



Since the ratio of singly ionized to unionized silicic acid, $[H_3SiO_4^-]/[H_4SiO_4]$, had been estimated to be 1.6/100 at a pH of 8 and 1.6/10 at a pH of 9, a sufficient concentration of both species was available at a pH of 8.5 to lend credence to the hydrogen-bonded ion mechanism.

In the 35 to 45°C region where the activation energy of the process was positive, the mechanism was conceived of occurring by simple thermal collision whereby the formation of the Si—O—Si bond occurred simply by displacement of a hydroxyl group or water.[44]



Thus, it is obvious from the preceding discussion that the crosslinking reaction of alkoxysilane derivatives is quite complex and is strongly influenced by such reaction variables as the nature of the substituents, the hydrolysis temperature, the pH of the medium, etc.

Limitations on the Use Of Alkoxysilane Compounds in Aqueous Systems

Since the Si—O—C bond of the alkoxysilane compound is readily hydrolyzed in an aqueous medium, preventative measures must be included in the experimental design of the project in order to suppress premature hydrolysis of the alkoxysilane functionality and to ensure attainment of the desired product. The ramification of using conventional emulsion techniques to polymerize such olefin-containing alkoxysilanes as VTES or γ-MAPTMS can be seen in the following example.

Table 3—Effects of pH on the Colloidal Stability Of the Incipient Emulsion

Polymer Composition EA/γ-MAPTMS	pH Adjustment	Percent Conversion
75/25	None	Coagulated
75/25	pH adjusted to 7 and allowed to cascade	Coagulated
75/25	pH maintained at 7	94.2
75/25	pH maintained at 9	Coagulated
87.5/12.5	None	Coagulated
87.5/12.5	pH adjusted to 7 and allowed to cascade	Coagulated
87.5/12.5	pH maintained at 7	93.8
87.5/12.5	pH maintained at 9	Coagulated

After several attempts to polymerize a 50/50-ethyl acrylate/VTES monomer mixture by means of conventional emulsion techniques, the conclusion was drawn that "the polymerization of vinylalkoxysilanes (through the vinyl unsaturation) in emulsion systems have not met with success. The presence of water results in hydrolysis-condensation reaction of the alkoxy groups which compete with any addition polymerization reaction of the vinyl groups. In all cases in which emulsion polymerization was carried out, only gel-like materials were obtained. Infrared analysis showed no diminution of the vinyl band intensity, thereby, indicating that the addition polymerization is very much slower than the hydrolysis and condensation reaction."[45]

Therefore, in view of the previous considerations, a feasibility study was conducted to examine means of suppressing the hydrolysis-condensation reaction of the alkoxysilane crosslinkable monomer. The approach involved an optimization of the more salient reaction variables associated with the polymerization process together with the utilization of more sterically hindered alkoxysilane-functional monomers.

EXPERIMENTAL

The following sample procedures were used to obtain the alkoxysilane monomers.

GAMMA-METHACRYLOXYPROPYLTRIMETHOXYSILANE: Gamma-methacryloxypropyltrimethoxysilane (γ-MAPTMS) was available commercially as silane adhesion promoter A-174 (Union Carbide).

GAMMA-METHACRYLOXYPROPYLTRIETHOXYSILANE: Gamma-methacryloxypropyltriethoxysilane (γ-MAPTES) was prepared using the transetherification process described by Reilly and Post.[46] Thus, 1.0 mole of γ-MAPTMS and 4.0 moles of ethanol were refluxed at 80°C for ten hours to yield 50.4% of γ-MAPTES. The monomer displayed a boiling point of 282°C at 760 mm and provided an elemental analysis of: theoretical percent C = 53.79, H = 8.96, Si = 9.66; actual percent C = 53.62, H = 8.92, Si = 9.76.

GAMMA-METHACRYLOXYPROPYLTRIISOPROPOXYSILANE: Gamma-methacryloxypropyltriisopropoxysilane (γ-MAPTIS) was prepared using a transetherifica-

Table 4—Effects of Various Surfactant Combinations in Providing Colloidally-Stable, Uncrosslinked Emulsions

Polymer Composition (EA/γ-MAPTMS)	Surfactants[a]	Theo. Solids (%)	Percent Conversion	% Acetone Insolubles After Aging the Emulsion for: 15 min at 80°C	1 Day at Ambient Temp.	3 Days at Ambient Temp.
87.5/12.5	X-200 L-77	37.5	95.9	76.3	73.4	74.3
87.5/12.5	X-200 L-77	50.0	96.7	84.1	80.3	84.5
75/25	X-200 L-77	37.5	97.5	—	—	—
75/25	X-200 L-77	50.0	92.4 (coagulated in 2 days)	—	—	—
87.5/12.5	X-200 L-7602	50.0	coagulated	—	—	—
87.5/12.5	X-200 L-7607	50.0	87.2	73.8	73.0	75.6
75/25	X-200 L-7607	50.0	93.2	81.4	78.3	83.6
87.5/12.5	X-200 L-720	50.0	59.2 (partially coagulated)	—	—	—
87.5/12.5	X-200 L-5410	50.0	59.2 (partially coagulated)	—	—	—
87.5/12.5	X-200 L-77	50.0	71.1	81.2	70.8	81.9
75/25	X-202 L-77	50.0	76.3 (coagulated in 5 days)	72.8	62.9	81.4
87.5/12.5	X-202 L-7602	50.0	55.8 (coagulated in 3 days)	54.6	49.4	58.9
87.5/12.5	X-202 L-7607	50.0	93.2	86.3	84.0	90.4
75/25	X-202 L-7607	50.0	90.4	85.7	82.0	87.1
87.5/12.5	X-202 L-720	50.0	61.4 (partially coagulated)	—	—	—
87.5/12.5	X-202 L-5410	50.0	62.1 (partially coagulated)	—	—	—

tion technique with isopropanol. Thus, 2.0 moles of γ-MAPTMS and 6.5 moles of isopropanol were refluxed in the presence of sodium metal for 12 hours to obtain a 30% yield of γ-MAPTIS. The experimental monomer displayed a boiling point of 135°C at 1.0 mm and provided an elemental analysis of: theoretical percent C = 57.83, H = 9.64, Si = 8.43; actual percent C = 57.79, H = 9.62, Si = 8.47.

GAMMA-METHACRYLOXYPROPYLTRIS-(2-METHOXYETHOXY)SILANE: Gamma-methacryloxypropyltris-(2-methoxyethoxy)silane (γ-MAPTMES) was available commercially as silane adhesion promoter A-175 (Union Carbide).

GAMMA-METHACRYLOXYPROPYLMETHYLDIMETHOXYSILANE: Gamma-methacryloxypropylmethyldimethoxysilane (γ-MAPMDMS) was available as an experimental monomer under the product code of Y-5647 (Union Carbide).

GAMMA-METHACRYLOXYPROPYLMETHYLDIETHOXYSILANE: Gamma-methacryloxypropylmethyldiethoxysilane (γ-MAPMDES) was prepared by reacting 1.0 mole of gamma-methacryloxypropylmethyldichlorosilane with 2.14 moles of ethanol in 1750 ml of hexane. Triethylamine (293 mL) was used as the reaction promoter and HCl acceptor. After heating to reflux for one hour together with an overnight gestation period, γ-MAPMDES was obtained in 40% yield; boiling point 106°C at 1.5 mm.

Preparation of the Alkoxysilane-functional Emulsions

While both thermal decomposition and redox methods were used as a means of initiation, the following sample procedure illustrates the general methodology used to prepare all the alkoxysilane-containing model emulsions.

REDOX INITIATION METHOD: A 500 mL, 4-neck flask was fitted with a stirrer, claissen adapter, thermometer, condenser, nitrogen inlet tube, and heating mantle. The apparatus was charged with 218.2 g of deionized water, and the contents were deoxygenated by heating to 95°C for five minutes while purging with nitrogen gas. After sparging, the deoxygenated water was cooled to room temperature, and 4%, based upon total weight of monomers, of a 75/25-anionic/nonionic blend of surfactants was added to the flask. The surfactant/water

Table 4—Effects of Various Surfactant Combinations in Providing Colloidally-Stable, Uncrosslinked Emulsions (continued)

Polymer Composition (EA/γ-MAPTMS)	Surfactants[a]	Theo. Solids (%)	Percent Conversion	% Acetone Insolubles After Aging the Emulsion for: 15 min at 80°C	1 Day at Ambient Temp.	3 Days at Ambient Temp.
87.5/12.5	X-301 L-77	50.0	91.8	76.8	66.9	87.0
75/25	X-301 L-77	50.0	91.3	80.0	77.1	97.0
87.5/12.5	X-301 L-7602	50.0	49.8 (partially coagulated)	—	—	—
87.5/12.5	X-301 L-7607	50.0	92.1	83.4	75.5	84.5
75/25	X-301 L-7607	50.0	89.3	90.3	86.0	93.9
87.5/12.5	X-301 L-720	50.0	(partially coagulated)	—	—	—
87.5/12.5	X-301 L-5410	50.0	(partially coagulated)	—	—	—
87.5/12.5	GR-7M L-77	50.0	coagulated	—	—	—
87.5/12.5	GR-7M L-7602	50.0	coagulated	—	—	—
87.5/12.5	GR-7M L-7607	50.0	coagulated	—	—	—
87.5/12.5	GR-7M L-720	50.0	coagulated	—	—	—
87.5/12.5	GR-7M L-5410	50.0	coagulated	—	—	—
87.5/12.5	RE-960 L-77	50.0	(partially coagulated)	—	—	—
87.5/12.5	RE-960 L-7602	50.0	(partially coagulated)	—	—	—
87.5/12.5	RE-960 L-7607	50.0	(partially coagulated)	—	—	—
87.5/12.5	RE-960 L-720	50.0	(partially coagulated)	—	—	—
87.5/12.5	RE-960 L-5410	50.0	(partially coagulated)	—	—	—

(a) X-200 = Triton X-200, X-202 = Triton X-202, X-301 = Triton X-301, GR-7M = Triton GR-7M, RE-960 = Gafac RE-960; L-77, L-7602, L-7607, L-720, L-5410 are product codes for Union Carbide's silicone-containing, nonionic surfactants.

mixture was stirred for five minutes, and 0.5%, based upon total weight of monomers, of n-dodecylmercaptan chain transfer agent was added to the agitated mixture. After stirring for five minutes, a 100 g monomer mixture consisting of conventional acrylates or methacrylates and the alkoxysilane monomer were added to the chain transfer agent/surfactant/water mixture. The resulting pre-emulsion was then initiated with a redox system consisting of 1 mL of a 0.15% aqueous solution of ferrous sulfate, 5 mL of a 5% aqueous solution of sodium metabisulfite, 5 mL of a 5% aqueous solution of ammonium persulfate, and 4 drops of t-butyl hydroperoxide. After initiation commenced, the reaction temperature was held at $37 \pm 2°C$ using external cooling while the pH was maintained at 7.0 ± 0.2 using ammonium hydroxide. After a three hour conversion period at 37°C, the resulting emulsion was cooled to ambient and filtered through cheese cloth.

Test Methods Employed In Characterization of the Emulsions

VISCOSITY-AVERAGE MOLECULAR WEIGHT: The viscosity-average molecular weight was determined using a Cannon-Fenske viscometer in accord with the procedure described by Collins, Bares, and Billmeyer.[47]

SWELLING RATIO DETERMINATIONS: Hydrodynamic swelling ratios were conducted on samples in latex form using the procedure outlined by Crews.[48] Swelling ratio represents the volume ratio of the solvent swollen polymer to unswollen polymer.

DEGREE OF INSOLUBILITY: The degree of insolubility was determined using refluxing acetone in a soxhlet extractor.

Test Procedures Used To Physically Characterize the Latex Films

Physical test determinations such as Sward rocker hardness, impact resistance, flexibility, adhesion, gloss, and solvent resistance were conducted according to standard procedures outlined in the *Paint Testing Manual*, 15 ed., G. G. Sward, ed., ASTM Technical Publication 500, 1972. Tensile strength and percent elongation were determined on an Instron 1130 tensile tester, using a crosshead speed of 2.0 cm/min.

Table 5—Effects of Various Anionic Surfactants In Providing Colloidally-Stable, Uncrosslinked Emulsions

Anionic Surfactant	Polymer Composition (EA/γ-MAPTMS)	Percent Conversion	% of Acetone Insolubles After Aging the Emulsions for: 15 min at 80°C	1 Day at Ambient Temp.	3 Days at Ambient Temp.
X-200	87.5/12.5	95.7	59.4	48.6	61.2
X-200	75/25	coagulated	—	—	—
X-202	87.5/12.5	92.8	75.8	70.4	71.1
X-202	75/25	89.2	81.1	70.6	75.0
X-301	87.5/12.5	91.7	76.2	72.8	74.9
X-301	75/25	coagulated	—	—	—
GR-7M	87.5/12.5	coagulated	—	—	—
RE-960	87.5/12.5	coagulated	—	—	—

DISCUSSION, RESULTS, AND CONCLUSIONS

Because of the marked tendency of alkoxysilane groups to hydrolyze in an aqueous environment, the preliminary investigations focused on optimizing those parameters of the emulsion system which aided in suppressing premature hydrolysis of the alkoxysilane functionality.

Effects of pH

Since strongly acidic or basic conditions as well as the presence of metal salts can markedly alter the rate of hydrolysis of alkoxysilane groups,[49,50] an interrogatory study was conducted to evaluate the effects which various pH ranges had on the stability of the resulting alkoxysilane-functional emulsions. The investigation involved monitoring the emulsion polymerization of a 75/25- or 87.5/12.5-ethyl acrylate (EA)/γ-MAPTMS monomer mixture while the pH of the medium was maintained at various conventional levels. A nonionic/anionic blend of surfactants was used consisting of 75% Triton® X-202 (a sodium alkylaryl polyether sulfonate) and 25% Union Carbide L-7607 (a silicon-containing nonionic surfactant). A portion of these results are presented in *Table* 3.

Allied with the trends established in other studies,[51] these data illustrate the somewhat dominant role which the optimum pH range assumes in controlling the colloidal stability of the emulsion. For example, polymerizations attempted without pH adjustment, under acidic conditions, or with the pH adjusted to 9.0 resulted in coagulation of the incipient latex, while polymerizations initiated at a pH of 7.0 developed sufficient colloidal stability to generate a free-flowing emulsion. Unfortunately, the degree of colloidal stability achieved at a pH of 7 was also marginal as the resulting emulsions generated greater than acceptable levels of coagulum and displayed inadequate shelf stability.

Determining the Optimum Surfactant Combination

The difficulties encountered in generating silicone-containing emulsions with acceptable colloidal stability have been noted in other studies involving the emulsion polymerization of olefin-containing siloxane monomers.[52] Conceivably in these emulsions, the normal degree of interaction between the constituents of the surfactant molecule and the particle surface may be vitiated by the low surface energy profile associated with the presence of silicone atoms. Under these circumstances the requisite particle to particle repulsive forces may fail to develop, and thermal collision of the particles can lead to agglomerate formation. Therefore, in order to develop emulsions with acceptable colloidal stability, an emulsifier study was conducted to determine the most effective surfactant combination for the emulsion polymerization of alkoxysilane-containing monomers. The experimental design of the emulsifier study included an evaluation of both nonionic and anionic surfactants. To gain some appreciation of the hydrophilic-lipophilic balance required in these systems, the anionic surfactants were selected as representing categories of different acid strengths, i.e., sulfonates (Triton X-200 and Triton X-202), sulfates (Triton X-301), sulfosuccinates (Triton GR-7M), and phosphoric acid esters (Gafac® RE-960) while the nonionic surfactants were all silicone-containing in order to promote a favorable interaction with the particle surface.

The polymerizations were conducted at a 75/25 and 87.5/12.5 weight ratio of EA/γ-MAPTMS, and 5% emulsifier, based upon total weight of monomer, was used at a ratio of 3 parts anionic to 1 part nonionic surfactant. All other reaction variables such as reaction time, amount and type of initiator and chain transfer agent, and pH were held constant. Each emulsion was

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Gafac is a registered trademark of GAF Corp.

Table 6—Determination of the Optimum Surfactant Concentration

Surf. Conc. (%)	Initiator System	RXN. Temp. (°C)	RXN. Time (hrs)	Percent Conversion	Shelf Stability [a]	Solvent Resistance [a] (Acetone)	Water Resistance [a]
3	Reflux	80	4	94.0	4	1	1
4	Reflux	80	4	94.5	3	2	2
5	Reflux	80	4	94.6	1	3	3
6	Reflux	80	4	94.5	1	4	4
3	Redox	70	1	94.1	3	1	1
4	Redox	70	1	94.0	1	2	2
5	Redox	70	1	93.3	1	3	3

(a) The ratings were based on a scale of 1 to 4 with 1 indicating good and 4 indicating poor.

prepared at 37.5% solids; and if the surfactant combination was successful, the procedure was repeated at 50% solids. The results of the surfactant evaluation are presented in *Table* 4.

In general, these data again illustrate the difficulty of generating alkoxysilane-containing emulsions with good stability. All attempts to employ silicone surfactants L-720, L-5410, and L-7602 were unsuccessful. In addition, the use of Triton GR-7M and Gafac RE-960 with surfactant L-77 or L-7607 also yielded unstable emulsions which coagulated before or soon after complete addition of the monomer feed.

In contrast with these results, the use of either Triton X-200, Triton X-202, or Triton X-301 in concert with surfactants L-77 or L-7607 provided stable emulsions at both 75/25- and 87.5/12.5-EA/γ-MAPTMS copolymer compositions. Films of these emulsions displayed good flow and coalescing properties but were prematurely crosslinked as indicated by extraction studies with acetone.

Since the propensity of alkoxysilane groups to hydrolyze may vary according to the magnitude of the ionic character of the surfactant, a subsequent study was conducted to determine the role played by each anionic surfactant in producing stable, gel-free emulsions. The results of this evaluation are presented in *Table* 5.

In general, the trends established in the nonionic/anionic surfactant study were again prevalent in the anionic surfactant study in that the use of sulfosuccinate or phosphoric acid ester emulsifiers yielded unstable emulsions which coagulated during addition of the monomer. Furthermore, the use of sulfate- or sulfonate-functional surfactants as the sole emulsifying agents yielded stable emulsions which were prematurely crosslinked. While emulsions prepared with Triton X-200 displayed the lowest degree of premature crosslinking, those prepared with Triton X-202 possessed the greatest colloidal stability as indicated by the formation of stable emulsions at higher concentrations of alkoxysilane monomer and by yielding emulsions with a longer shelf-life before coagulation. Presumably, the enhanced stability afforded by Triton X-202 may reflect a synergistic interaction between certain constituents of the surfactant molecule and an alkoxysilane-enriched particle surface. Triton X-202 possesses a lower ethylene oxide content than that of Triton X-200 and, therefore, displays a greater attraction for lipophilic systems.

While stable emulsions could be generated using anionic surfactants as the sole emulsifying agent, greater stability (i.e., longer shelf-life before coagulation) was achieved using the nonionic/anionic blend of surfactants. Therefore, all subsequent studies employed a 3/1 ratio of Triton X-202/surfactant L-7607 to effect polymerization of the model emulsions.

Optimization of the Surfactant Concentration

While the choice of surfactants is recognized as being a principal factor which governs the degree of stability achieved during the formation of the incipient latex, such parameters as surfactant concentration, particle size, and particle size distribution are also considered to be primary determinants which influence the physical characteristics of colloidal systems. For example, latex particle size has been found to directly affect such physical characteristics as colloidal stability, viscosity, rheology (flow and leveling), drying time, vapor transmission rate (in films), gloss, and tensile strength. Similarly, the concentration of surfactant use in the polymerization process greatly alters such properties as the rate of polymerization, particle size (and the effects associated with it), coalescing ability, adhesion, and water resistance of the resulting product.

Therefore, in order to establish the proper concentration of surfactant which would provide an optimal balance of properties, a ladder study was conducted whereby the total emulsifier concentration used to effect polymerization was varied in increments of 1% from 3% to 6%, based on weight of total monomer. The resulting emulsions were evaluated in terms of percent conversion, shelf stability, and water and solvent resistance of the films. The results are presented in *Table* 6.

In general, these data support the expected trend that an increase in surfactant concentration engenders a decrease in solvent and water resistance and an increase in shelf-life (colloidal stability). Therefore, to achieve a balance in these diametrically opposed properties, the 5% surfactant concentration, based on weight of monomer, was selected as the optimum for the reflux polymerization method while 4% surfactant concentration was chosen as the optimum for the redox initiation technique.

Table 7—Determination of the Optimum Polymerization Temperature[a]

Reaction Temp. (°C)	Reaction Duration (hrs)	Percent Conversion	% Acetone Insolubles After Aging the Emulsion for: 15 min at 80°C	1 Day at Ambient Temp.	3 Days at Ambient Temp.
50	5.0	11.8	0.0	0.0	0.0
50	18.0	29.5	42.6	40.8	41.6
60	5.0	59.8	60.0	55.5	59.2
60	10.0	88.6	75.0	61.1	68.9
70	5.0	84.1	74.2	68.6	71.1
80	4.0	89.4	81.8	78.9	80.1
80	5.0	94.2	87.0	82.0	85.7
90	4.0	96.7	89.8	86.4	88.5

(a) All emulsions were prepared at 50% solids using a 75/25-EA/γ-MAPTMS monomer feed in combination with the reflux method.

Optimization of the Polymerization Temperature

Since the temperature used to effect polymerization has a profound effect on such reaction variables as the rate of polymerization, the molecular weight of the polymer, the critical micelle concentration of the surfactant, particle size and latex stability, and, more importantly, the tendency of the alkoxysilane functionality to undergo premature crosslinking; an optimization study was conducted whereby the polymerization temperature was varied in increments of 10°C over the range of 50°C to 90°C. The suitability of a specific reaction temperature was determined as a function of percent conversion and degree of premature crosslinking. The results of the study are presented in *Table* 7.

