JOURNAL OF COATINGS TECHNOLOGY

JCTAX 53 (679) 1–90 (1981)

AUGUST 1981

Surface Tension of Silicone Release Paper Coatings

EVEN IN OXYGENATED SOLVENTS, LACK OF TEAMWORK IS NO LAUGHING MATTER.

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So if you use oxygenated solvents, having the leading supplier on your side can really give you something to smile about.

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Rohm and Haas pioneered low pollution technologies for waterborne air-dry coatings. And today, we retain our low-VOC leadership with excellent thermoplastic acrylic resins like RHOPLEX WL-81 and RHOPLEX WL-91. These proven performers offer outstanding application and resistance properties, at a highly competitive price.

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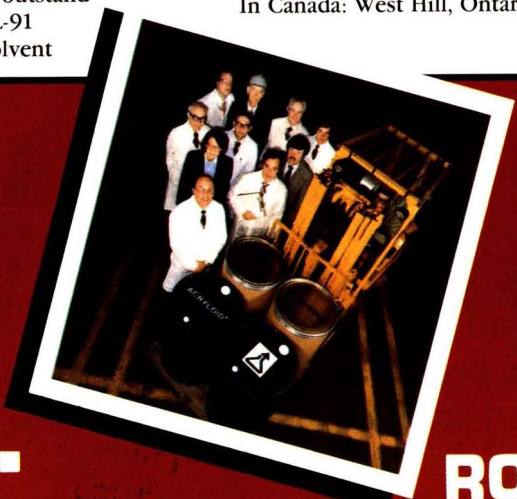

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We've got the answers.

ROHM AND HAAS

AUGUST 1981

JOURNAL OF COATINGS TECHNOLOGY

Volume 53 Number 679

Features

Federation Activities

Departments

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

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Subscriptions U.S. and Canada—1 year, $20; 2 years, $37; 3 years, $52. Europe (Air Mail)—1 year, $33; 2 years, $63; 3 years, $91. Other countries—1 year, $28; 2 years, $53; 3 years, $76.

Second generation epoxies fo