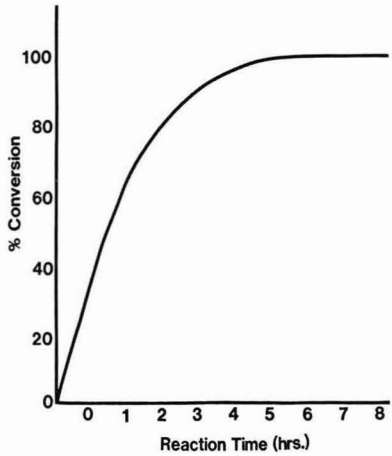

Figure 1—Conversion with reaction time study

As anticipated, the percent conversion and degree of premature crosslinking increased with increasing reaction temperature. Since obtaining a high degree of conversion was paramount for achieving monomer-free, model emulsions, the 80°C reaction temperature was selected for use in subsequent evaluations in spite of the relatively high degree of premature crosslinking which took place under those conditions.

Because the use of unnecessarily long polymerization times at high temperatures would lead to further loss of alkoxysilane functionality, the optimum gestation period at 80°C was determined to achieve an acceptable balance between percent conversion to polymer and the degree of premature crosslinking. Based upon the results presented in *Figure* 1, a four-hour reaction period was selected as a reasonable compromise between adequate percent conversion and excessive premature crosslinking.

Environmental Conditions of the Emulsion Which Influence Crosslinking

While the previous optimization study was successful in developing an alkoxysilane-functional emulsion with acceptable colloidal stability, the implacability of the hydrolysis-condensation reaction continued to be the principal impasse preventing the development of a viable system. In light of this situation, emphasis was now directed at implementing those preventative measures which would aid in suppressing the hydrolysis reaction of the alkoxysilane functionality. While numerous studies have documented the detrimental effects associated with the presence of water,[53-55] less attention has been given to the role played by the other constituents of the emulsion system (i.e., surfactants, buffer, initiator, type of monomer, etc.) in promoting the hydrolysis reaction. Therefore, to ascertain the nature of the relationship between the hydrolysis-condensation reaction of alkoxysilane groups and the constituents used in the emulsion system to effect polymerization, a model compound hydrolysis study was conducted which monitored the self-coupling tendency of methyltrimethoxysilane as a function of the additives used to effect emulsion polymerization. The hydrolysis study was conducted under simulated emulsion reaction conditions and ideally involved a step-wise deletion of each ingredient (acrylate monomer, initiator, buffer, surfactant, etc.) from the reaction medium until only a binary mixture of methyltrimethoxysilane in water remained.

Qualitatively, the results of this study indicated that the hydrolysis-condensation reaction was accelerated

Table 8—Effectiveness of Various Alkoxysilane Derivatives to Suppress the Hydrolysis-Condensation Reaction

Alkoxysilane Constituent	% Acetone Insolubles				Swelling Ratio	
	2.5% Alkoxysilane Monomer		5% Alkoxysilane Monomer		2.5% Alkoxysilane Monomer	5% Alkoxysilane Monomer
	Calc.[a]	Actual	Calc.[a]	Actual		
Emulsions Prepared Under Reflux Conditions						
Trimethoxy	—	58.3	—	83.4	31.3	27.4
Triethoxy	49.8	33.1	71.3	51.8	≃100	65.6
Triisopropoxy	43.5	28.9	62.3	47.3	≃100	75.0
Tris-(methoxyethoxy)	39.2	63.1	55.9	73.8	18.5	11.6
Dimethoxy	41.5	46.9	59.4	60.9	60.8	39.9
Diethoxy	38.7	19.1	55.3	39.5	>100	>100
Emulsions Prepared Under Redox Conditions						
Trimethoxy		54.6		85.3	50.8	25.4
Triethoxy		52.8		69.5	59.8	45.1
Triisopropoxy		49.9		66.0	59.2	40.7
Dimethoxy		63.1		80.3	50.2	28.9
Diethoxy		41.4		63.6	≃100	60.1

(a) The calculated acetone insolubles were determined using the following format.

(1) Weight percentages of crosslinkable monomer were converted into milliequivalents of crosslinkable monomer per 100 g of resin. For example, for the 5% by weight level of comonomer, 100 g of resin would contain 60.5 meq. of MAPTMS (eq. wt. of 82.7 g. eq.) while the same weight of resin would contain 51.7 meq. of MAPTES (eq. wt. of 96.7 g. eq.).

(2) The calculated percentages of acetone insoluble material are obtained by multiplying the actual percent of acetone insolubles for a control (MAPTMS) by the ratio of milliequivalents of functional monomers present. For example, to forecast the percentage of insolubles for MAPTES involves the following: 51.7 meq. MAPTES 60.5 meq. MAPTMS × 83.4% insolubles for MAPTMS = 71.3% insolubles for MAPTES.

by an increase in the reaction temperature, an increase in the acidity of the medium, and by the presence of surfactant and initiator. For example, when a water/methyltrimethoxysilane mixture was subjected to simulated emulsion reflux conditions, approximately 7% of the alkoxysilane model compound was converted to crosslinked product after four hours at 80°C. However, when a water/methyltrimethoxysilane/surfactant combination was subjected to the same conditions, approximately 50% of the model compound was converted to crosslinked product. Furthermore, treatment of a water/γ-MAPTMS/ethyl acrylate/surfactant mixture to the emulsion reflux conditions resulted in an approximate 28% loss of the alkoxysilane monomer to the hydrolysis-condensation reaction. In light of these circumstances, attention was now directed at developing alternative and more effective means of suppressing the hydrolysis-condensation reaction.

Use of Alkoxysilane Substituents With Greater Hydrolytic Stability

To overcome the impasse associated with the facile hydrolysis of methoxysilane groups, the use of vinyl-type monomers containing more sterically hindered alkoxysilane functionality was investigated as a means of suppressing the hydrolysis-condensation reaction. The vinylsiloxane monomers chosen for this purpose included gamma-methacryloxypropyltriethoxysilane (γ-MAPTES), gamma-methacryloxypropyltriisopropoxysilane (γ-MAPTIS), gamma-methacryloxypropyltris-(2-methoxyethoxy)silane (γ-MAPTMES), gamma-methacryloxypropylmethyldimethoxysilane (γ-MAPMDMS), and gamma-methacryloxypropylmethyldiethoxysilane (γ-MAPMDES). Regrettably, attempts at preparing gamma-methacryloxypropyltri(t-butoxy)-silane were unsuccessful.

The various alkoxysilane monomers were copolymerized with ethyl acrylate at the 2.5% and 5% by weight levels, and the conditions used to effect polymerization were those derived from the previous optimization studies. Both reflux (four hours at 80°C) and redox (three hours at 37°C) modes of initiation were employed. The results of the study are presented in *Table* 8.

As anticipated, these data indicate that the tendency towards premature crosslinking can be greatly reduced through the use of substituents which provide greater steric hindrance to hydrolysis. A comparison of the results obtained with the trimethoxy/triethoxy/triisopropoxy series indicates that as the size of the substituent increased, the degree of premature crosslinking decreased. Considering the 95/5-EA/trialkoxysilane copolymer emulsion prepared under reflux conditions, the use of the triisopropoxysilane monomer in place of the trimethoxysilane monomer resulted in a 43% decrease in acetone insolubles and an 174% increase in the value of the swelling ratio which indicates a substantial decrease in the degree of premature crosslinking. Ostensibly, the increase in van der Waal's radius associated with the larger alkoxy group aided in sterically shielding the Si—O—C bond from hydrolysis by water molecules.

The importance of the steric effect in controlling the rate of hydrolysis can be further demonstrated by comparing the differences obtained between the calculated and actual insolubles values. For example, good agreement exists between the calculated and actual percentages of acetone insolubles if the substituent remains the same but the number of functional groups decreases. For the trimethoxy and dimethoxy functional emulsions, the calculated values of 41.5% and 59.4% agree well with the actual values of 46.9% and 60.9% for the emulsions containing 2.5% and 5% alkoxysilane monomer, respectively. Moreover, values of 0.775 and 0.763 were obtained for the diethoxy/triethoxy ratio using the calculated and actual percent insolubles, respectively, at the 5 weight percent level of alkoxysilane monomer.

In contrast with these results when the size of the alkoxy substituent was varied as in a homologous series, little agreement was found between the calculated and actual insolubles values. For the triethoxy and triisopropoxy substituents, the actual percent insolubles was much lower than the calculated value which would indicate that a steric effect was operative. For the emulsion containing the tris(methoxyethoxy) substituent, the above relationship between the calculated and actual percent insolubles was reversed, again indicating that the crosslinking reaction was governed in part by steric effects.

Table 9—Aging Characteristics of Various Alkoxysilane Groups in the Emulsion Environment

Alkoxysilane Constituent	Swelling Ratio		
	Initial	After 30 Days	After 90 Days
Trimethoxy	27.4	10.4	2.5
Triethoxy	65.6	30.0	6.0
Triisopropoxy	75.0	28.0	6.0
Dimethoxy	39.9	4.7	3.0
Diethoxy	166.4	110.0	45.0

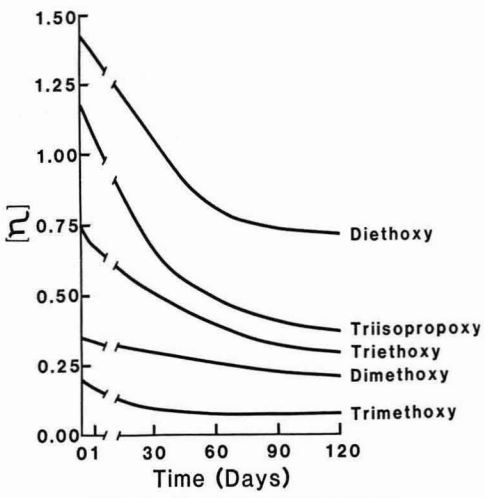

Figure 2—Change in intrinsic viscosities

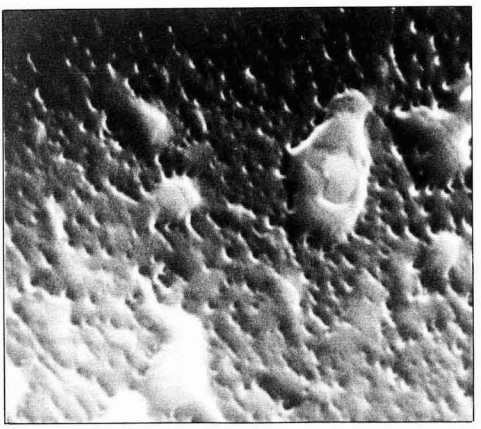

Figure 3—SEM micrograph for gamma-methacryloxypropyltrimethoxysilane. Emulsion cure time: one month; magnification: 10,000; and ratio of EA/Silane: 95:5

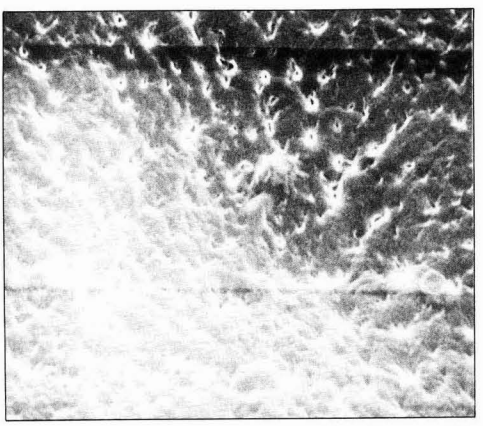

Figure 4—SEM micrograph for gamma-methacryloxypropyltrimethoxysilane. Emulsion cure time: 24 months; magnification: 10,000; and ratio of EA/Silane: 75:25

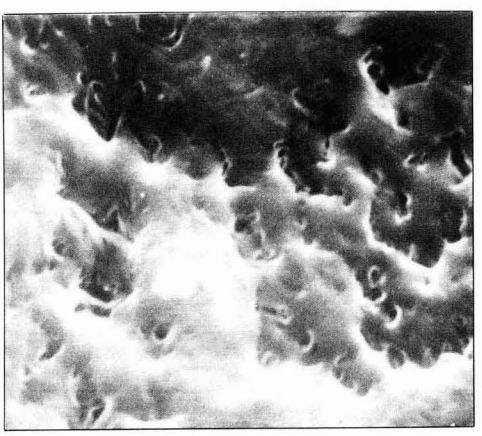

Figure 5—SEM micrograph for gamma-methacryloxypropyltriethoxysilane. Emulsion cure time: eight months; magnification: 10,000; and ratio of EA/Silane: 95:5

While utilization of more sterically-hindered alkoxy groups considerably improved the hydrolytic stability of the resulting emulsions, these data also indicated that the degree of premature crosslinking could be further reduced by decreasing the number of alkoxy groups attached to the silane moiety. For example, in the reflux-initiated, 95/5-EA/alkoxysilane copolymer emulsion, utilizing the diethoxysilane monomer in place of the triethoxysilane monomer resulted in a 24% decrease in acetone isolubles and a 52% increase in swelling ratio value. Additionally, the emulsion containing the diethoxysilane functionality displayed the lowest degree of premature crosslinking as indicated by a swelling ratio value of > 100 and by 39.5% acetone insolubles.

Based upon the data presented in *Table* 8, the tendency towards premature crosslinking among the various alkoxysilane derivatives decreased according to the order: trimethoxy > tris(methoxyethoxy) > dimethoxy > triethoxy > triisopropoxy > diethoxy. Unexpectedly, the emulsion prepared at 80°C (reflux method) displayed less premature crosslinking than those prepared using the redox method at 37°C.

Aging Characteristics As a Function of the Alkoxysilane Group

Since the development of a viable emulsion was predicated on the ability of the alkoxysilane groups to resist hydrolysis during normal aging as well as during the polymerization process, the various alkoxysilane-containing latexes were evaluated in a long term stability test which monitored the extent of premature crosslinking as a function of time. The aging tests were conducted on the 95/5-EA/alkoxysilane copolymer emulsions, and the degree of crosslinking was followed using swelling ratios, intrinsic viscosity, scanning electron microscopy, and film characterization techniques. *Table* 9 illustrates a portion of the data obtained from the swelling ratio determinations.

In general, these data indicate that while the extent of premature crosslinking can be considerably suppressed through the proper choice of alkoxysilane functionality, the hydrolysis-condensation reaction still proceeds at a finite rate and eventually transforms the uncrosslinked matrix into a highly crosslinked network. Again, the ability of the various alkoxysilane groups to resist hydrolysis increased according to the approximate order: trimethoxy $\simeq$ dimethoxy $<$ triethoxy $\simeq$ triisopropoxy $\ll$ diethoxy. The diethoxysilane-functional emulsion displayed excellent resistance to premature crosslinking as indicated by a swelling ratio value of 45 after aging for 90 days which considerably exceeds the initial swelling ratio value of 27.4 for the trimethoxysilane-functional emulsion.

Since the hydrodynamic volume of the polymer coil decreases upon the formation of a network structure, intrinsic viscosity measurements on solutions of the isolated polymer are also useful as a means of monitoring the aging characteristics of alkoxysilane-functional emulsions.[56,57] The effectiveness of the various alkoxysilane derivatives to resist premature crosslinking is graphically illustrated by the results presented in *Figure* 2.

As expected, these data indicate that as the hydrolysis-condensation reaction progressed the intrinsic viscosity of the alkoxysilane-containing resin decreased. In general, the trends established through the insolubility and swelling ratio determinations were again corroborated by the intrinsic viscosity measurements. For example, the ability of the various alkoxysilane functionality to resist hydrolysis increased according to the approximate order: trimethoxy < dimethoxy < triethoxy < triisopropoxy < diethoxy. The emulsions containing the diethoxysilane functionality were again preeminent in resisting premature crosslinking. After 90 days of aging, the polymer containing the diethoxysilane functionality displayed an intrinsic viscosity of 0.69 dL/g while the polymer containing the trimethoxysilane functionality demonstrated an initial intrinsic viscosity of only 0.18 dL/g and an intrinsic viscosity of 0.08 dL/g after aging for 90 days. The order of stability among the various alkoxysilane derivatives has also been supported by the findings established in other studies which investigated the propensity of various alkoxysilanes to form silanols.[58]

Since the formation of a crosslinked network greatly reduces the degree of flow and deformation available for film coalescence, the capacity of the various alkoxysilane derivatives to resist premature crosslinking was also expected to be apparent in the surface topography of films from these systems. To visually characterize the effects which the various alkoxysilane derivatives had on the coalescing ability of the emulsion particles, scanning electron micrographs were taken on films of the emulsions after various aging times and at varying concentrations of crosslinkable monomer. A portion of these results are illustrated in *Figures* 3–8.

Visual comparison of the surface topography indicated that as the concentration of alkoxysilane monomer and aging times increased, the degree of film coalescence decreased as judged by the existence of remnant particle contours and open surface pores. The coalescing ability of the various alkoxysilane-functional emulsions increased according to the approximate order: trimethoxy < dimethoxy < triethoxy < triisopropoxy < diethoxy which agrees with the order of crosslinking obtained through swelling ratio and intrinsic viscosity measurements. Again, the emulsions containing the diethoxysilane monomer were found to develop preeminent characteristics as compared to the emulsions prepared with the other alkoxysilane monomers. Emulsions containing γ-MAPMDES displayed an inordinate degree of film coalescence as indicated by the virtual lack of remnant particle contours and surface pores.

Since the hydrolysis reaction of the alkoxysilane group markedly affects both the film coalescing ability and the polymer microstructure, the bulk properties of these systems were also expected to vary in accord with the premature crosslinking tendencies of the various alkoxysilane derivatives. Therefore, to determine the ability of the various alkoxysilane derivatives to provide optimal coatings properties, a battery of conventional physical tests was conducted on films of the alkoxysilane-functional emulsions. The results of this testing are presented in *Table* 10.

Even though the plasticizing effect which develops at higher concentrations of ethyl acrylate somewhat over-

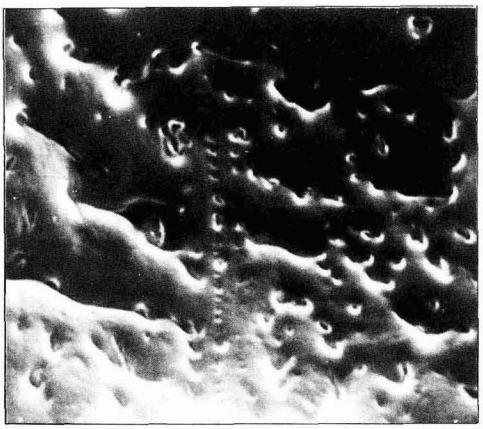

Figure 6—SEM micrograph for gamma-methacryloxypropyltriisopropoxysilane. Emulsion cure time: one month; magnification: 10,000; and ratio of EA/Silane: 95:5

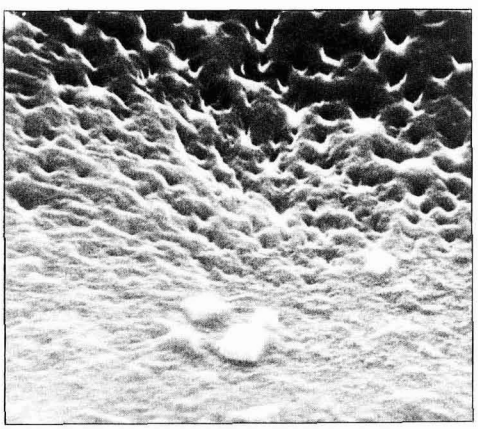

Figure 7—SEM micrograph for gamma-methacryloxypropylmethyldimethoxysilane. Emulsion cure time: 15 months; magnification: 10,000; and ratio of EA/Silane: 95:5

Figure 8—SEM micrograph for gamma-methacryloxypropylmethyldiethoxysilane. Emulsion cure time: one month; magnification: 10,000; and ratio of EA/Silane: 95:5

Table 10—Physical Properties of Coatings Derived from Various Alkoxysilane-Functional Emulsions

Polymer Comp.	100% EA	95/5 EA/γ-MAPTMS	95/5 EA/γ-MAPMDMS	95/5 EA/γ-MAPTES	95/5 EA/γ-MAPTIS	95/5 EA/γ-MAPTMES	95/5 EA/γ-MAPMDES
Emulsion aging time	3 days	7 days	8 days	10 days	16 days	16 days	6 days
Film drying time	21 days	21 days	21 days	21 days	21 days	21 days	21 days
Coating thickness (mils)	1.5	1.5	1.5	1.4	1.5	1.4	1.5
60° Gloss (%)	80	88	84	87	87	87	86
Hardness							
Sward	2	4	4	4	2	6	4
Pencil	>6B	5B	5B	5B	5B	4B	6B
Adhesion (%)	100	100	100	—	100	100	100
Mandrel flexibility	pass ⅛"	pass ⅛"	pass ⅛"	pass ⅛"	pass ⅛"	pass ⅛"	pass ⅛"
Impact resistance							
Forward (in.-lb)	140	140	140	140	140	140	140
Reverse (in.-lb)	140	140	140	140	140	140	140
Tensile Strength (kg/cm^2)	2.3	16.2	18.8	9.0	8.8	8.4	15.7
Elongation (%)	800	504	200	495	650	85	980
Water blush time (min)	4.5	>15	>15	>15	>15	>15	>15
MEK double rubs/mil	10	180	110	120	105	100	89

shadows the more subtle effects associated with the chemical nature of the various alkoxysilane comonomers (or disparities which exist in the microstructure of the crosslinked polymer), the following conclusions reflect some of the more qualitative aspects arising from the presence of the alkoxysilane monomer.

(1) All copolymer compositions containing the various alkoxysilane comonomers tended to display increased film gloss which indicated that good compatibility was achieved among the various copolymer species. Unfortunately, surface gloss measurements did not provide insight into differences which exist among the various alkoxysilane derivatives.

(2) In comparison with films of the uncrosslinked control emulsion, [100% poly(ethyl acrylate)], coatings containing the various alkoxysilane derivatives displayed between a 3.6- to 7.8-fold increase in tensile strength upon formation of a network structure. Interestingly, coatings containing the trimethoxysilane monomer developed greater tensile strength than those containing the diethoxysilane monomer, in spite of the latter's ability to achieve a greater degree of film coalescence. The capacity to develop higher tensile strength films at lower degrees of coalescence indicates that the methoxysilane functionality achieves a higher degree of crosslinking as compared to the diethoxysilane functionality. Unfortunately, since in these systems the external stress involved in overcoming the internal cohesive forces is a function of both the crosslink density and the degree of film coalescence, the use of tensile strength data to establish an order of effectiveness among the various alkoxysilane derivatives meets with limited success as illustrated by the somewhat anomalous behavior of the samples containing triethoxysilane and triisopropoxysilane comonomers.

The use of thermal conditioning treatments to increase the degree of film coalescence were also ineffectual. For example, coatings of a 95/5-EA/γ-MAPTMS copolymer emulsion displayed a 38% loss in tensile strength by postheating the samples for one hour at 80°C. While thermal treatment presumably promotes an increase in the degree of coalescence and crosslinking, several studies have reported instances where at low levels of crosslinking the tensile strength goes through a pronounced maximum and subsequently decreases rapidly as the degree of crosslinking increases. This response was attributed, in part, to a heterogenity in the spacings between crosslinks which placed most of the stress on a small proportion of the network chains.[59] Also, in view of the inordinately high level of premature crosslinking attained by these systems, attempts to increase the degree of film coalescence through thermal treatment may be inane.

(3) As anticipated, the percent elongation decreased as the extent of crosslinking increased. In comparison with films of the uncrosslinked control [100% poly(ethyl acrylate)], the various alkoxysilane comonomers engendered a decrease in elongation, ranging from 16.7% for triisopropoxysilane- to 61.5% for dimethoxysilane-functional copolymers. Surprisingly, films containing the diethoxysilane comonomer displayed an increase in elongation as compared to the control. This latter response suggests that in spite of the formation of a crosslinked network, the diethoxysilane comonomer imparted increased flexibility and/or coalescing ability to the system.

(4) In comparison with films of the control, the presence of the silicone derivative greatly increased the water resistance of the coatings. However, no marked differences were discernable in the resistance abilities provided by the various alkoxysilane derivatives.

(5) As expected, the formation of a network structure greatly increased the solvent resistance of the latex coatings. In comparison with the control, films containing the various alkoxysilane monomers displayed increased solvent resistance ranging from 9-fold for the diethoxysilane moiety to 18-fold for the trimethoxysilane moiety. The excellent solvent resistance demonstrated by the latter derivative reflects the capacity of the trimethoxysilane moiety to achieve a high degree of crosslinking. When the alkoxysilane-containing emulsions were aged

for periods greater than one month, the solvent resistance of the resulting coatings decreased presumably because of the discontinuous nature of the incompletely coalesced coatings.

Based upon the overall performance achieved in the above evaluations, together with the capacity to markedly reduce the occurrence of the hydrolysis-condensation reaction, γ-MAPMDES was chosen as representing the most suitable candidate among the various alkoxysilane-containing monomers tested for producing model, crosslinkable emulsions. Crosslink density determinations performed as a function of time on the 95/5-EA/γ-MAPMDES copolymer emulsions indicated that even though the hydrolysis-condensation reaction proceeded at a finite rate, the suspended latex particles developed only a slight degree of premature crosslinking after aging for 90 days at ambient conditions.

Therefore, because of the inability to prevent the time-dependent and implacable hydrolysis of the C—O—Si bond in an aqueous environment, the use of conventional alkoxysilane monomers such as γ-MAPMDES is limited mainly to applications requiring precrosslinked emulsion systems.[60] However, if alkoxysilane-functional emulsions are to achieve the more ubiquitous status sought by industry for an advanced-generation system, then hydrolysis-resistant monomers or aqueous barrier techniques must be developed which prevent the premature crosslinking of the alkoxysilane moiety.

PROJECT OVERVIEW

In summary, a feasibility study was conducted which investigated the acceptability of using alkoxysilane-functional monomers as a means of developing crosslinkable emulsions. γ-methacryloxypropyltrimethoxysilane was used in an evaluative study whereby several reaction variables were optimized in order to prevent excessive hydrolysis of the Si—O—C bond and to obtain emulsions possessing the requisite colloidal stability. The optimization study was successful in achieving alkoxysilane-functional emulsions with good colloidal stability; however, the model emulsions possessed an unacceptable degree of premature crosslinking as indicated by the formation of an 87% acetone insoluble polymer.

Thus, to provide crosslinkable functionality with greater resistance to hydrolysis, several vinyl-type monomers containing more sterically hindered alkoxysilane groups were investigated. By monitoring the degree of premature crosslinking which occurred as a function of time, the ability of the various alkoxysilane groups to resist hydrolysis was found to follow the approximate order: trimethoxy ≃ dimethoxy < triethoxy ≃ triisopropoxy ≪ diethoxy.

The emulsion containing the diethoxy functionality displayed excellent resistance to premature crosslinking as indicated by an initial swelling ratio value of >100, an initial intrinsic viscosity of 1.29, a percent insolubility of 39.5, and by the ability to form highly coalesced films. In comparison with 100% poly(ethyl acrylate) control, coatings of a 95/5-ethyl acrylate/γ-methacryloxypropylmethyldiethoxysilane copolymer emulsion demonstrated increased gloss, superior water resistance, a 6.5-fold increase in tensile strength, a 1.2-fold increase in elongation, and an 8.9-fold increase in solvent resistance.

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ERRATA

Figures 1 and 3 of the article, "Melanin Biosynthesis in *Aureobasidium pullulans*," by Dr. Donald J. Siehr (October 1981, pp 23–25) were in error.

The correct *Figures* are shown below.

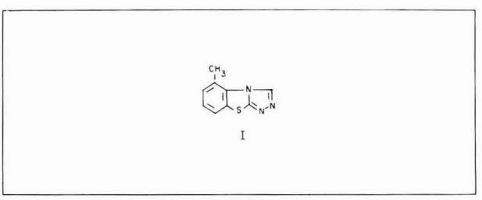

Figure 1—Tricyclazole

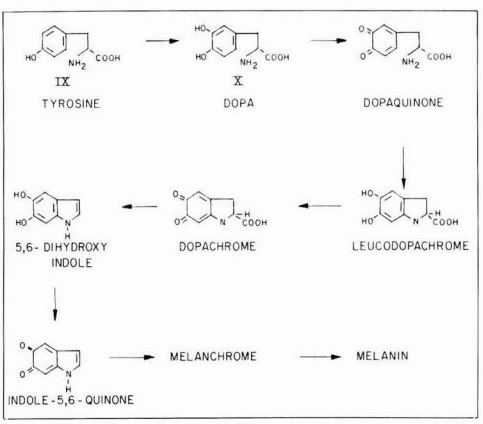

Figure 3—Pathway for melanin biosynthesis from tyrosine. The formation of DOPA (X) and Dopaquinone are enzymic catalyzed reactions. The other steps may be either enzymic or nonenzymic

New Approaches to Non-Toxic Antifouling Coatings for Ship-Hull Protection

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Fouling of ship hulls is demonstrated as a problem of worldwide importance. It is shown that the current commercial methods of fouling protection are based upon the use of toxic ingredients in the so-called antifouling coatings. These ingredients must leach out or release slowly in the surrounding water. The longer a ship stays in an enclosed area, the higher toxicity leach or release is required particularly in fouling-rich regions. This in turn creates pollution problems affecting fish and other living inhabitants of the marine environment. Intensive studies on copper in the seas showed high enough concentrations in dissolved form, in suspension and in sediments, to cause alarm. Therefore, a need emerged to work on systems of coatings which would prevent fouling attachment by principles other than toxin leaching or release. The paper presents two such systems which have demonstrated some success in preventing attachment in marine regions of high fouling intensity. A preliminary mechanism of repellency is suggested in each case.

INTRODUCTION

If not protected, ships' bottoms and submerged steel structures are not only subjected to corrosion but also to attack by fouling. Fouling initiates by attachment of swimming larvae of great variety of species on objects at rest in harbors, lakes, and canals; it grows and multiplies inside and outside enclosed areas at rates depending upon the prevailing ecological conditions.[1] Fouling roughens the hull of the ship, increases drag, reduces the speed, clogs pipes, increases vibration, increases the fuel consumption, and increases the need for frequent placement in dry dock.

Several methods of fouling prevention have been tried in the past. The only method which has appeared to be most effective and practical until now is the application of coatings containing a biocide, with properties toxic to fouling organisms. The mechanism of surface protection by these paints depends upon controlled leaching of the poisonous ingredients. The biocide which dominates the field is cuprous oxide. The reasons are that it has the widest toxic effect on the majority of fouling organisms; has moderate solubility in sea water; is a good pigment; and is moderate (but increasing) in cost in comparison with heavy toxic counterparts such as mercury, tin, and silver.

Though cuprous oxide offers the "best" solution of the fouling problem at present, a number of disadvantages exist of which two are most important. First, its antifouling formulations have limited time of effective performance, estimated at 13 months in warm fouling-rich areas.[2] Bearing in mind that structures like drilling rigs have an expected life-time of 20 to 30 years, one can see the vast difference between life-times. The second disadvantage is the possible dangers to the environment from the presence of high concentrations of copper. For example, a contamination of 0.68 μg Cu/L is sufficient to cause growth inhibition to types of algae; 25–50 μg

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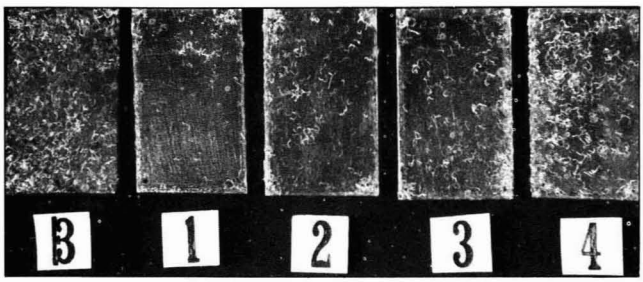


Figure 1A—PVC panels coated with different number of layers of cellulose acetate (C.A.) and uncoated PVC panel. Panel B: uncoated PVC blank; Panel 1: PVC coated with one layer of (C.A.); Panel 2: PVC coated with two layers of (C.A.); Panel 3: PVC coated with three layers of (C.A.); and Panel 4: PVC coated with four layers of (C.A.)

Cu/L kill algae and diatoms and seriously inhibit the growth of other species.[3] This will naturally have negative impact on organisms like sardines[4] which depend for nutrition on those simpler organisms particularly the diatoms, and thus a damaging effect on the fishery industry. Other investigators[5] have presented alarming results of 100 μg/L copper in the harbor La Rochelle, La Pallice, and Antibes particularly near the fishing and pleasure boats. Those copper contents show a real pollution; therefore, it could not be assumed that it would remain without any effect on food chains of organisms living in the harbor. Further alarm was expressed by Hilderbrand[6] and Disalvo.[7]

The above results are supported by recent studies, begun in 1977, on copper pollution in the Suez Canal waters and sediments (two years after reopening the Canal for world navigation). They revealed values of copper ranging between 20 μg/L and an extreme high of 1150 μg/L. An average of a great number of measurements was estimated at 70 μg/L.[8] This value is seven times higher than the so-called "safe concentration" which is the concentration considered to pose minimal risk of deletereous effect for copper according to Water Quality Criteria (W.Q.C.).[3]

The most widely accepted alternatives to copper-containing antifouling coatings were introduced in the 60's by the use of organometallic compounds, namely, organotins and organoleads. Organoleads were soon discarded and organotins were limited on the commercial level to three, namely, tributyltin oxide (TBTO), tributyltin fluoride (TBTF), and triphenyltin fluoride (TPTF). TBTF and TPTF, as powders, are comparatively safer in use than TBTO which is a liquid. In spite of their long-term action, the use of these kinds of paint formulations is not well regarded for two main reasons: (a) their ineffectiveness towards algal growth and plant fouling and (b) the atmospheric hazards they may create during removal of old paint for repainting.[10]

However, the use of organotins was expanded by incorporating the tributyltin moiety in resinous binders.[11-13] Thus, a terpolymer of tributyltin methacrylate, butyl methacrylate, and methyl methacrylate (ratio 2:1:1, respectively) was found to resist shell fouling, but not green and brown algae, for a period of one year.[14] The storage and use problems of organotin polymers were recently reviewed.[15] These problems add to the already mentioned shortcomings of the anti-fouling formulations based on organotins. Even more serious is the conclusion that these organotin polymers hydrolyze to release organotin compounds which are lethal to macro-organisms at minute concentrations.

So far, the best compromise is to combine a little organotin compound with a wide range toxin such as cuprous oxide. The former takes care of the long-term action while the latter checks algal growth. Such formulations were prepared and tested; they not only represent the best approach to antifouling coatings using toxic materials, but also show advantageous points with respect to longevity of action, reduced algal growth, and reduced copper leaching.[16]

Despite continuous experimental trials and useful ideas on non-toxic (toxin-free) antifouling coatings, none has reached any commercial stage. The ideas cover a wide range, including investigation of materials which control the rate of settlement of fouling organisms, the surface charge, and the hydrophobic-hydrophilic balance. For example, 18 of 20 samples of Caribbean bacterial populations showed preference for hydrophobic rather than hydrophilic surfaces.[17] In case where charge was investigated, positively charged and neutral surfaces were preferred over negative ones.[17] Minimum strengths of biological adhesion were proposed to correlate strongly with an initial critical surface tension in the range between 20 and 30 dynes/cm[18] corresponding in some cases to structures with adjacent methyl and hydroxyl groups.[19] Several other investigations used very smooth, slippery, or brushlike surfaces, silicones, fluorinated-epoxy, and glycol methacrylate based compositions. All showed promise in early stages, but long-term protection is still out of reach.

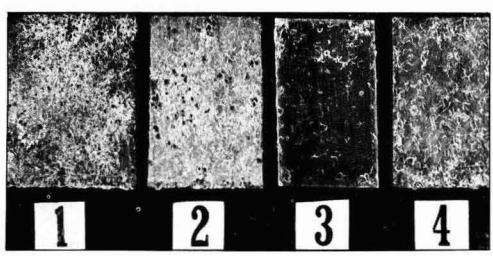


Figure 1B—PVC panels coated with cellulose acetate with and without an Araldite undercoat. Panel 1: PVC coated with Araldite only; Panel 2: PVC precoated with Araldite then coated with cellulose acetate (by dipping); Panel 3: PVC coated with cellulose acetate only; and Panel 4: PVC coated with a mixture of C.A. and Araldite

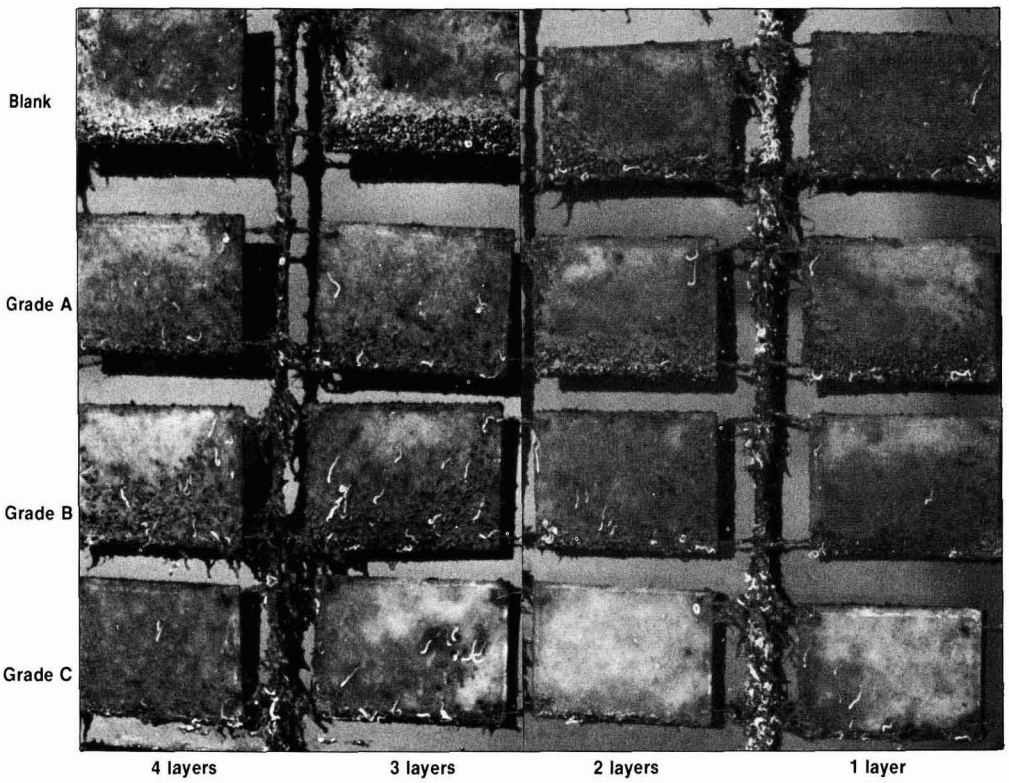


Figure 2—Cellulose acetate of different grades (second test)

In the present paper, two materials of no toxicity but with surface properties thought to be fouling repellent are described. Their behavior towards fouling organisms during testing as non-toxic antifouling coatings in fouling-rich regions is demonstrated.

EXPERIMENTAL

Materials

Three grades of pure film-forming cellulose acetate (C.A.) in powder form were received from three different sources and were used without further purification.

A silica-bearing organosiloxane of composition based upon a preparation by Clark[20] was used. The initial components are monomeric trimethoxymethyl silane and colloidal silica. The final film composition is a complex crosslinked structure embedding silica particles which participate in the network through hydrogen bonding and partial etherification of surface hydroxyl groups. The reactions taking place are basically as follows:

$$CH_3{-}Si{-}(OCH_3)_3 \xrightarrow[H_2O/\text{iso-prop. alcohol}]{SiO_2\ \text{Coll.}/H^+} CH_3Si(OH)_{3-n}(OCH_3)_n + (3-n)CH_3OH$$

where n is smaller than 3 and greater than 0.

$$CH_3Si(OH)_{3-n}(OCH_3)_n + SiO_2\ (\text{coll.}) \longrightarrow H(O{-}\underset{\underset{(SiO_2)_y}{|}}{\overset{\overset{CH_3}{|}}{Si}}{-}O{-}\underset{\underset{OCH_3}{|}}{\overset{\overset{CH_3}{|}}{Si}})_x OH$$

a crosslinked structure involving combined silica + $H_2O\uparrow + CH_3OH\uparrow$ (see *Figure* 3)

Curing

Solvents and other chemicals were of the A.R. or equivalent grades.

Preparation of Test Panels

The powdered cellulose acetate samples were made into 10% solutions in acetone. PVC sheets, 2mm thick, were coated front and back with the C.A. solution. The number of layers applied were one, two, three and four using a film applicator which gives a wet thickness 120 μm per layer. Proper air drying was allowed between each application. The panels were finally left to dry, and the edges were dipped in cellulose acetate solutions to eliminate pores and weak points.

The silicon-silica resin was coated on: (a) steel plates precoated with a zinc chromate primer, and (b) on Plexiglas® panels of dimensions 15 × 20 cm.

Plexiglas is a registered trademark of Rohm and Haas Co.

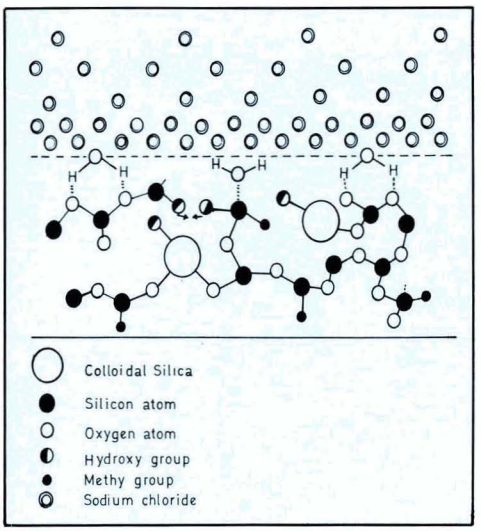


Figure 3—Schematic representation for a cross section of silica-bearing polymethylsiloxane

The coated panels and blanks in both cases were connected by nylon threads to steel frames suitable for environmental exposure.

The Exposure Site

The frames were submerged in the test area of the raft[21] in Alexandria eastern harbor, Egypt, for different periods of time at the depth of 150 cm from the surface. Periodic visual and biological examination and photographic recording of the condition of the panels were performed. The harbor is a semi-enclosed, semi-circular water basin. It lies approximately at 29° E longitude and 31° N latitude. The water of the harbor is subjected to some modification by land drainage which includes the sewage discharged by several sewer outfalls around the area. The maximum water depth is 11 meters; the water area is about 50.4 hectares. The harbor is used mainly for fishing and pleasure boats. The annual average temperature is about 21° C. The predominantly warm water throughout the year is an important factor in producing almost incessant fouling. The salinity of water is between 37 and 38 parts per thousand. The high salinity is recognized to be as important as temperature in enhancing the occurrence and abundance of fouling organisms. The range of pH is between 8 and 8.3.[22] From the ecological point of view, such an area provides a suitable place for testing in view of the fact that marine fouling organisms of all types flourish almost all the year round.[21]

Table 1—Critical Surface Tension And Permeability Coefficient of C.A. and PVC[24]

Property	C.A.	PVC
γ_c (dynes/cm)	39	26–31.5
Permeability coefficient $\times 10^6$ at 25° C	5500	275

RESULTS AND DISCUSSION

Trials with Cellulose Acetate

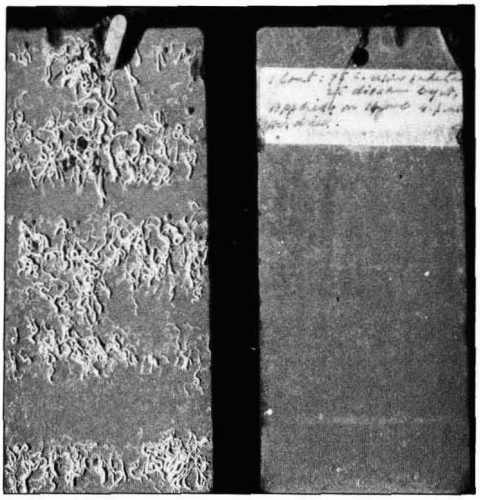
FIRST TEST: Cellulose acetate samples were tested in the above exposure site. Two series of PVC panels coated with cellulose acetate were used.

Series (A)—Consisted of four panels of PVC each coated with a different number of layers, from one to four layers. A blank uncoated PVC panel was used as control. The panels were immersed in the raft for a period of about 23 days starting from August 9–31, 1978. The photographic recording of the test is shown in *Figure* 1A.

Series (B)—Consisted of four panels of PVC coated with cellulose acetate with mixed Araldite® epoxy resin

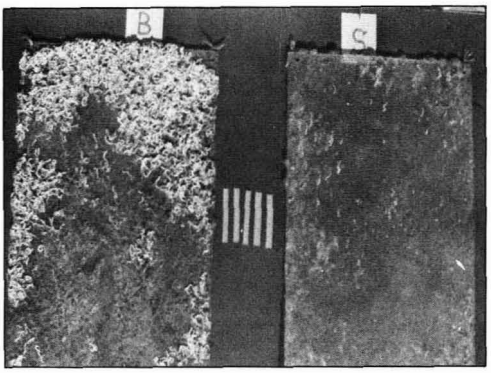
Table 2—Silica-Bearing Silicon Resin Coated on Zinc Chromate And Immersed in Alexandria Harbor

Period	Average Water Condition of the Blank Panel (Anticorrosive only)		Condition of Test Panel	
	Temperature		Fouling organisms	Physical appearance
–15 days 27 April–11 May (1978)	22°	15–20 small barnacles on each side, slime film	None on front or back side. Slime film	Blisters in the thinner region (upper half) but disappeared upon air drying following washing with tap water. Thin cracks in the film and small widely distributed whitening.
–30 days 27 April–26 May (1978)	24°	The 15–20 small barnacles on each side grew to double to triple size, slime film.	1 barnacle on one side 3 on the other side of smaller size than on blank. 5 small tube worms mostly near edges (weak points), slime film.	Same as above.
–49 days 27 April–15 June (1978)	25°	Full coverage of mature barnacles and other foulers. Average diameter of adhering barnacle individual about 1 cm.	Slime film, settlement of fouling organisms about 50 small (newly settled) barnacles on each face, and five small tube worms and two lots of Bryozoa.	Beginning of rusting physical flaking off following blistering.



Blank Sample

Figure 4—Silicon resin coated on steel panels precoated with zinc chromate paint



Blank Sample

Figure 5—Silicon resin coated on Plexiglas

and hardener as an undercoat and as co-resin. The panels of this series were tested simultaneously under the same conditions applied in series A. The photographic recording of the test is shown in *Figure* 1B.

Figures 1A and 1B show the following behaviors: There is clear evidence that a cellulose acetate film prevents fouling more effectively than does an uncoated PVC (the blank panel). As the film thickness of cellulose acetate decreases, its ability to resist fouling increases. Panels in *Figure* 1A resist fouling in the following order $1 > 2 > 3 > 4$. The fouling repellency properties of cellulose acetate is sensitive to the presence of substrate as shown in *Figure* 1B where Araldite was used as undercoat and as co-resin.

SECOND TEST: This test was carried out to evaluate three grades of cellulose acetate with minor structural differences. Each grade was coated on four untreated PVC panels in a number of layers ranging from 1 to 4. Four uncoated PVC panels were used as control blanks. The 16 panels were all included in one frame and were tested in the same area and the same raft[21] for a longer immersion time of about 48 days starting from December 8, 1978 to January 24, 1979. *Figure* 2 represents the appearance of the panels at the end of the test period.

The most important observations are that cellulose acetate coated panels of all types show better repellency to algae compared with the uncoated PVC blanks. Also, further evidence is provided that thinner coats provide better fouling repellency than thicker coats. One of the cellulose acetates, grade C, has better repellency than the other two grades.

The reasons for choosing cellulose acetate were mainly the same as those governing its use as a membrane in reverse osmosis water desalination: its hydrophylic nature, large water absorption, and salt rejection. The water column on the panel may represent the pressure exerted in reverse to the osmotic pressure in a desalination process. Moreover, cellulose acetate was found to adsorb alkali halide ions at concentrations of 50–500 ppm from dilute aqueous solution when its thin films were soaked in these solutions.[23] The film may thus acquire a surface so *different* from the bulk of the sea that the larvae will find it inhospitable for settling and undesirable for attachment, and will be affected from the sudden change at the surface and simply turn away from it. *Table* 1 gives the critical surface tension and permeability coefficients for C.A. and PVC[24] which may help explain the preference of algal spores and tube worms larvae for uncoated PVC panels.

Trials with a Silica-Bearing Silicon Resin

Silica-bearing organosiloxanes of composition based on the preparation mentioned above was used in this case. The network structure developed embodies silica lightly grafted to the matrix through its surface hydroxyl groups. The thin films produced from the polymeric aqueous alcoholic solutions were clear and tenaceous and possessed the following laboratory properties which suggested them for use as non-toxic antifouling coatings:

(1) Using the contact angle method, they were found to have intermediate critical surface tension for wetting similar in values to organic polymeric materials having adjacent methyl and hydroxyl groups, recommended by Baier, et al[19] for minimum fouling settlement.

(2) They had the unusual property of hyperfiltration, i.e., of isolating salt from salt solution: (a) a drop of 3.8% sodium chloride solution placed on a thin film of the material on a slide of steel and covered to minimize evaporation gave cubical crystals of NaCl on the surface while the steel substrate rusted, (b) a similar drop placed on a layer of the material on cellophane paper gave a cluster of crystals after some minutes while the water diffused through the membrane. In a blank experiment on uncoated cellophane no crystals were isolated and both salt and water diffused quickly.

Araldite is a registered trademark of Ciba-Geigy Corp.

(3) The concentration of NaCl solution increased on passing the solution through a column packed with polystrene (PS) beads coated with the material (coating was performed by immersing the PS beads in a dilute resin solution followed by air-drying). The increase in concentration was determined by a thermostatically controlled refractometer reading to the fourth decimal.

A suggested structure and schematic representation of the cross-section of this material in film form is given in *Figure* 3. It is likely that a combination of a surface with suitable energy and configuration, together with salt repellency at the surface and preferential water uptake in the upper molecular layers, were the reasons for creation of a thin layer of water higher in salt concentration than the bulk of the sea. This, in turn, was responsible for the no-fouling effect lasting for several weeks when the material was tested for the first time in Alexandria testing station[21] and shortly after in a testing station in Miami, Florida.

Figure 4 shows the appearance of two steel panels coated with zinc chromate paint; one—the blank—fouled, while the other—topped with a thin layer of the above silicon composition—was perfectly clean.

In a second test carried out in the same manner, the time of immersion at Alexandria harbor was extended to 49 days, from April 27 to June 15, 1978. The conditions of the tested panel and blank during this period of time are summarized in *Table* 2. The most important conclusions derived from the results given in *Table* 2 are: The small size of foulers compared with much greater size of their counterparts on blank indicates that settlement on the silicon material occurred late after the beginning of the test. The silicon material used prevented settlement for a period which we can estimate at 40 days. Whether the loss of silicon material repellency to larvae, or the physical deterioration of the anticorrosive coating was the cause of settlement, was not possible to ascertain.

To avoid corrosion problems, further testing of the silicon resin was carried out using Plexiglas panels. The tests were performed concurrently in Alexandria and Miami harbors for about five weeks from October 4 to November 8, 1978. The blank panels were intensely fouled while the panels coated with the silicon resin were only slightly affected, as typically shown in *Figure* 5.

CONCLUSIONS

Coatings made of cellulose acetate and silica-bearing methyl siloxane resin, respectively, showed marine fouling resistance without exerting toxicity. The period of protection did not, however, exceed 40 days, which is considerable under the intensive fouling conditions in which the tests were performed. This period may possibly be extended by modifications enhancing and sustaining the properties thought to be responsible for nontoxic repellency, such as, the creation of a thin water-coating interface of higher salt concentration than the bulk of the sea, the control of dimensions of film voids and their surroundings, and proper adjustment of surface energy and surface charge. In view of the need pertaining to preservation of the marine environment, a collaborative effort along this line is called for.

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Measurement of Solubility And Solubility Parameters For Small Organic Solutes In Polymer Films by Gas Chromatography

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A method has been developed that gives fast, reproducible results for infinite dilution solubility parameters of polymers, and the solubility of small organic probes at infinite dilution in polymers. This method, using inverse gas chromatography, studies interactions with polymers in the solid phase. Solubility parameters and solubilities are reported for poly(ethylene-vinylacetate), 40% w/w vinylacetate, with both polar and nonpolar organic probes.

INTRODUCTION

Most experimental approaches used in investigating the thermodynamics of polymers involve dilute solution studies: osmometry, viscometry, swelling measurements, etc. In 1969, Smidsrød and Guillet[1] showed that solutions of small molecules in polymers could be studied using the polymer as the stationary "liquid phase" in gas chromatography. Equations had already been derived[2,3] for conventional gas chromatography (GC) to obtain activity coefficients, heats of solution, and heats of mixing.

Patterson, et al.[4] modified the equation for the activity coefficient of the solute at infinite dilution of solute probe [subscript (1)] in polymer [subscript (2)] by weight rationalization, to eliminate the need for estimating a value for M_2, the molecular weight of the polymer, thus providing the theoretical framework for thermodynamic studies of polymer systems in the solid phase. According to this treatment, the weight fraction activity coefficient for the probe in the polymer is given by

$$\ln(a_1/w_1)^{\infty} = \ln\left(\frac{273.16R}{p_1^0 V_g M_1}\right) - \frac{p_1^0(B_{11} - V_1)}{RT} \qquad (1)$$

where R is the gas constant, p_1^0 is the solute vapor pressure, w_1 and a_1 are weight fraction and activity of the probe molecule, and M_1, V_1, and B_{11} are the molecular weight, molar volume, and second virial coefficient of the probe. V_g is the specific retention volume at the column temperature T expressed per gram of polymer w_L on the column

$$V_g = V_N/w_L \qquad (2)$$

with the net retention volume V_N expressed as

$$V_N = F(t_R - t_m)\left(\frac{273.16}{T_f}\right)\left(\frac{760}{P_0}\right)\left(\frac{P_A - P_w}{P_A}\right)J_3^2 \qquad (3)$$

which is the flow rate F times the retention time for the probe t_R minus that for an inert marker such as methane or air t_M. The fractions $273.16/T_f$ and $760/P_0$ are used so that the carrier gas flow rate can be quoted under standard temperature and pressure conditions. The fraction $(P_A - P_w)/P_A$ accounts for the contribution of water pressure P_w in the soap bubble flowmeter at the temperature at which the flow rate was measured T_f, to the total atmospheric pressure P_A. J_3^2 is a correction factor to account for the finite compressibility of gas in the column and is given by

$$J_3^2 = \frac{3}{2}\left[\frac{(P_i/P_o)^2 - 1}{(P_i/P_0)^3 - 1}\right] \qquad (4)$$

where P_i and P_o are the column inlet and outlet pressure, respectively.

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Table 1—Molar Volumes and Solubility Parameters For the Solutes at 75°C

Solute	V_1(ml/mol)	δ_1(cal/cc)$^{1/2}$
1-Chlorobutane	112.99	7.71
1-Octene	167.38	7.02
n-Butanol	97.13	10.58
Chlorobenzene	107.55	8.89
Chloroform	86.44	8.45
Methyl propyl ketone	114.72	8.30
Toluene	113.25	8.30
n-Decane	206.75	7.22
n-Hexane	141.83	6.56
Benzene	95.32	8.46
n-Octane	173.86	6.99
n-Pentane	126.89	6.37

Table 2—χ Values for the Solutes in P(E-VAc) At Three Experimental Temperatures

	χ		
Solute	65°C	75°C	85°C
1-Chlorobutane	0.192	0.206	0.183
1-Octene	0.423	0.418	0.400
n-Butanol	0.939	0.871	0.830
Chlorobenzene	−0.081	−0.057	−0.052
Chloroform	0.434	0.375	0.345
Methyl propyl ketone	0.418	0.392	0.386
Toluene	0.034	0.053	0.049
n-Decane	0.599	0.578	0.546
n-Hexane	0.593	0.578	0.702
Benzene	0.095	0.098	0.098
n-Octane	0.581	0.562	0.538
n-Pentane	0.708	0.632	0.554

The infinite dilution activity coefficient can be related to the Flory-Huggins χ parameter by

$$\chi = \ln(a_1/w_1)^{\infty} - \ln(v_1/v_2) - \left[1 - \frac{V_1}{(\overline{M}_2)_n v_2}\right] \quad (5)$$

where v_1 and v_2 represent specific volumes and $(\overline{M}_2)_n$ is the number average molecular weight of a polydisperse polymer sample. The latter is usually large enough so that the last term in brackets becomes very nearly equal to one.

Since χ is an energy parameter, it can be written as the sum of an entropic (S) and an enthalpic (H) contribution

$$\chi = \chi_S + \chi_H \quad (6)$$

Using Hildebrand-Scatchard theory

$$\chi_H = (V_1/RT)(\delta_1 - \delta_2)^2 \quad (7)$$

where δ, the solubility parameter, is defined as

$$\delta = (\Delta E_{vap}/V)^{1/2} \quad (8)$$

χ_S is often taken to be a constant approximately equal to 0.35.[5,6] Using equations (6) and (7)

$$(\delta_1^2/RT) - (\chi/V_1) = (2\delta_2^{\infty}/RT)\delta_1 - [(\delta_2^{\infty}/RT) + (\chi_S/V_1)] \quad (9)$$

Hence a plot of the left-hand side vs δ_1 should give a straight line whose slope gives the value of δ_2^{∞}. Numerous polymers have been studied using this method.[7-9]

SOLUBILITY MEASUREMENTS

Solubility of organic vapors in polymers can be expressed in several ways. When Henry's Law conditions are satisfied (usually when the concentration of solute in a solution approaches infinite dilution), the solubility of component i in the solution is given by

$$S_i = p_i/H_i \quad (10)$$

where p_i is the equilibrium partial pressure of i in the vapor and H_i is the Henry's constant, the equilibrium mole fraction of i in the solution. If this equation is applied to a system where the partial pressure of i is 1 atm, then the solubility (equilibrium mole fraction of i) is

$$S_i^{(1)} = 1/H_i \quad (11)$$

Solubility can also be expressed in terms of the Ostwald solubility coefficient β, or the Bunsen absorption coefficient[10] α, where

$$\beta = V_g(T/273.16) = \frac{\text{weight solute/gram stationary phase}}{\text{weight solute/cc gas at column temperature}} \quad (12)$$

and

$$\alpha = \rho\beta \quad (13)$$

with ρ being the density of the stationary phase.

Solubilities of organic molecules in polymers are often determined by permeability measurements in solid films. The permeability P is the product of the solubility $S_i^{(1)}$, and the diffusion constant D.[11]

$$P = D_i S_i^{(1)} \quad (14)$$

A typical experiment yielding P and D is carried out by suddenly exposing one side of a film to a partial pressure (usually 1 atm) of permeant and then monitoring the concentration on the other side of the film as a function of time. Knowing P and D, $S_i^{(1)}$ can be found. At lower partial pressures ρ_i, the permeability, will be given by

$$P = (\rho_i/\rho_o)D_i S_i \quad (15)$$

where $\rho_0 = 1$ atm.

Solubilities can also be determined from inverse gas chromatography data using the method recently outlined by Liu and Prausnitz.[12] They define H_i as

$$H_i = \lim_{c_i \to 0} (f_i^L/c_i) \quad (16)$$

where f_i^L is the fugacity of solute in the stationary (liquid) phase, and c_i is the weight fraction concentration of solute in the liquid phase. If the solute fugacity is assumed to be proportional to the weight fraction of solute in the polymer, Henry's constants can be calculated more directly using experimental data.

Assuming ideal behavior of the gas in the column, equation (1) can be rewritten as

$$\frac{a_1 p_1^0}{w_1} = \frac{273.16\,R}{V_g M_1} \quad (17)$$

since the term containing B_{11} arises out of the equation of state for a slightly imperfect gas. The product $a_1 p_1^0$

gives p_1, the vapor pressure of the probe over the stationary phase. Recall that w_1 is defined as the weight solute per weight solution; in other words, w_1 is equivalent to the solubility S_1, therefore

$$(p_1/S_1)^{\infty} = \frac{273.16\,R}{V_g M_1} = H_1^{\infty} \tag{18}$$

For a solute pressure of 1 atm the solubility in weight probe per weight solution is then[12]

$$S_1^{(1)} = \frac{V_g M_1}{273.16\,R} = 1/H_1^{\infty} \tag{19}$$

In calculating the Henry's constants, Liu and Prausnitz apply a correction for the finite solubility of nitrogen (carrier gas) in the polymer. This corrected H_1 is given by

$$H_1 = \frac{H_1^{exp}}{1 + (M_1 H_1^{exp}/M_{N_2} H_{N_2})} \tag{20}$$

Knowing H_1 values, $S_1^{(1)}$ can be calculated from equation (19). These solubilities can also be directly related to the experimental data reported in terms of activity coefficients.

$$S_1^{(1)} = \frac{1}{p_1^0 (a_1/w_1)^{\infty}} \tag{21}$$

EXPERIMENTAL

Columns

Poly(ethylene-vinylacetate) (P(E-VAc)), 40% w/w vinylacetate, was obtained from Aldrich. An accurately weighed amount of polymer was slowly dissolved in xylenes (ACS reagent grade). To this solution was added a preweighed amount of sieved 70/80 mesh, acid washed, silanized Chromosorb G. The mixture was slowly heated with stirring until most of the xylenes had evaporated. The damp solid was then dried for 72 hr at ca. 50°C. The coated support was sieved (70/80 mesh), then packed with the aid of a mechanical vibrator into a 0.25 in. o.d. copper column.

Percent loading of polymer on the column was determined via a duplicate calcination, using uncoated support as a blank. In the column used, the percent loading was 4.03, representing 0.3826 g of polymer.

Apparatus

A Hewlett Packard 5840 gas chromatograph with a dual flame ionization detector was used. The carrier gas was nitrogen and flow rates were measured using a soap bubble flow meter. Column pressures were measured with a mercury manometer.

Samples (ca. 1.2 μL gas) were injected using a Hamilton gas-tight syringe. Methane was used as a marker for dead volume in the column so

$$t_N = t_{probe} - t_{CH_4} \tag{22}$$

Equation (1) was derived for the conditions of a linear sorption isotherm for the probe, and bulk absorption of the probe into the stationary phase. In addition to these constraints, it is important to ensure that there is an equilibrium between the components in the column. These requirements were met by performing three experimental checks. A second column, with a different percent loading (different surface-to-bulk ratio) was tested. A change in V_g for a probe with the second column would indicate that surface interactions were making a significant contribution. To correct for this, V_g would have to be extrapolated to its value for infinite percent loading of the column. Next, the probe sample size was varied. A change in t_N with sample size would occur if there was a non-linear sorption isotherm, making it necessary to extrapolate t_N to its value for zero sample size. The last check involved varying the flow rate; a change in V_g would indicate that the interaction was diffusion controlled. In other words, the probe may not have had time to diffuse through the bulk of the polymer as it travelled along the column. This could be corrected by extrapolating V_g to the value it would have for zero flow rate. None of these adjustments were necessary for the experiments described here.

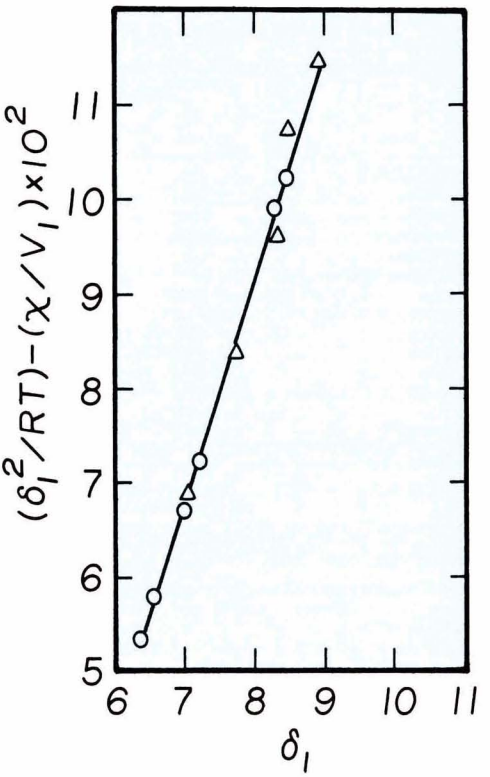

Figure 1—Infinite dilution solubility parameters for poly(ethylene-vinylacetate) at 75°C using experimentally determined χ parameters: (△) polar probes, (○) nonpolar probes. δ_2^{∞} (slope) = 8.26 ± 0.17. Extrapolated to 25°C: δ_2^{∞} (slope) = 9.10 ± 0.44

Data Reduction

Solute vapor pressures were calculated using the Antoine equation,

$$\log p_1^0 = A + [B/(t+C)] \tag{23}$$

where A, B, and C are literature constants[13-15] for each

Table 3—Henry's Constants and Solubilities for Probes in P(E-VAc) at Selected Experimental Temperatures [a]

Probe	65°C		75°C		85°C	
	H_1, atm	S_1, weight fraction 1	H_1, atm	S_1, weight fraction 1	H_1, atm	S_1, weight fraction 1
1-Chlorobutane	2.29	0.437	3.25	0.308	4.31	0.232
1-Octene	0.832	1.20	1.24	0.807	1.75	0.572
n-Butanol	0.840	1.19	1.32	0.759	2.01	0.498
Chlorobenzene	0.234	4.27	0.360	2.78	0.525	1.91
Chloroform	1.22	0.820	1.78	0.561	2.44	0.410
Methyl propyl ketone	1.37	0.730	1.96	0.510	2.77	0.361
Toluene	0.688	1.45	1.03	0.973	1.44	0.694
n-Decane	0.126	7.94	0.204	4.90	0.313	3.19
n-Hexane	6.34	0.158	8.55	0.117	12.8	0.078
Benzene	1.98	0.505	2.79	0.358	3.78	0.264
n-Octane	0.848	1.18	1.25	0.802	1.77	0.565
n-Pentane	19.7	0.051	24.7	0.040	28.5	0.035

(a) For partial pressure of probe equal to 1 atm.

solute, and t is the experimental temperature in °C. Second virial coefficients were found using[16]

$$B_{11}/V_c = 0.430 - 0.886(T_c/T) - 0.694(T_c/T)^2 - 0.0375(n-1)(T_c/T)^{4.5} \quad (24)$$

V_c and T_c are the critical volume and temperature of the solute. T and T_c are in °K and n is a constant for each solute, indicative of the number of carbon atoms.

Molar volumes of probes and the polymer were found using literature density equations, or by fitting literature data to a polynomial. Solute solubility parameters at 25°C were found in the literature and values at the experimental temperatures were calculated using

$$\delta_1 = [(\Delta H_{vap} - RT)/V_1]^{1/2} \quad (25)$$

with

$$\Delta H_{vap} = \Delta \bar{H}_1^{\infty} - \Delta H_S \quad (26)$$

where the partial molar heat of mixing of the solute at infinite dilution in polymer is

$$\Delta \bar{H}_1^{\infty} = R\partial \ln(a_1/w_1)^{\infty}/\partial(1/T) \quad (27)$$

and the heat of solution is

$$\Delta H_S = -R\partial \ln V_g/\partial(1/T) \quad (28)$$

The correction factor to the Henry's constants was found using the data of Liu and Prausnitz.[12] Corrected H_1 values differed from the uncorrected values by less than 1%, making this adjustment unnecessary.

RESULTS

Table 1 gives molar volumes and solubility parameters for the solutes at 75°C. *Table* 2 shows χ values for the solutes in P(E-VAc) at three experimental temperatures. *Figure* 1 shows the results for δ_2^{∞} at 75°C, the midway point of the temperature range used. The error quoted represents the standard deviation of the slope for a least squares plot. A value for δ_2^{∞} was also calculated at 25°C. To obtain this, literature values were used for ΔH_{vap}, δ_1 and V_1 for the probes, and χ was extrapolated using

$$\chi = \alpha + (\beta/T) \quad (29)$$

which is considered valid over a small temperature range (in this case, only 50°). There is a difference between δ_2^{∞} (75°C) and δ_2^{∞} (25°C), although both are within the literature[17] range of 8.44 to 9.67. It is not certain whether this difference represents a true temperature dependence of δ_2^{∞}, or whether it is due to the difficulty in fitting χ to the inverse dependence on T.

Since the range of solubility parameters quoted in the literature for any one polymer is so broad, it is difficult to make any claims concerning the absolute accuracy of this method; however, the V_g values were reproducible to within ± 5%, which would appear to make this technique more precise than those now commonly in use. In earlier studies, DiPaola-Baranyi and Guillet[7] showed that the values of δ_2^{∞} obtained for polystyrene and poly(ethylacrylate) were in the mid-range of reported literature values for δ_2.

Weight fraction Henry's constants and solubilities are given in *Table* 3 for the probes in P(E-VAc). The solubilities were calculated for a partial pressure of solute at 1 atm. The H_1 values for n-hexane, benzene, toluene, and n-octane in P(E-VAc) seem to follow the trend observed by Maloney and Prausnitz[18] for these solutes in polyethylene.

Table 4 gives H_1 and $S_1^{(1)}$ values for five probes in polystyrene at 183°C using the data of DiPaola-Baranyi and Guillet,[7] and *Table* 5 gives the same information for

Table 4—Henry's Constants and Solubilities For Five Probes in Polystyrene at 183°C [a]

Probe	H_1, atm	S_1, weight fraction 1
n-Decane	13.6	0.074
n-Dodecane	5.09	0.196
n-Tetradecane	1.86	0.539
cis-Decalin	3.80	0.263
trans-Decalin	5.02	0.199

(a) For partial pressure of probe equal to 1 atm; using the data of DiPaola and Guillet, ref. 7.

Table 5—Henry's Constants and Solubilities For Five Probes in Poly(vinylacetate) at 125°C [a]

Probe	H_1, atm	S_1, weight fraction 1
Cyclohexane	48.6	0.021
Benzene	17.2	0.058
n-Butylcyclohexane	5.48	0.182
n-Dodecane	3.11	0.322
n-Decane	9.40	0.106

(a) For partial pressure of probe equal to 1 atm; using the data of DiPaola-Baranyi et al., ref. 8.

five different probes in poly(vinylacetate) at 125°C, using the data of DiPaola-Baranyi, et al.[7,8]

Obtaining thermodynamic information on polymers by solution methods involves finding a liquid which will dissolve enough of the polymer to make a measurement. To find the solubility parameter of a polymer via viscosity or swelling measurements, a series of solvents with a range of solubility parameters would be needed. Finding solubilities through permeability studies means that enough of the vapor in question must pass through the film in a reasonable amount of time, so that the change in concentration can be monitored. Inverse gas chromatography avoids all of these limitations. Measurements are made on a system where the solid polymer makes up the concentrated phase, and the technique is so sensitive, only extremely small amounts of the probe are necessary to measure an interaction. By modifying the experimental conditions IGC can be used in a variety of ways,[19] including determination of glass transition temperatures,[20] calculation of percent crystallinities,[21] and measurement of diffusion constants[22] for organic vapors in polymer films. The ease of experimentation and wide range of applications make inverse gas chromatography an excellent tool for measuring physicochemical properties of polymers.

ACKNOWLEDGMENTS

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Society Meetings

Baltimore — Oct. 21

Jim McCormick discussed plans for the Society's 50-Year Celebration to be held April 3. The event will feature a special presentation at Toby's Dinner Theatre, Columbia, MD.

Bill Buttrick, of Union Carbide Corp., Performance Chemicals and Polymers Division, presented "HIGH PVC LATEX PAINTS: PRACTICE AND THEORY."

The presentation centered on three basic formulations: (1) a medium quality, medium cost, medium PVC paint; (2) a very high PVC, low cost formulation and; (3) a high quality low PVC paint of relatively high RMC. An ambitious exposure program sought to determine the effects of PVC, binder formulation, conditions of substrate, and porosity on the durability of exterior latex paint.

Mr. Buttrick explained that a predictable relationship exists between the PVC of the paint and its porosity. As PVC approaches or exceeds CPVC, porosity is introduced. In field tests, porosity was shown to increase blister resistance, but reduce resistance to cracking. Overall, porosity was deleterious to film integrity, said Mr. Buttrick.

The advantages of high PVC coatings are lower raw material cost and excellent hiding, according to Mr. Buttrick. Unfortunately, these advantages are gained at a loss in overall quality and durability. The risks of selling such products include greater frequency of complaints, customer dissatisfaction, and the loss of customers to alternative materials.

CARL B. MINCHEW, *Secretary*

C-D-I-C — Oct. 12

Dr. Allan B.J. Rodriques, of E.I. duPont de Nemours and Co., Color Operations Group of the R&D Division, gave a talk and slide presentation entitled, "COLOR VISION AND THE ASSESSMENT OF COLOR DIFFERENCE IN INSTRUMENTAL COLOR MATCHING."

Dr. Rodrigues began with a brief but thorough discussion of the physiology of the eye and described the anatomical reasons why we see color and why all individuals don't see color exactly the same. He pointed out that color vision is not only a function of the eye but also of the brain, which interprets the signals received from the eye, stores information, and learns over a period of time to improve deficiencies in the signals received from the eye.

A number of slides were used to demonstrate the psychology of color as a function of the eye/brain interaction, a technique that all artists use very successfully to affect the mood of an individual looking at a painting. Dr. Rodrigues noted that the reverse is also true. An individual's state of mind does have an effect on color preception. He said that everyone working with color and color matching has used this phenomenon to obtain customer approval perhaps without knowing exactly what he was doing.

Dr. Rodrigues then described the development of a mathematical model of human color vision by the International Committee on Illumination (CIE). This model is based on the spectral reflectance of the colored object, the spectral distribution of the illuminant, and the tristimulus response of the observer. When these integrations are calculated and chromoticity coordinates are defined, we can plot in x,z space the CIE Chromoticity Diagram. This color space has a number of practical disadvantages, according to Dr. Rodrigues. The next step was the development of CIELAB Color Space which also takes into consideration the tristimulus values of the illuminant. The CIELAB Color Space is a three dimensional plot that defines lightness, hue, and saturation. Its advantages are that it is a uniform color space, it provides a uniform method of color description, it is easily understood and is widely accepted by people working with color, said Dr. Rodrigues.

CIELAB color specifications are very effective but do have limitations that must be recognized by the user said Dr. Rodrigues. These limitations include variations caused by differences in gloss, surface texture, light level used by the observer, size of the sample, time of observation, and color of the surrounding area. He emphasized that instrumental color matching and human observations do not compete with each other. Each has its own special strength and weaknesses and by understanding and using their differing strong points the

user will be assured of a successful color matching program.

Q. Are CIELAB numbers more accurate with higher L values?

A. In general no, but darker colors do present somewhat of a problem. 0.3 CIELAB color units are normally a just perceptible difference. With a low L value 0.8 units might be a just perceptible difference. Also darker colors should be evaluated in bright light so that an adequate amount of reflected light hits the eye.

Q. Can metallic colors be accurately evaluated with instrumentation?

A. At the present time, no. The problem of course is that in metallics the color changes with the angle of viewing. Perhaps some adequate instrumentation may be available within a year.

ROBERT A. BURTZLAFF, *Secretary*

Golden Gate — Oct. 19

"USE OF MERCURY IN PROTECTIVE COATINGS" was presented by William E. Machemer, of Troy Chemical Corp.

Mr. Machemer explained that the presentation was based on work comparing nonmercurial and mercury-containing preservatives. Water-based decorative paints, a corrosion resistant baking primer, clay slurry, and a vinyl wall paper adhesive were discussed. In the water-based decorative paints, the mercurial-containing preservatives were more effective than nonmercurial-containing products, while in the corrosion resistant primer, the mercurial candidates were ineffective, reported Mr. Machemer. The most effective candidate proved to be 3-iodo-2-propynyl butyl carbamate which was effective at a .02¢/gal level. Mercurials proved ineffective in the clay slurry and in the wallpaper adhesive, nonmercurials proved more effective than the mercury-containing compounds.

K.E. TRAUTWEIN, *Secretary*

Houston — Sept. 9

Dennis Erikson, of Monsanto Co., presented "CROSSLINKERS FOR TODAY'S ENVIRONMENT."

Mr. Erikson explained the chemistry and properties of different melamines from the simple hexamethylol melamine through different blocked melamines where alcohols partially or wholly replace the methylol groups. The blocked systems can be cured at lower temperatures, but the monomeric types are more flexible, said Mr. Erikson. The best candidates are mixed ethers which have both methylated and butylated sites. These products provide the highest solids coating at a desired viscosity with better gloss and cratering resistance.

Mr. Erikson presented what he termed the "Bubble Chart." Products were placed on the chart as circles to denote whether each was more polymeric or more monomeric. The upper or limiting case was hexamethylol melamine (HMM). At the upper end of the chart, were those with best stability, lower water solubility, and increased flex as they become more monomeric. At the lower end of the chart, were those which produce harder films, have lower cure times, and have higher water solubility. The potential exists of blending two resin types together for best performance rather than having to pick the closest single candidate, according to Mr. Erikson.

The effect of different catalysts on melamine performance were also shown in a table comparing the catalyst at 0.2 and 0.5% levels, based on the melamine content, as shown in cured films baked 10 minutes at 250° F or 30 minutes at 250° F. Overall, the blocked catalyst systems gave the best results, said Mr. Erikson.

GEORGE SCHWARTZ, *Secretary*

Houston — Oct. 14

George Brandt, of George C. Brandt, Inc., presented "TECHNOLOGY AND PROFITS IN THE PAINT INDUSTRY."

The per gallon, per company profitability of the paint industry is marginal, according to Mr. Brandt. The usual facts and figures for the industry belie this with glowing reports of at least average return-on-investment. This favorable report is based upon the low margin and low capitalization of the paint industry, said Mr. Brandt. In many cases the paint plants of today are old.

There are three areas where the profitability can be changed, according to Mr. Brandt. Savings are possible in the raw materials that are used to make the paint. This area is no longer available unless there are some major technological breakthroughs in raw materials used by the industry, said Mr. Brandt. The second place where savings could be made are in the processing and packaging of paint. Once more a major breakthrough is necessary in areas such as dispersion equipment. Over the last several years, savings in overhead have occurred and resulted in increased profitability as a result of mergers, according to Mr. Brandt. This process has peaked and the profit picture is looking poor again. The third place where profits can be increased is in the marketing area. Over the past several years the approach to paint sales has been the "two-for-one" and the "penny sale". Both of these ploys took a product with poor profit and lowered the selling price of the paint, explained Mr. Brandt. The increased volume did not seem to increase the profit picture. The consumer has, as a result, come to buy paint by the dollar rather than by performance.

Mr. Brandt showed that the cost of the paint in most instances is far overshadowed by the cost of application. This is especially true if a high performance paint is used. Mr. Brandt pointed out that for a minor increase of $1.00 to $1.50 per gallon the profit picture can be very good. In addition, the improved profit will result in other improvement.

GEORGE SCHWARTZ, *Secretary*

C-D-I-C Society 1981–82 Executive Committee. Seated left to right: Treasurer—David C. Kinder; Secretary—Robert A. Burtzlaff; President—Robert D. Thomas; and Vice-President—Nelson W. Barnhill. Standing left to right: Past-President—Robert A. Broerman; Council Representative—William Mirick; and Past-President—William J. Frost

Kansas City — Oct. 8

"MULTIFUNCTIONAL EPOXY RESINS" was presented by Marcel Gasche, of Ciba-Geigy Corp.

Mr. Gasche defined multifunctional epoxy resins as having more than two epoxy groups per molecule and as having better performance than conventional bisphenol A epoxy coatings. According to Mr. Gasche, some of these systems can withstand boiling 50% sulfuric acid, but they do have a problem with brittleness. Force cure and heat cure systems are available.

Uses for these multifunctional epoxy resins were discussed. Mr. Gasche said these resins are used in oil drilling pipes, coal stacks, and sulfur dioxide scrubbers.

Q. How can hydrogen sulfide resistance be improved?

A. This is a problem which has not been completely solved. The only thing that really seems to work is a fluorocarbon coating costing about $350 per gallon.

MELVAN BOYER, *Secretary*

Los Angeles — Oct. 14

Ken O'Morrow, Chairman of the Environmental Committee, reported on the CARB public hearing for Rule 1113 and announced the workshop scheduled for consideration of Rule 1107 for metal coatings at SCAQMD in South El Monte. Bert Osen offered some additional comments on the CARB hearing and urged industry support of the SCAQMD amended rule and attendance at the hearing. Adding further supportive comments, was Earl Fenstermaker, representing the Ad Hoc Committee of Small Manufacturers.

William E. Machemer, of Troy Chemical Corp., presented a talk entitled "USE OF MERCURY IN PROTECTIVE COATINGS."

In his introduction, Mr. Machemer pointed out that, although EPA has ruled favorably on the use of mercurial products in water-based coatings, it is possible that mercury could be banned in the future. This has caused the study of a variety of both mercurial and nonmercurial candidates in protective coatings or products used to make protective coatings. This study included evaluation of: (1) A series of four latex paints tested for in-can preservation, (2) A corrosion-resistant baking primer tested for susceptibility to in-plant contamination, (3) A clay slurry contaminated with a sulfur-reducing bacterium, and (4) Antibacterial and mildew requirements for interior application of a water-based vinyl adhesive. Conclusions were drawn from these studies comparing performance of the chemically identified mercurial and nonmercurial candidates. Effectiveness was compared both on percentage used and cost per gallon, said Mr. Machemer.

Q. You did not comment on other formulation variables. What effect has pH variation on the effectiveness of the bactericides?

A. At low pH, such as 5 or below, formaldehyde releasing agents break down on storage and become ineffective. Surfactants can affect control. Point of addition is important; e.g. volatility influenced by heat. Pigment dispersions sometimes have an adsorption characteristic to be considered. Cardinal rule is to add mercury in initial water phase to sterilize subsequent ingredients as added. Some nonmercurial candidates must be handled differently.

Q. The reproducibility of biological tests is very limited. How many tests were run to arrive at your conclusion?

A. Do not agree in the sense that all results are unreliable. Our method of test for in-can preservation has developed

reliable recommendations. However, the petri-dish test for exterior mildew control is unreliable.

Q. You mentioned papers dealing with phenolic preservatives and others. Were these compared in effectiveness with the mercurials?

A. These papers were published in Volume 20 of the Society for Industrial Microbiology. They concerned the chemistry, not application.

Q. Is the Amino Methyl proposal used in the Clay Slurry study, FDA approved?

A. No.

Q. As a general rule should not mercurial and nonmercurial (or nonsoluble mercurial compounds) prove most effective in protecting the hydrophobic/hydrophylic incredients of a system?

A. I do not know. Anytime water is added, the possibility of microbiological attack is increased.

EARL B. SMITH, *Secretary*

New England — Sept. 17

Donald Aikman, of the D.H. Litter Co., and Monica Squires, of Tenneco Chemicals, Inc., presented President Robert G. Modrak, of Benjamin Moore & Co., with the Tenneco gavel. President Modrak presented the Past President's pin to Daniel Toombs, of Lukens Chemical Co.

Other officers for 1981-82 include: Vice-President—John Fitzwater, Polyvinyl Chemical Co.; Secretary—N. Bradford Brakke, Lilly Chemical Products; Treasurer—Fran Koebert, Kyanize Paint Co.; and Society Representative—Daniel Toombs.

Professor Steven Driscoll, of the University of Lowell, presented "PRACTICAL APPLICATIONS OF COATINGS/FLUIDS RHEOLOGY."

A brief background of rheology was given by Professor Driscoll. He defined it as the study of deformation and flow of material, the mechanics of deformable bodies, and the internal response of materials to a force.

Emphasis was placed on the steady state and dynamic state of viscoelasticity and the necessity of being able to determine both. Most of the common methods used in coatings give only the steady component and do not measure the elastic component, therefore, the researcher gets only part of the story, according to Prof. Driscoll.

Some of the effects of time on viscoelasticity (heavy rate dependency), the effects of molecular weight distribution, and the effects of molecular configuration on rheological properties were discussed by Prof. Driscoll. He explained that a high shear rate process is often controlled by low shear rate phenomenon, therefore, the whole picture is not visible unless the total viscoelastic behavior can be measured.

Equipment and examples of practical applications in the plastics field were discussed. Prof. Driscoll provided information to help the paint chemist see possible applications for the technique in the organic coatings field.

N. BRADFORD BRAKKE, *Secretary*

Mexico Society Officers for 1981-82. Seated left to right: Past-President—Rogelio Cuellas; President—Salvador Gallardo; Vice-President—Mauricio Esquivel; and Society Representative—Antonio Pina. Standing left to right: Membership Chairman—George Carrington; Treasurer—Pedro Romero; Secretary—Teresa Suarez; By-Laws Chairman—Jose A. Herrera; and Educational Chairman—Roberto Garcia

New England — Oct. 15

"ADVANCES IN WATER-BASED ACRYLIC MAINTENANCE PAINT FORMULATION" was presented by David Watson, of Rohm and Haas Co.

Mr. Watson gave a brief survey of the early difficulties with water-borne paints in the area of maintenance coatings. One very large drawback, according to Mr. Watson, was the poor rheology control of the time.

Slides illustrated latex maintenance coatings in service. Mr. Watson noted that latex topcoats over zinc rich primers actually outperformed all alkyd systems.

Mr. Watson pointed out that application temperature and film thickness were critical in the performance of latex maintenance coatings. He explained the problem of "early rust" and "flash rust." Early rust was defined as a rust surface stain that occurs after application and after the film is dry-to-touch. It occurs through multiple coats of paint over a ferrous substrate. Flash rust was defined as the rust surface stain that occurs during the drying of the first coat applied over a ferrous substrate. According to Mr. Watson, both conditions are intensified by thin films and low curing temperatures. Early rust and flash rust are worse over white blasted steel than over minimally prepared steel.

Several key points to good performance of latex maintenance coatings were listed: (1) Use of corrosion inhibitive pigments of high solubility (zinc oxide was found to be crucial to good corrosion resistance), (2) Use of a vehicle system eliminating the water sensitive components; e.g., replace glycols with glycol ethers that are good coalescing agents but that are still fugitive enough to get out of the film, (3) Use an alkyd modifier (up to 20% of the binder), (4) Use a specific flash rust inhibitor such as sodium nitrite, and (5) Use of a rheology modifier to insure adequately thick films.

The importance of rheology modifiers was stressed by Mr. Watson since they help to get rid of pinholes and allow thicker films to be formed for maximum protection of the substrate.

Q. What effect does high humidity have on the drying of these coatings?

A. The most critical condition to be aware of is the dew point. Flash rust is the thing to look for and try to avoid at this point. These coatings dry quite well in high humidity above the dew point.

Q. What kind of primer is recommended, zinc rich or organic types?

A. Latex maintenance coatings have been used successfully over both types.

Q. Is there a particular problem with flash rusting over pre-rusted steel?

A. Actually, there are fewer problems over old substrates. The most sensitive surface is a white metal blasted surface.

Q. What are the pros and cons of alkyd modification?

A. Most formulas for heavy and medium duty maintenance coatings are alkyd modified. It improves the adhesion and blister resistance.

Q. Does the alkyd significantly improve the alkali resistance?

A. There doesn't seem to be enough present to help or hinder. You may want to leave the alkyd out over a zinc rich primer.

Q. Could you comment on dispersants?

A. Those that seem to be stable with reactive pigments give horrible salt spray resistance. We have developed a new dispersant that is stable with reactive pigments and gives good salt spray results. (The speaker did not mention the type.)

Q. What is the coating solids?

A. Usually in the low 40% range with a relatively low PVC to get a good, cohesive film.

N. BRADFORD BRAKKE, *Secretary*

New York — Oct. 13

Vito Altivilla, of Lorcon Chemicals, spoke on "A CHEMICALLY MODIFIED POLYSACCHARID RESIN MODIFIER."

According to Mr. Altivilla, the new resin modifier can be used for partial replacement of either alkyd or vinyl acrylic latexes. He stated that its advantages included better adhesion, nonyellowing, and better gloss retention. Uses of the resin modifier are in trade sales paints, for exterior wood finishes, and interior floor finishes, said Mr. Altivilla. In trade sales paints, one can replace from 30% in high glosses to 60% in flats, based on the vehicle solids. These resins also develop clear formulations for both exterior wood finishes and interior floor finishes depending on the phthalic content of the alkyd. Other products areas include dry red oxide primers and machinery enamels, said Mr. Altivilla.

Limitations of the resin modifier, according to Mr. Altivilla, are its reactions with magnesium silicate and silicone additives, which cause cratering. Caster oil derivatives cause uncontrollable viscosities, said Mr. Altivilla.

Water-based cobalt was suggested as a drier along with standard calcium drier, since it is not subject to biological attack. Mr. Altivilla recommended normal levels of biocides and fungicides to be used to protect the rest of the paint.

HERB ELLIS, JR., *Secretary*

Philadelphia — Oct. 6

Honored guests included Federation Executive Vice-President, Frank Borrelle and Director of Field Services, Thomas Kocis.

Joseph Kettenacker, of Ciba-Geigy Corp., presented "COLORANT FORMULATION—PIGMENT SELECTION."

Selecting pigments for a color match or replacing a single pigment in a designated formula is not an exceedingly difficult task, according to Mr. Kettenacker. However, when faced with the replacement of a colorant in several thousand formulations or in initial formulations where the desire is to optimize pigment usage, the task is more difficult and one needs to consider the tools available for pigment selection, said Mr. Kettenacker.

Spectrophotometric curve interpretation, chromaticity diagram analysis, optical considerations, and other criteria were reviewed as methods for pigment selection. These objective assessment tools can be used not only for screening potential pigments, but also for optimizing formulations for production control, explained Mr. Kettenacker. Applied colorimetry, coupled with appropriate criteria can be used to form a logical basis for screening and formula optimization, said Mr. Kettenacker.

RALPH MYERS, *Secretary*

Piedmont — Oct. 21

Andrew Ridell, of Ransburg Equipment Co., gave a talk entitled "ELECTROSTATIC SPRAYING OF WOOD FINISHES."

The use of electrostatic spraying is gaining increased acceptance in the furniture industry, said Mr. Ridell. This method gives the user two advantages over other paint application systems: (1) economic—lower paint usage and reduction in number of operators, and (2) regulatory—less hazardous waste paint to dispose of and lower concentration of air emissions.

According to Mr. Ridell, the mechanism of operation is to atomize the paint, apply an electric charge, and direct towards a conductive target. Paint is atomized when it is thrown by centrifical force from the edge of a rapidly spinning metal disk having a constant electric potential between 65,000 and 90,000 volts at very low amperage. The flow rate to the disk center is 250 to 350cc/min at a low viscosity and slow flash time. The target wooden furniture piece is place 12" to 14" from the disk and made conductive through the use of commercial sensitizers and humidity chambers, explained Mr. Ridell.

Q. What is the optimum voltage setting?

A. For electrostatic hand guns—65,000 volts while bell and disk units operate at 90,000 volts.

J.E. HUSTED, *Secretary*

Pittsburgh — Oct. 5

Russell R. Koch, of Universal Color Dispersions, presented a talk on the "WONDERFUL WORLD OF COLOR."

Color is in nature, in our jobs, and everywhere, with paint supplying much of the color for the world, said Mr. Koch. There are approximately 24 different colors available in dispersions with 11 generic types of resin available. To have all of these available, explained Mr. Koch, you would need a total of 264 shading bases in a paint plant. Many of these would be used frequently, some seldom, and a few never. Mr. Koch said that the same sensible way to make paint and profit is through universal color dispersions.

Good pigment dispersion requires good technology to insure compatibility of the resin used in the dispersion to the paint resin, said Mr. Koch. Quality control is needed to get equal color strength and identical types of pigments.

Universal color dispersions utilize the full strength of the color. They can save time and labor in making the paint so that more batches can be made daily. The cost of inventory is reduced and there are not partially open bags, this reduces the dust problem. According to Mr. Koch, capital is saved because you do not need equipment to make the dispersion. This capital could then be used for plant expansion. The professional lab people can utilize their time better formulating new paints instead of color dispersions. This means more paint formulas and greater opportunities for sales, said Mr. Koch. Making your own color dispersions means more wash water and disposal problems. Cost of disposal is now a significant factor.

There are three ways to use universal color dispersions, explained Mr. Koch. You could shade partially colored batches, shade white bases, or use clear bases. The most economical way is to use universal color dispersion in white bases, he added.

MICHAEL GILLEN, *Secretary*

Rocky Mountain — Oct. 12

William E. Machemer, of Troy Chemical Corp., spoke on "THE USE OF MERCURY IN PROTECTIVE COATINGS."

DONALD SHILLINGBURG, *Secretary*

Future Society Meetings

Birmingham

(Feb. 4)—"Recent Developments in the Use of Nickel and Chrome Titanium Pigments in Surface Coatings"—Mr. Kelch, BASF UK Ltd.

(Feb. 26)—Annual Ladies Night.

(Mar. 4)—"Wetting and Dispersing Agents for Non-Aqueous Systems"—Mr. Quednau, Byk-Mallinckrodt Chem. Prod. GmbH, Ltd.

(Apr. 1)—"Coping With Uncertainty in Business"—L.N. Sneddon, Sundridge Park Management Center.

(May 6)—"Comparison of Exposure Test Methods"—Speaker from Hoechst UK Ltd.

Chicago

(Feb. 1)—"High Solids Vinyl Resins"—Speaker from Union Carbide Corp., and "High Solids Reactive Coatings"—Dr. L.W. Hill, Monsanto Co.

(Mar. 1)—"Anatomy of a Latex Paint"—Dr. L.R. Freimiller, Rohm and Haas Co., and "Gloss Latex Paints"—J. Bax, Pacific Scott Bader Co.

(Apr. 5)—"Technical Eeffectiveness"—E.B. Euchner, SCM Corp., and "Stress Management"—Mel Clapp, Cities Service.

Cleveland

(Jan. 21)—Joint Meeting with Cleveland Paint & Coatings Association. Speaker Royal A. Brown, National Paint & Coatings Association.

(Feb. 16)—Joint Meeting with National Association of Corrosion Engineers. "Statistical Analysis and Experimental Design for Coatings Chemists"—Earl Hill, Lord Corp. "Polyurethane Coatings for Heavy Duty Maintenance"—Richard Hergenrother, Mobay Chemical Co.

(Mar. 16)—Mini-Symposium on High Solids. "Versatility of High Solids Industrial Coatings"—Rich Johnson, Cargill, Inc. "Design Considerations for High Solids Reactive Coatings"—Dr. Loren W. Hill, Monsanto Plastics and Resins Co.

(Mar. 23-24)—25th Symposium on Advances in Coatings Technology.

(Apr. 20)—Plant Tour.

(May 18)—60th Anniversary of Federation Membership. Past Presidents and Spouses' Night.

Dallas

(Feb. 11)—Ladies' Night.

(Mar. 11)—"Optimizing Resins and Solvents for Low VOC High Solids Coatings"—Steve Belote, Eastman Chemical Co.

(May 13)—"Anatomy of an Emulsion Polymer"—Benjamin Kine, Rohm and Haas Co.

Golden Gate

(Jan. 18)—"Hydrophobic Fumed Silicas for Coatings"—Terry Bowerman, Degussa Corp.

(Feb. 15)—"Animation Magic—The Part Paints Play"—Ron Stark, International Animated Film Society.

(Mar. 15)—"The Unique Properties of Ultra-Fine Silica"—John C. Becker, Jr., Omya, Inc.

(Apr. 19)—"Hazardous Waste Disposal"—Michael L. Markowitz, Rollins Environmental Services of Texas, Inc.

(May 17)—"New Developments in Sandmill Dispersions Technology"—Ronald E. Swett, Moorehouse Industries, Inc.

(June 14)—"Compliance Solvents for Industrial Coatings"—Violete Stevens, Dow Chemical Corp.

Houston

(Feb. 13)—Ladies' Night.

(Mar. 10)—"Optimizing Resins and Solvents for Low VOC High Solids Coatings"—Steve Belote, Eastman Chemical Products, Inc.

(May 12)—"Anatomy of an Emulsion Polymer"—Benjamin Kine, Rohm and Haas Co.

Los Angeles

(Feb. 10)—Ladies Night. "Animation Magic—The Part Paints Play"—Ron Stark, International Animated Film Society.

(Mar. 10)—"Unique Properties of Ultra Fine Silica"—John C. Becker, Jr., Omya, Inc.

(Apr. 14)—"Hazardous Waste Disposal"—Michael L. Markowitz, Rollins Environmental Services of Texas, Inc.

(May 12)—"New Developments in Sandmill Dispersion Technology"—Ronald E. Swett, Moorehouse Industries.

(June 9)—"Compliance Solvents for Industrial Coatings"—Violete Stevens, Dow Chemical Corp.

Montreal

(Feb. 3)—"The Paint Business—A Challenge or A Dead End"—Jacques Mayer, International Paints.

(Mar. 3)—Joint Meeting with Quebec Paint Industry Association (AQIP).

(Apr. 7)—Manufacturing Committee Presentation.

(May 5)—"The Purchasing, Sales Interface"—John Humfreys, Sherwin-Williams Co., and Paul Rheaume, NL Chemicals, Canada, Inc.

Northwestern

(Feb. 2)—"Pigment Dispersion and the C.P.V.C."—R.I. Ensminger, NL

Toronto Society 1981-82 Executive Committee. Standing left to right: Ernie Humberger—Metric; Steve Balmer—Environment; Jan Grodzinski—Past-President; Andy Jones—Montreal Liaison; Larry Ham—Publicity; Ray Reynolds—Manufacturing; Kurt Weitz—Council Representative; and Stamatis Kambanis—Technical. Seated left to right: Frank Reckless—By-Laws and Specifications; Rob Kuhnen—Secretary; Peter Hiscocks—Treasurer; Frank Laroche—President-Elect; Paul Cooper—President; Dave Prince—Entertainment; and Ted Stevenson—Membership

Chemicals/NL Industries, Inc. "FACTORS GOVERNING TINTER PERFORMANCE"—F.K. Daniel, Elio Cohen, and Mike Frantz, Daniel Products Co.

(Apr. 6)—FEDERATION VISIT.

(May 5)—MANUFACTURING SEMINAR.

Piedmont

(Jan. 20)—"ENVIRONMENTALLY ACCEPTABLE AND ENERGY EFFICIENT EPOXY RESIN COATINGS"—Dr. Ron Bower, Shell Development Co.

(Feb.)—JOINT DINNER/DANCE with Piedmont Paint & Coatings Association.

(Mar. 17)—"COMPLIANCE—SOLVENT OPTIONS"—Speaker from Dow Chemical Corp.

(Apr.)—JOINT MEETING with Virginia Section.

(May 20)—"COMPUTER SELECTION OF SOLVENT BLENDS"—Dr. Albert Rocklin, Shell Development Co.

(June 16)—"ECONOMIC RECOVERY OF SOLVENT VAPORS"—Larry J. Durr, DCI Corp.

Pittsburgh

(Feb. 1)—"SURFACE TENSION/WETTING"—Dr. George Gerhardt, Mobil Chemical Co.

(Mar. 1)—"THE WHYS AND WHEREFORES OF CARTRIDGE FILTRATION IN THE COATINGS INDUSTRY"—Donald S. Onnen, AMF Cuno Div.

(Apr. 5)—"ENVIRONMENTAL UPDATE"—Dr. Hugh M. Smith, Sun Chemical Co.

(May 3)—"DESIGN CONSIDERATION FOR HIGH SOLIDS REACTIVE COATINGS"—Dr. Loren W. Hill, Monsanto Plastics and Resins Co.

Rocky Mountain

(Mar. 8)—"THE UNIQUE PROPERTIES OF ULTRA FINE SILICA" John C. Becker, Jr., Omya, Inc.

(Apr. 12)—"HAZARDOUS WASTE DISPOSAL"—Michael L. Markowitz, Rollins Environmental Services of Texas, Inc.

(May 10)—"NEW DEVELOPMENTS IN SANDMILL DISPERSIONS TECHNOLOGY"—Ronald E. Swett, Morehouse Industries.

(June 7)—"COMPLIANCE SOLVENTS FOR INDUSTRIAL COATINGS"—Violete Stevens, Dow Chemical Co.

St. Louis

(Jan. 19)—EDUCATION NIGHT. Coordinator Dr. Herman Lanson, LanChem Resins Corp.

(Feb. 16)—VALENTINE'S NIGHT and Federation Visit.

(Mar. 16)—"MICROBIOLOGICAL SPOILAGE OF LATEX EMULSIONS, CAUSES, AND PREVENTION"—John A. Jakubowski, Merck and Co.

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Eudowood Gardens, Towson). JOSEPH D. GUISTO; Lenmar, Inc., 150 S. Calverton Rd., Baltimore, MD 21223.

BIRMINGHAM (First Thursday—Calthorpe Suite, Edgbaston). D. H. CLEMENT, Holden Surface Ctgs. Ltd., Bordesley Green Rd., Birmingham B9 4TQ, England.

CHICAGO (First Monday—meeting sites in various suburban locations). JOHN R. INGRAM, DeSoto, Inc., 1700 S. Mt. Prospect Rd., Des Plaines, IL 60018.

C-D-I-C (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; Nov., Feb., in Dayton). ROBERT A. BURTZLAFF, Potter Paint Co. of Ind., P.O. Box 265, Cambridge City, IN 47327.

CLEVELAND (Third Tuesday—meeting sites vary). DONALD C. DENISON, JR., Hilton Davis Chemical Co., 5254 Berkshire Dr., N. Olmsted, OH 44070.

DALLAS (Thursday following second Wednesday—Steak & Ale Restaurant). T. LEON EVERETT, Dan-Tex Paint & Ctg. Mfg., Inc., P.O. Box 18045, Dallas, TX 75218.

DETROIT (Fourth Tuesday—meeting sites vary). SHEILA G. DRAKE, Wyandotte Paint Products, Inc., 650 Stephenson Hwy., Troy, MI 48084.

GOLDEN GATE (Monday before third Wednesday—Alternate between Sabella's Restaurant on Fisherman's Wharf and the Sea Wolf at Jack London Square, San Francisco). KEN E. TRAUTWEIN, Sherwin-Williams Co., P.O. Box 23505, Oakland, CA 94623.

HOUSTON (Second Wednesday—Sonny Look's, South Main). GEORGE SCHWARTZ, Cook Paint & Varnish Co., P.O. Box 3088, Houston, TX 77001.

KANSAS CITY (Second Thursday—Cascone's Restaurant). MEL BOYER, Patco Coatings Products, 3947 Broadway, Kansas City, MO 64111.

LOS ANGELES (Second Wednesday—Steven's Steak House). EARL SMITH, Spencer Kellogg Div., Textron, Inc., P.O. Box 7205, Long Beach, CA 90807.

LOUISVILLE (Third Wednesday—Hasenour's Restaurant). E. D. THOMASSON, Louisville Varnish Co., 1400 Maple St., Louisville, KY 40207.

MEXICO (Fourth Thursday—meeting sites vary). TERESA SUAREZ, Sherwin-Williams Co., Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Bill Wong's Restaurant). ERIC TEMPLETON, NL Chemicals Can., Inc., 2140 Sun Life Bldg., Montreal, Que., Can., H3B 2X8.

NEW ENGLAND (Third Thursday—Fantasia Restaurant, Cambridge). N. BRADFORD BRAKKE, Lilly Chemical Products, P.O. Box 188, Templeton, MA 01458.

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

NORTHWESTERN (Tuesday after first Monday—Edgewater East Restaurant). HERBERT DAVIDSON, Spencer-Kellogg Div., Textron, Inc., 525-25th Ave. S.E., Minneapolis, MN 55414.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). WILLIAM SHACKELFORD, Gaco-Western, Inc., P.O. Box 88698, Seattle, WA 98188.

PHILADELPHIA (Second Thursday—Valle's Steak House). RALPH MYERS, Del Vac Ink & Color Co., 1301 Taylors Ln., Riverton, NJ 08077.

PIEDMONT (Third Wednesday—Howard Johnson's Coliseum, Greensboro, NC). JAMES E. HUSTED, Mobil Chemical Co., P.O. Box 2438, High Point, NC 27261.

PITTSBURGH (First Monday—Skibo Hall, Carnegie Mellon Univ.). MICHAEL GILLEN, Van Horn, Metz & Co., Inc., 400 Keystone Dr., Carnegie, PA 15106.

ROCKY MOUNTAIN (Monday following first Wednesday—Gusthaus Ridgeview, Lakewood, CO). DONALD SHILLINGBURG, Union Chemical Div. of Union Oil, 1535 W. 13th Ave., Denver, CO 80204.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant). ROBERT J. GIERY, Spatz Paint Industries, Inc., 1601 N. Broadway, St. Louis, MO 63102.

SOUTHERN (Gulf Coast Section—Various Dates; Central Florida Section—Third Thursday after first Monday; Atlanta Section—Third Thursday; Memphis Section—Second Tuesday; Miami Section—Tuesday prior to Central Florida Section). J.E. GEIGER, Sun Coatings, Inc., 12295 75th St., N., Largo, FL 33540.

TORONTO (Second Monday—Mayfair Restaurant). R. KUHNEN, Tioxide Canada, Inc., 1 Eva Rd., Etobicoke, Ontario, Canada M9C 425.

WESTERN NEW YORK (Third Tuesday—Lord Amherst Restaurant, Williamsville, NY). MICHAEL C. KAUFMAN, Bisonite Co., Inc., P.O. Box 84, Kenmore St., Buffalo, NY 14217.

Elections

C-D-I-C

Active

COCUZZI, DAVID A.—Hanna Chemical Coatings Corp., Columbus, OH.
MARMANDE, EMILE—Perfection Paint Co., Indianapolis, IN.
PILCHER, GEORGE R.—Hanna Chemical Coatings Corp., Columbus.
SUEVER, ANTHONY R.—ASARCO Inc., Columbus.
SUNDERMAN, DEXTER—Hanna Chemical Coatings Corp., Columbus.
UNDERWOOD, VIRGIL E.—Lilly Industrial Coatings, Indianapolis, IN.
WEIHRAUCH, BRUCE W.—Hanna Chemical Coatings Corp., Columbus.

Associate

GILLIS, TERESA M.—Rohm and Haas Co., Cincinnati, OH.

CHICAGO

Active

CULHANE, WILLIAM J.—Sherwin-Williams Co., Chicago, IL.
FREEMAN, RICHARD A.—Federated Paint Mfg. Co., Chicago.
HARLEY, ROGER H.—Cellofilm Corp., Chicago.
HAUGEBERG, THOMAS M.—United States Gypsum Co., Des Plaines, IL.
KIEKOW, MICHAEL J.—W.C. Richards Co., Blue Island, IL.
KIRBY, JAMES A.—Sherwin-Williams Co., Chicago.
LEDFORD, JOHN M.—Midland Div., Dexter Corp., Waukegan, IL.
SHARP, LOUIS J.—Midland Div., Dexter Corp., Waukegan.
TIMMERMAN, PAUL J.—Midland Div., Dexter Corp., Waukegan.
WAIDZUNAS, PAUL C.—Midland Div., Dexter Corp., Waukegan.
YOUSUF, MOHAMMED K.—Cargill, Inc., Carpentersville, IL.

Associate

BARONE, GLENN S.—Hercules Incorporated, Oak Brook, IL.
BLACKWELL, STEPHEN C.—Inmont Corp., Chicago, IL.
DIEHL, JACK—Columbian Chemicals Co., Itasca, IL.
KEMMERER, GAIL, JR.—Spencer Kellogg, Div. of Textron, Inc., Des Plaines, IL.
SULLIVAN, TIMOTHY G.—Cellofilm Corp., Argo, IL.
TARRANT, JOHN M.—Spencer Kellogg, Div. of Textron, Inc., Des Plaines, IL.

NEW YORK

Active

AMRICH, GEORGE M., JR.—Benjamin Moore & Co., Newark, NJ.
BAUMAN, MOE—Bauman & Co., Inc., Livingston, NY.
CONSIDINE, WILLIAM J.—Ciba-Geigy Corp., Ardsley, NY.
ENGEL, WALTER D.—Kirker Chemical Co., Paterson, NJ.
GILCHRIST, THOMAS—Kosan Industrial Corp., Long Island City, NY.
HIMICS, RICHARD J., DR.—Daniel Products Co., Jersey City, NJ.
JAMIL, MUHAMMAD—Hempel's Marine Paints, Wallington, NJ.
KUSTOFF, MORRIS—Consultant, Flushing, NY.
LIBERTI, FELIX P.—Koppers Co., Newark, NJ.
MCADAMS, LOUIS V.—Ciba-Geigy Corp., Ardsley, NY.
MEHTA, ASHOK K.—NL Industries, Inc., Hightstown, NJ.
MINEROWICZ, JOHN P.—International Paint Co., Union,NJ.
NEWFIELD, BERNARD—Proco International, Newark, NJ.
PLATT, DAVID—Rulbo Sales Inc., Bloomfield, NJ.
PONT, J.D.—International Paint Co., Inc., Union, NJ.
PROCTOR, ROBERT—Chemray Coatings Inc., Middlesex, NJ.
ROSENTHAL, JAMES—Magnet Paint Co., Brooklyn, NY.
TINELLO, VINCENT J.—NL Industries Inc., Perth Amboy, NJ.
ULLAH, SADAT M.—Pyramid Paint Prod., Inc., Brooklyn, NY.
VISO, JOSEPH—Daniel Products Co., Jersey City, NJ.

Associate

JORDAN, JAMES J.—BASF Wyandotte Corp., Parsippany, NJ.
LEAHEY, MICHAEL J.—Peltz Rowley Chemical Co., Wayne, NJ.
RETTANO, PHILIP A.—Kay-Fries Ind., Montvale, NJ.
SMERAK, LANCE P.—Mobay Chemical Corp., Hawthorne, NJ.
WANDERMAN, EDWARD M.—Proco International Ltd., Newark, NJ.

NORTHWESTERN

Active

ALM, ROGER R.—3M Co., St. Paul, MN.
HUBER, BARBARA L.—Valspar Corp., Minneapolis, MN.
OSTROWSKI, JOHN S.—Valspar Corp., Minneapolis.

Meetings/Education

Innovations in Coatings Seminar Sponsored by UMR, Feb. 10–11

A two-day seminar on "Stimulating Innovation in Coatings R & D Laboratories" will be offered by the University of Missouri-Rolla February 10–11 at the Bahia Mar Hotel and Yachting Center, Fort Lauderdale, FL.

The course will be of special interest to product development research managers, coatings research and development personnel, manufacturing and engineering managers, process engineers, market managers and sales managers. Designed to help improve research productivity, the seminar will teach participants how to use their resources to produce innovative coatings sooner and more profitably.

Topics to be discussed are: how to innovate in difficult times; incentives for innovation; how to increase innovative productivity by using an innovation index model; design of a motivation/innovation improvement plan; and time management. There will be group participation, and private consultations with course instructors.

Guest lecturers include Milton A. Glaser, Consultant to industry and government on innovation, and Jack McDade, Group Training Manager, 3M Education, Training and Development. John A. Gordon Jr., of UMR coatings continuing education and lecturer in chemistry, is course director.

Fee for the seminar is $425 per person and includes all classroom materials.

For additional information contact Norma Fleming, Arts and Sciences Continuing Education, G-7A Humanities-Social Sciences, University of Missouri-Rolla, Rolla, MO 65401, (314) 341-4201.

Pacific Northwest Society to Hold Annual Symposium May 6–9

The annual symposium sponsored by the Pacific Northwest Society for Coatings Technology has been scheduled for May 6–9 at the Bayshore Inn, Vancouver, B.C. The society will be celebrating its 35th anniversary.

Thursday, May 6 will begin with a social event, while Friday and Saturday will be devoted to technical sessions and the annual meeting. Also on Saturday, the international competition prior to the banquet and installation of officers will be held.

For additional information, contact Barry Lamb, Harrisons & Crosfield, Ltd., 810 Derwent Way, New Westminster, B.C. V3M 5R1.

CALL FOR PAPERS

International Symposium on Adhesive Joints: Their Formation, Characteristics, and Testing
Kansas City, MO
September 12–17, 1982

The Symposium, to be held at the American Chemical Society's meeting, will provide a forum for discussing the latest developments, identifying areas which need intensified R&D activity, and cross-pollination of ideas. The technical program will contain both invited and contributed papers, which will be of both overview and original research in character, and it is planned to chronicle the proceedings in an easily accessible volume. The invited speakers have been selected to represent widely differing disciplines and interests from academic, governmental, and industrial research laboratories.

Papers related to the following topics are being solicited: surface cleaning, preparation, and modification for adhesive bonding; contact angle, wettability and adhesive joint strength; understanding of interfacial interactions and their relevance to joint strength; ways to improve joint strength; bond durability; characterization of adhesive joints; testing of adhesive joints; and fracture behavior of adhesive joints.

All inquiries should be addressed to: Dr. K.L. Mittal, Symposium Chairman, IBM Corp., Building 300-40E, Hopewell Junction, NY 12533, 914 897 6630.

"Profitable Painting" Seminar Offered by UMR, Jan. 18–22

The University of Missouri-Rolla will offer a week-long seminar entitled "Profitable Painting in a Tough Market" beginning January 18 at the Astro-Village Hotel, Houston, TX.

The course is designed to help painting contractors operate a more profitable business in today's economy. Participants will learn how to motivate their staff to sell the job, avoid legal problems, eliminate costly estimating mistakes, and identify new markets.

John Gordon, Jr., of UMR coatings continuing education, and John Cleveland, Editorial Director of the American Painting Contractor and Decorating Products World Magazine, are directors for the seminar.

Fees are structured to allow individuals to attend as many days as they wish. Fee for the five days is $550; four days, $540; three days, $430; two days, $290; and one day, $150.

For additional information, contact Norma Fleming, Coordinator, Arts and Sciences Continuing Education, G-7A Humanities-Social Sciences Bldg, UMR, Rolla, MO 65401, 314-341-4202.

O.C.C.A. Australia Makes Plans For 25th Convention in 1983

The Oil and Colour Chemists' Association Australia will hold their Silver Jubilee Convention with Exhibition at the Southern Cross Hotel, Melbourne, Australia from September 28 through October 1, 1983.

On Wednesday, September 28, the Exhibition will open and delegates can register. Thursday, Friday, and Saturday will be devoted to lectures featuring technical and commercial subjects. Saturday, October 1, will close the convention and exhibition with the association's official dinner. An interesting and informative social program will be arranged for ladies attending.

CALL FOR PAPERS

ASTM Symposium On "Fire Resistant Coatings: The Need for Standards"

Philadelphia, Pennsylvania October 18, 1982

A call for papers is issued for "Fire Resistant Coatings: The Need for Standards" symposium, sponsored by the American Society for Testing and Materials' Committee E-6 on Performance of Building Constructions and its Subcommittee E06.21 on Serviceability.

The objective of this one-day symposium is to present state of the art developments in direct applied fire resistant coatings, such as sprayed or towelled. Specifically included are mastic materials, cement types, cementitious and plasters containing lightweight mined aggregates or processed fibers, and mineral fiber materials. Papers addressing what is needed in the way of standards to improve building performance in these areas are encouraged.

Prospective authors are requested to submit a title, three copies of a one-page abstract and an ASTM Paper Submittal Form by February 28, 1982 to Symposium Chairman Dr. Morris Lieff, County College of Morris, Dover, NJ 07801. ASTM Paper Submittal Forms are available from Dr. Lieff or from Kathy Greene, ASTM Publications Div., 1916 Race St., Philadelphia, PA 19103, 215-299-5414.

People

The appointment of **William D. Bren** to the position of Eastern Regional Sales Manager has been announced by the Spencer Kellogg Division of Textron, Inc. Mr. Bren replaces **Gordon F. Greer** who has retired after 34 years of service to the firm. Mr. Bren is a member of the Detroit Society.

Georgia Kaolin Co., Inc., Elizabeth, NJ, has announced the election of **Dr. Jean-Paul Richard** as President and Chief Operating Officer succeeding former President **Edward G. Engel,** who was elected Chairman of the Board, and will continue as Chief Executive Officer.

Midland Division, The Dexter Corp. has announced the following promotions. **Richard E. Caplan** has been named Vice-President, New Products. He previously held the position of Vice-President, Packaging Products. Assuming the responsibility of Marketing Director, Packaging Products, is **Harold T. Crutcher,** formerly Sales Manager of the firm's European operations. **Patricia LaFay** has been promoted to Project Chemist. Ms. LaFay is a member of the Chicago Society.

Joining the Midland Division are **Joyce McFadden** as Senior Analytical Chemist and **Barry Clark** as Senior Coatings Chemist.

John C. Meiman has been appointed Sales Representative by Hammond Lead Products, Inc., Pittsburgh, PA.

The U.S. Paint Division, Grow Group, Inc. has announced the appointments of **Rich J. Liptak** to Great Plains District Sales Manager and **John H. Wilkening** to Western District Sales Manager.

Glidden Chemicals Coatings, SCM Corp., has appointed **Jerry H. Richter,** Product Manager for Interior Panel Coatings.

Several personnel changes have been announced by Glidden Coatings & Resins, SCM Corp. **Roger P. Hall** has been named Manager-Technology, based at the firm's Research Center, Strongsville, OH. **Ronald F. Dieckman** became Resin Materials Manager, Huron, OH. **Peter J. Rocco** was appointed Plant Superintendent, Reading, PA, and **Kennedy O. Quick** was promoted to Southwest Region Plant Manager, based in Carrollton, TX.

W.D. Bren

Dr. J.P. Richard

R.G. Rufe

Dr. R.J. Himics

Hercules Incorporated, Wilmington, DE, has named **Robert G. Rufe,** Product Manager for Pulpex polyolefin pulps. He also continues as Product Manager for Aqualon absorbent fibers. Mr. Rufe is a Philadelphia Society member.

Chemcentral Corp., Chicago, IL, has announced the retirement of **John W. Sampson.** He has been with the firm 32 years, most recently serving as Manager of Marketing Services and has served on the Board of Directors. Succeeding Mr. Sampson is **Lew R. Trice,** formerly Account Manager based in Houston, TX.

The retirement of **Donn Tucker,** General Manager of the Portland, OR operation, was also announced by Chemcentral. **Harry D. Hughes,** Sales Manager based in Los Angeles, CA, will succeed Mr. Tucker.

Recent technical sales representative appointments include **William C. Shearer,** based in Seattle, WA; **Gary W. Rogers,** headquartered in Portland, OR; and **Randall M. Manley,** based in St. Louis, MO.

William E. Flaherty, a former Gulf and Western Industries Executive Vice-President, acquired key assets of the New Jersey Zinc Co., Inc., and became its President and Chief Executive Officer. The team of officers for the reborn company include: **Ira P. Barsky,** Executive Vice-President and Chief Administrative Officer; **William C. Black,** Senior Vice-President, Sales and Marketing; **Walter C. Bladstrom,** Senior Vice-President, Finance; and **David O. Carpenter,** Vice-President, Assistant to the President, and Secretary to the Board of Directors.

Daniel J. Walsh has been named Purchasing Agent for M&T Chemicals Inc., Rahway, NJ.

Daniel Products Co. has appointed **Dr. Richard J. Himics** to the newly-created post of Vice-President, Diversifications. He will be responsible for expanding the extensive line of pigment dispersions, dispersing agents, and surface modifiers, marketed by the firm.

Gerald L. Metcalf has been appointed Vice-President-Production Pigments/Magnetics by the Minerals, Pigments and Metals Division of Pfizer Inc.

The Valspar Corp. has appointed **Robert C. Erickson** as General Manager, Specialty Products, based in Minneapolis, MN.

The Sherwin-Williams Co. has announced the following organizational changes. **Carl A. Bellini,** President and General Manager of Stores Division, has been promoted to Group Vice-President responsible for the firm's Stores Division and the Gray Drug Stores Division, which includes Drug Fair. Replacing Mr. Bellini is **Richard R. Anglin,** formerly Vice-President-Merchandise/Operations for the Stores Division. **Fred W. Barney** has been promoted to President and General Manager of the Gray Drug Stores Division. He was formerly President and Chief Operating Officer of the Division.

Lynn Dreyer has been appointed Technical Sales Representative for the Pigments Department of Ciba-Geigy Corp., based in Cleveland, OH.

Brian B. Galbraith has been named Manager, Marketing and Long Range Planning, for the Chemical Group at Union Camp Corp., Jacksonville, FL.

The appointment of **Marie O'Brien** as Manager-Marketing Services has been announced by StanChem Inc.

John Blunt has joined Con/Chem, Inc., as Technical Director, based in Los Angeles, CA.

NL Chemicals/NL Industries, Inc. has announced a major reorganization of staff assignments in its U.S. sales and marketing organization. **Daniel B. Robertson** has been appointed Director of Sales, while **Michael J. Kenny** assumes the responsibilities of Director of Marketing and Technical Services. **William A. Kampfer** was named Manager, Sales Development and Coordination.

Other staff changes for the firm include: **George W. Bovenizer,** Eastern Regional Sales Manager; **Leonard C. Komar,** Marketing Manager-Titanium Dioxide Products; and **Robert E. Van Doren,** Marketing Manager-Rheological Additives and Special Coatings Pigments. Mr. Van Doren is a member of the New York Society.

Donald J. Saunders has been named General Manager of Thoro System Products, Miami, FL. He replaces **Phil C. Donnelly** who has retired after 32 years of service with the firm.

PPG Industries, Coatings and Resins Division, has announced the following appointments in their Research and Development Department, Allison Park and Springdale, PA. **Russell E. Boston** has been named Senior Development Associate and **John W. Du** was appointed Development Associate. **Dr. David T. McKeough** was appointed to the position of Senior Research Associate. Named to the position of Senior Development Associate, was **Dr. Raymond S. Stewart.** He is a member of the Pittsburgh Society.

Ernest A. Hahn was appointed Assistant General Manager of Automative Refinishes of PPG Industries' Coatings and Resins Division, Detroit, MI.

Glenn R. Davis has joined The O'Brien Corp. as Quality Assurance Manager at the firm's Baltimore operations. He is a Baltimore Society member.

R.D. Spitz has been named Manager of Applications Development for Cordova Chemical Co., North Muskegon, MI.

Fred F. Boehle, of Boehle Chemicals, Inc., Southfield, MI, has been elected President of the Midwest Chemical Distributors Council and Regional Vice-President of the National Association of Chemical Distributors. He is a member of the Detroit Society.

Philip A. Reitano has been appointed Product Manager, Resins and Plastics, for Kay-Fries, Inc., member of Dynamit Nobel Group. He is a member of the New York and Philadelphia Societies.

Tom Elias has joined Dar-Tech, Inc., Cleveland, OH, as a Sales Representative. He will be responsible for sales in Cincinnati, Dayton, Cleveland, and the Western area of Ohio. Mr. Elias is a member of the Cleveland Society.

Rohm and Haas Co., Philadelphia, PA, has announced the appointment of **Brigitte F. Gervais** as Technical Representative for its Polymers, Resins, & Monomers Business Team. Ms. Gervais will be headquartered in Cleveland, OH.

Perstorp Inc. has announced the appointment of **Sharon M. Wehrle** to the position of Order Processing Coordinator, and **Ann L. Marini** to the position of Administrative Assistant at its Toledo Division, OH.

Obituary

Professor Leo L. Carrick, 92, died in Dodge City, KS, on September 8. He was a pioneer college instructor of Protective Coatings.

Dr. Carrick received his B.S. and M.S. Degrees in Chemistry from Valparaiso University in 1910 and 1911, and a Ph.D from Indiana University in 1922. He began his science teaching career at Princeton Indiana High School and was a student instructor at Indiana University while working on his graduate degrees. In 1920, he joined the faculty at North Dakota Agricultural College, inaugurating a Protective Coatings curriculum. He later became Dean of their School of Chemical Technology. During 1945–59, Dr. Carrick taught at the University of Michigan, and in 1959 became a Professor of Chemistry at Colorado State University.

Dr. Carrick was a consultant in protective coatings and was a member of the American Chemical Society.

Literature

Filtration Handbook

A revised 28-page filtration handbook is available which details filtration basics and optimum techniques for the use of diatomite filter aids. This full-color brochure explains the chemical and physical characteristics of diatomite and the principles behind its use as a precoat and body feed. New additions to the handbook are tables detailing particle size, typical chemical analysis, and an expanded chart of physical properties. Also included are a trouble-shooting chart pinpointing the causes of filtration problems, and a filtration glossary. For a free copy of the handbook, FA-84A, write Johns-Manville, Service Center West, 1601 23rd St., Denver, CO 80216.

Metering Pumps

New precision metering pumps for low volume applications with automated colorant dispensing systems are the subject of recent literature. The pumps, available in air and hydraulic models, enable a dispensing system to dispense colorants in small quantities in a variety of container sizes. For further information, contact Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08540.

APCA Proceedings

The Air Pollution Control Association (APCA) has published a proceedings summary of its 9th Government Affairs Seminar. The topic of the seminar was the National Commission on Air Quality's Report to Congress entitled "To Breathe Clean Air." The 92-page, illustrated publication follows the format of the seminar, dividing the topic into three main areas: Commission Recommendations; Prevention of Signficant Deterioration and Non-Attainment; and Standards, Permitting and Compliance. Also included is the keynote address given by Senator Robert T. Stafford, chairman of the Senate Committee on Environment and Public Works. The publication fee is $5. To obtain a copy, write Publications Dept., APCA, P.O. Box 2861, Pittsburgh, PA 15230-2861.

Catalysts

Literature has been published which features water- and solvent-borne catalysts for the processing of alkyd resins. For technical bulletins and safety data sheets, contact Interstab Chemicals, Inc., Thermoset Process Chemicals, P.O. Box 638, New Brunswick, NJ 08903.

ASTM Publications

ASTM, developers of over 6000 active voluntary consensus standards used worldwide, recently released Part 27 and Part 28 of the *Annual Book of ASTM Standards*. Part 27 contains 224 standards covering paint and testing for formulated products and applied coatings. Featured in Part 28 are 147 standards covering paint-pigments, resins, and polymers. For additional information, write American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

Thickness Gauge

Literature is available describing a new, computerized coating thickness gauge. This digital read-out, microprocessor-based portable coating thickness tester features automatic push-button calibrations, push-button selection for readouts in English and metric scales, and easy and accurate operation. For more information, write Elcometer, Inc., Div. of Elcometer Instruments, Ltd., P.O. Box 1203, Birmingham, MI 48012.

Process Sampler

Literature is available featuring a new, unique process sampler, designed to reduce pollution, increase safety, eliminate spillage, and operate simply and economically. For more information, write Dopak, Inc., 252 Nassau St., Princeton, NJ 08540.

Vinylidene Chloride Copolymers

Literature is available featuring the several unique characteristics of vinylidene chloride copolymers. Described advantages include: their high chlorine content for fire retardant coatings; their ability to act as gas and moisture vapor barriers; and their excellent exterior durability. Coatings based on these copolymers offer flexibility and extensibility. They can be used as coatings for both polystyrene and polyurethan foam, and have the potential to be used as sanitary coatings in food processing plants, as barrier coatings for agricultural use, and as fabric coatings. For information, contact Pacific Scott Bader Inc., 1145 Harbour Way South, Richmond, CA 94804.

Polyurethane Coatings

A six-page brochure is available describing corrosion-control coatings, which have proven durability to withstand harsh environments, abrasion, and impact. The four-color bulletin provides charts on chemical resistance, abrasion resistance, and independent corrosion test data. Selection information for specifying various topcoats and primers is included. For a free copy of the brochure, contact Hughson Chemicals, Lord Corp., P.O. Box 1099, 2000 W. Grandview Blvd., Erie, PA 16512.

Light Booth

Literature has been published featuring a light booth designed to allow visual color matching of materials and to detect the presence of metamerism by providing a variety of controlled light sources within a neutral enclosure. Features, applications, and uses are detailed. For further information, contact Gardner Laboratory Div., Pacific Scientific Co., P.O. Box 5728, 5521 Landy Lane, Bethesda, MD 20014.

Polyvinyl Acetate

A technical paper is now available which compares the performance properties of polyvinyl acetate and styrene butadiene emulsions in paper coatings. The literature details research comparing the two emulsions in a variety of coating properties such as brightness, gloss, pick strength, rub resistance, opacity, ink receptivity, odor, glueability, color rheology, and blister resistance. Specific information is provided about cost comparisons, partial vs complete replacement of styrene butadiene with polyvinyl acetate, compatibility blends, and effect of starch type on polyvinyl acetate substitution. For a free copy of "Polyvinyl Acetate versus Styrene Butadiene in Paper Coatings," contact Air Products and Chemicals, Inc., Market Manager—Coatings, Polymer Chemicals Div., P.O. Box 538, Allentown, PA 18105.

Fluorescent Color

A concise and complete manual featuring fluorescent color has been published. The 28-page bulletin with color guide describes several types of pigments for use in the manufacture of paints, plastics, inks, and coatings. Spectrophotometric data is provided, physical properties of each series of pigment are discussed, and recommendations are made on the preferred pigments to be used in various applications, including typical formulations. Technical bulletin 2001 is available from Day-Glo Color Corp., 4732 St. Clair Ave., Cleveland, OH 44103.

Colorimeter System

A new colorimeter designed to measure extremely small areas for use in the laboratory or for in-plant quality control is discussed in a recent brochure. For more information, write Gardner Laboratory Div., Pacific Scientific Co., P.O. Box 5728, 5521 Landy Lane, Bethesda, MD 20014.

Resin

A new synthetic resin developed for use as a base in the manufacture of paints and other protective coatings is the subject of recently published literature. For more information, write Marketing Dept., Chemical Products Div., Cargill, Inc., Box 5630, Minneapolis, MN 55440.

Instrumental Analyses

West Coast Technical Service Inc. has published a new full color, 16-page catalog describing "Professional and Laboratory Services." Featured in an Instrumental Analyses section are gas and liquid chromatography, mass spectrometry, combined GC-MS, infrared, and thermal analyses. Other sections describe services provided in the areas of environmental analyses, industrial hygiene, polymers, gas analyses, electronic microcircuits, and trace metals analyses. Also offered is a supplement featuring a listing of cost information for most types of analyses. For additional information, write WCTS, 17605 Fabrica Way, Cerritos, CA 90701.

Attritor

Literature is available featuring an attritor, designed specifically for dry grinding metal powders and metal oxides and for grinding dispersion strengthened metals. For information, contact Union Process Inc., 1925 Akron-Peninsula Rd., Akron, OH 44313.

Surfactants

A product list is now available which describes 16 different surfactants and also provides chemical descriptions and details specific applications for each product. For a free copy, contact Air Products and Chemicals, Inc., Performance Chemicals Div., P.O. Box 538, Allentown, PA 18105.

Preservative

Literature is available featuring a new liquid organic industrial preservative for use in protecting resin emulsions, adhesives, dispersed colors, and cutting oils against bacterial deterioration. For information, write Cosan Chemical Corp., Carlstadt, NJ.

Hydrophobic Fumed Silica

Two technical booklets describing a unique hydrophobic fumed silica are now available. Technical bulletin No. 6, "Hydrophobic Aerosil, Manufacture, Properties, and Applications," features methods of manufacture, analytical data, surface characteristics, and behavior characteristics in water and organic liquids. In addition, the 16-page booklet discusses the product's use in coatings, silicone rubber, joint sealing compounds, printing inks, powders, and silica gel greases. Physiological information and physico-chemical data are also presented. Technical bulletin No. 18, "Special Effects When Using Aerosil in Coating Systems," includes sections on the product's use as a suspending agent, corrosion inhibitor, and thixotropic agent. Charts outline important toxicological and physico-chemical data. Booklets may be obtained by writing, Pigments Div., Degussa Corp., Rt. 46, Hollister Rd., Teterboro, NJ 07608.

Letters

(Continued from page 109)

Committees of each Constituent Society will have much expertise to contribute. I would be happy to provide copies of the draft standards and further information to the Technical Committees and other Federation members.

I am happy to see Mr. Jerome urging members of the Federation to draw up minimum performance standards for paint. I believe that such standards will boost paint's image in the mind of the user, and will provide benefits to manufacturer, retailer, and purchaser alike.

ROBERT F. BRADY, JR.
Chief, Paints Branch,
Federal Supply Service
General Services Administration
Washington, D.C.

Vice-Chairman,
ASTM Subcommittee D1.41

(Mr. Brady is a member of the Federation from the Baltimore Society.)

[At its October 27 meeting in Detroit, the Federation's Board of Directors endorsed the concept of the Southern Society's intended series of brochures on "Consumer Guide to Trade Paint Quality." Proof copies of the first brochure, "Interior Latex Flat Paint," are currently being reviewed by Technical Directors in the Southern Society and the Executive Committees of the Federation Societies. It is expected that the brochure will be finalized and printed in large quantities sometime in the Spring of 1982—Ed.]

Letters to the Editor

Call for Paint Standards in Government Specs

TO THE EDITOR:

I am pleased to learn that our Federation President, Howard Jerome, is calling for performance labeling for trade sales paint. As the person responsible for government specifications for paint, I would like to use any standards developed by the paint industry for government purchasing, and I am pleased to see Mr. Jerome leading the way. There are opportunities for Federation members who agree with Mr. Jerome to contribute to the development of minimum performance requirements for trade sales paint.

A subcommittee of ASTM's Committee D-1 on Paint and Related Coatings and Materials entitled "Criteria for Procurement of Commercial Paint and Coatings" is preparing a standard for interior flat latex paint. A round-robin test of "best grade commercial flat latex wall paint" from 12 manufacturers has been conducted in 10 laboratories. ASTM standard methods were used to measure scrub resistance, 85° gloss, contrast ratio, and porosity, and a draft "Standard Guide for Purchasing Interior Flat Latex Paint" based on the results of this round-robin and other data is now being circulated for ASTM D-1 subcommittee ballot. The results will be discussed at the January 18 meeting in New Orleans.

Last June, the subcommittee examined the first draft of a "Standard Guide for Exterior Latex Paint." It is likely that plans will be made to do round-robin testing of commercial exterior latex paints at the January meeting. At that time the subcommittee will be looking for qualified individuals to participate in the testing program. In time, we plan to take on additional standards as the availability and interests of volunteers permit.

Members of the subcommittee do not intend to submit Federal specifications to the balloting process; rather, entirely new documents will be written. Subcommittee members also realize that they are preparing voluntary standards, and that they are not able to tell large users which kind of paint to buy. The user will make that decision himself, probably choosing from the optional quality levels provided by a well-written, flexible standard. In the case of government purchases of paint, my staff will study standards for paint as they become available and choose which, if any, quality level is suitable for government use. The government presently uses more than 200 ASTM and other voluntary standards to test the paints it buys.

I encourage people who are knowledgeable in paint formulation and performance to participate actively in this work. Clearly, such people are most likely to be found in the ranks of Federation members. The Technical

(Continued on page 108)

Reader Cautions on Using Electrochemical Evaluations

TO THE EDITOR:

I have read with great interest the article entitled "Electrochemical Techniques to Evaluate Corrosion of Coated Metal" by D. V. Satyanarayana Gupta which appeared in the October issue of JCT.

Since it is common practice to evaluate the corrosion control properties of coatings by exposure to an electric field in one mode or another, I would like to inject a word of caution in interpreting the data so obtained.

There is evidence that subjecting a film to a small electric field well below its dielectric breakdown potential will markedly change the film permeability properties in aqueous media, viz., W. W. Kittleberger, *J. Phy. & Colloid Chem., 53* 392 (1949); C. A. Kumins & A. London, *J. Poly. Science, 46* 395 (1960); and C. A. Kumins, *Off. Digest, 34* 857 (1962).

They have shown that film formers used in the coating industry exhibit weak ion exchange properties and thus even mechanically perfect membranes are permeable to the critical ions. Following ion exchange theory and validated by experimental data, they become "leaky" to the counter ion (the one that is excluded) when the activity of the external ion exceeds the value of the fixed ionic group associated with the polymer molecules that compose the film. In our work it was found that exposure of a poly (vinylacetate, vinylchloride) membrane (VYHH) immersed in a dilute KCl solution to an electric field of about one volt/cm, which is several orders of magnitude below the dielectric breakdown potential, completely destroyed its permselective properties to allow the diffusion of the normally excluded counter ion through the film. This resulted in increased transport of the salts in solution.

Recently, S. R. Eisenberg and A. J. Grodzinsky (Proc. of the Northeast Bioengineering Conference—Boston, Massachusetts 1980) have shown that an applied electric field can change the permeability characteristics of a collagen membrane. The electric field affects the average ionic concentration inside the membrane which alters its ultrastructure.

While collagen has a much higher ion exchange capacity than the usual coating film, the effects reported in this reference are similar to those observed in our laboratory. Under these conditions, the enhanced flow of both the anion and cation through the film plus the water associated with the hydrated ion will favor a corrosion regime which may not correlate with actual exposure conditions. The effects of this artificial stimulation also may vary from film former to film former in a manner different from environmental exposure.

While electrical measurements are attractive because of their ease and simplicity, the data so generated may not be as readily correlated with the extended field performance of a coating in delaying the onset of the actual metal corrosion process.

CHARLES A. KUMINS
Consulting Services
Cleveland, Ohio

[It has been brought to our attention that in the article, "Electrochemical Techniques to Evaluate Corrosion of Coated Metal," by D.V.S. Gupta (October 1981, pp 41-48), Figures 5 through 8 and 10 were inadequately referenced.

These first appeared as Figures 8-12 in the article, "The Electrical Properties of Protective Polymer Coatings as Related to Corrosion of the Substrate," by M.W. Kendig and H. Leidheiser, Jr. (J. Electrochem. Soc., *Vol 123, No. 7, 982-989, July 1976).*

The author has been so advised.—Ed.]

Coming Events

FEDERATION MEETINGS

(Apr. 29–30)—Spring Meetings. Society Officers on 29th; Board of Directors on 30th. Lenox Hotel, Boston, MA. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Nov. 3–5)—60th Annual Meeting and 47th Paint Industries' Show. Sheraton Washington Hotel, Washington, D.C. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

1983

(Oct. 12–14)—61st Annual Meeting and 48th Paint Industries' Show. Queen Elizabeth Hotel, Montreal, Quebec, Canada. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

SPECIAL SOCIETY MEETINGS

(Feb. 17–19)—Water-Borne and Higher-Solids Coatings Symposium sponsored by Southern Society for Coatings Technology and University of Southern Mississippi—Department of Polymer Science. Hyatt Regency Hotel, New Orleans, LA. (Mr. Fred M. Ball, Eastman Chemical Products, Inc., P.O. Box 431, Kingsport, TN 37662).

(Mar. 10–12)—Southern Society Annual Meeting. Hyatt Regency, Savannah, Ga. (Dan Dixon, Freeport Kaolin Co., P.O. Box 337, Gordon, GA 31031).

(Mar. 23–24)—25th Annual Technical Conference of the Cleveland Society for Coatings Technology. Baldwin-Wallace College, Berea, OH.

(Apr. 21–23)—Southwestern Paint Convention. Shamrock Hilton Hotel, Houston, TX.

(May 6–8)—Pacific Northwest Society. Annual Symposium. Bayshore Inn, Vancouver, B.C. (Barry Lamb, Harrisons & Crosfield, Ltd., 810 Derwent Way, New Westminster, B.C. V3M 5R1).

(May 19–20)—New England Society Coatings Tech Expo '82. Sheraton Inn, Boxborough, MA.

1983

(Feb. 23–25)—16th Biennial Western Coatings Societies' Symposium and Show. Hyatt Regency, San Francisco, CA.

OTHER ORGANIZATIONS

(Jan. 17–21)—American Society for Testing and Materials Committee D-1 Meeting on Paint and Related Coatings and Materials. Monteleone Hotel, New Orleans, LA. (Jane M. Turner, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Jan. 18–22)—"Profitable Painting in a Tough Market" Seminar. Astro-Village Hotel, Houston, TX. (Norma Fleming, Coordinator, Arts and Sciences Continuing Education, G-7A Humanities-Social Sciences Bldg., University of Missouri-Rolla, Rolla, MO 65410).

(Feb. 7–10)—Inter-Society Color Council. Williamsburg Conference, Williamsburg, VA.

(Feb. 10–11)—"Stimulating Innovation in Coatings R&D Laboratories" Seminar. Bahia Mar Hotel and Yachting Center, Fort Lauderdale, FL. (Norma Fleming, Arts and Sciences Continuing Education, G-7A Humanities-Social Sciences, University of Missouri-Rolla, Rolla, MO 65401).

(Feb. 22–24)—The Adhesion Society's Annual Technical Meeting. Mobile, AL. (Pat Dreyfuss, Institute of Polymer Science, The University of Akron, Akron, OH 44325).

(Mar. 3–5)—"The Versatile Thermosets" RETEC, Society of Plastics Engineers, Inc. and the Thermoset Division. Marriott Oakbrook Motor Hotel, Oakbrook, IL. (Paul Fina, College of DuPage, Box P, Riverside, IL 60546).

(Mar. 8–10)—National Paint and Coatings Association's Marine and Offshore Coatings Conference. Grand Hotel, Point Clear, AL. (Armand P. Herreras, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Mar. 8–10)— Production Planning and Inventory Management Seminar. Atlanta, GA. (National Paint and Coatings Association, Meetings and Conventions Div., 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Mar. 29–Apr. 1)—National Plant Engineering & Maintenance Show and Conference. McCormick Place, Chicago, IL. (Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10167).

(Apr.)—Symposium on Color in Protective Coatings sponsored by the Chemical Institute of Canada, Protective Coatings Division. Montreal and Toronto. (D.S. Wiersma, Celanese Canada, Inc., 2 Robert Speck Pkwy., Suite 900, Mississauga, Ont., L4Z 1H8 Canada).

(Apr. 19–20)—Inter-Society Color Council. Annual meeting. Charlotte, N.C.

(Apr. 19–20)—22nd Annual Symposium of the Washington Paint Technical Group. Marriott Twin Bridges Motel, Washington, D.C. (John Montgomery, Secretary, Washington Paint Technical Group, P.O. Box 12025, Washington, D.C. 20005).

(Apr. 21–28)—Hanover Fair '82 for Surface Treatment and Coatings Technology Equipment and Materials. Hanover, West Germany. (The Hanover Fairs Information Center, P.O. Box 338, Whitehouse, NJ 08888).

(Apr. 27–29)—Oil & Colour Chemists' Association's 34th Annual Exhibition, "International Forum for the Surface Coatings Industries." Cunard International Hotel, Hammersmith, London, England. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex, HAO 2SF).

(May 9–14)—XVIth Congress of FATIPEC, Brussels, Belgium.

(May 11–13)—Powder & Bulk Solids Conference/Exhibition. O'Hare Exposition Center, Rosemont, IL. (Cahners Exposition Group, 22 W. Adams St., Chicago, IL 60606).

(May 17–21)—"Dispersion of Pigments and Resins in Fluid Media" Short Course. Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).

(June 7–11)—"Adhesion Principles and Practice for Coatings and Polymer Scientists" Short Course. Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).

(June 13–16)—Dry Color Manufacturers' Association Annual Meeting. The Greenbrier, White Sulphur Springs, WV. (P.J. Lehr, DCMA, Suite 100, 1117 N. 19th St., Arlington, VA 22209).

(June 20–23)—American Society for Testing and Matrerials Committee D-1 Meeting on Paint and Related Coatings and Materials. Sheraton Center, Toronto, Canada. (Jane M. Turner, ASTM, 1916 Race St., Philadelphia, PA 19103).

(June 21–25)—"Applied Rheology for Industrial Chemists" Short Course. Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State University, Kent, OH 44242).

(Oct. 11–13)—10th Congress of the Federation of Scandinavian Paint and Varnish Technologists. Copenhagen, Denmark. (G. Christensen, Sadolin & Holmblad Ltd., Holmbladsgade 70, DK-2300, Copenhagen S, Denmark).

(Oct. 18)—"Fire Resistant Coatings: The Need for Standards" Symposium. Philadelphia, PA. (Symposium Chairman Dr. Morris Lieff, County College of Morris, Dover, NJ 07801).

1983

(Sept. 28–Oct. 1)—Oil & Colour Chemists' Association's Silver Jubilee Convention and Exhibition. Southern Cross Hotel, Melbourne, Australia. (O.C.C.A.A., 1983 Pacific Coatings Convention, C/- Tioxide Australis Pty. Ltd., Private Bag 13, Ascot Vale, Victoria, 3032, Australia).

(Oct. 11–13)—"Finishing '83" sponsored by the Association for Finishing Processes of the Society of Manufacturing Engineers. Cincinnati Convention Center, Cincinnati, OH. (Susan Buhr, AFP/SME Administrator, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

Advertisers Index

'Humbug' from Hillman

Diary of a First Time Conventioneer

Day Two (afternoon–evening)

After the bustle of activity at this morning's sessions, it was a pleasure to get away from the Hall for a time and enjoy a relaxing lunch at a local open-air restaurant. Pleasant Italian folk music mixed with the bucolic sound of a nearby stream lent an atmosphere of charm while I enjoyed a repast of a mixture of meats (*carne misto* as they say in Italy) washed down with a cooling drink.

Well . . . to tell the truth, I had a hot dog and Pepsi while the vendor's rendition of "O Sole Mio" assaulted my ears (*Il Duce* would have had him shot!) and water from a leaking hydrant ran down the street.

After that satisfying fare and a stroll around town, I got back to Convention Hall just when the afternoon sessions were starting. As I was studying the program, a slam on my back signaled the arrival of an old college friend. At a place like a convention, casual acquaintances become bosom buddies and a friend seems like a blood brother. My new blood brother, Sam, grabbed my arm and pulled me along, saying now that he found me he wasn't going to let me go. Such desperation!

Sam is one of those unusual combinations of brain and brawn who recited the Periodic Tables while taking handoffs during football practice. One way or another, he never lost an argument. Therefore, I obediently trotted along as he told me to join him at a lecture he wanted to hear. It turned out to be "Application of HFGPC and HPLC to Characterize Oligomers and Small Molecules Used in Environmentally Acceptable Coatings Systems."

As the speaker started, I tried to figure out how I was going to report on this one to my boss when I couldn't even understand the title! Meanwhile, Sam took notes furiously and kept whispering, "terrific," "well done," and "so clearly explained." I wanted to kill him but instead nodded knowingly and wondered how I could buy my friendship back from this nut.

I managed to handle the challenge, however, and sat through the less than stimulating (to me) lecture fairly well. I admit to several episodes of day dreaming while staring at a beautiful head of hair in front of me. Unfortunately, disaster struck when the lecture was over and the face belonging to that beautiful head of hair was wearing a five o'clock shadow.

As we left, Sam said, "Gee, that was well done but I'm sorry I had to miss that other talk."

"What other talk?" I was stupid enough to ask.

"Comparative Cure Kinetics and Thermal-Mechanical Property Characterization of Organic Coatings by Dynamic Mechanical Analysis and Differential Scanning Calorimetry," he said seriously.

Taking my life into my hands, I smacked him as hard as I could and ran like hell. I quickly got lost in the crowd and headed back to my hotel.

I found a message waiting for me when I returned to my room. Finally—an invitation to dinner with cocktails before at my supplier-host's hospitality suite! Anxious not to miss a thing, I quickly showered, dressed, and cabbed back to the headquarters hotel. When I arrived at 6 pm I was happily greeted by the room's sole occupant—the bartender. I immediately put him to work. As time went on, other people wandered in and I started several no-name friendships over a cup or two of spirits. Seventy-five minutes and some libations later our host appeared and announced that we would leave for dinner in about an hour. Meanwhile, "How about a drink?"

Some time later, we left with a great number of people and piled into cabs for the restaurant. The place had a French name and looked kind of blurry. I can remember having several more drinks and can recall doing a lot of talking. It seemed to me I was very funny, talking about how rotten my host's service was and how I was looking for a new supplier. A few people smiled. He didn't.

I think I had something to eat but I'm not sure. I did get back to my hotel, though I'm not sure how.

• • •

My old friend, Milt Glaser, whom I have mentioned before as Past-President of our Federation, now has been further distinguished by having his name placed on Dexter Corporation's new laboratory building. I am indeed proud of my friend.

However, I, too, have my name on doors in many buildings. But, I must admit the honor is shared with others of my gender.

Well, Milt has again offered to share several of his collection of quotes with us. You will be treated to others in later issues.

"One must wait for the coming of evening before one can truly judge how splendid the day has been." *Aristotle*

"Success in one's life work is due to good habits (virtue) and good fortune." *Aristotle*

"If good fortune comes your way, the hell with the good habits (virtue)." Hillman

"Managing people is probably the most difficult of arts."

Being told about a man who was reputed to have a quick and ready opinion on every subject, Voltaire is reported to have replied acidly, "Is he as ignorant as all that?"

Computers are being used for just about everything these days, including as a device for translating from one language into the other. But problems do come up as follows:

English to French: "The spirit is willing but the flesh is weak."

French to English: "The wine is good but the meat is rotten."

—Herb Hillman

Color-matching Aptitude Test

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

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

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

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

Brochure available upon request. Price: $400.

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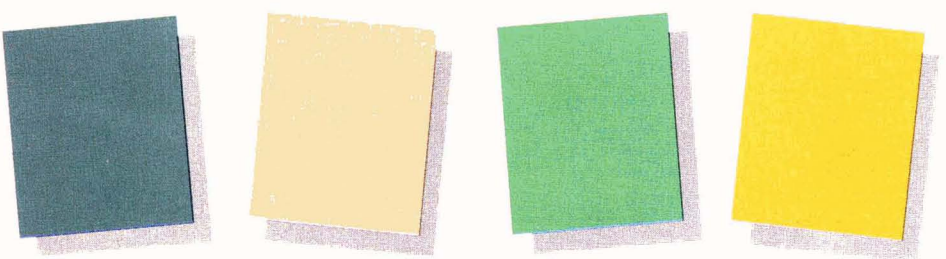

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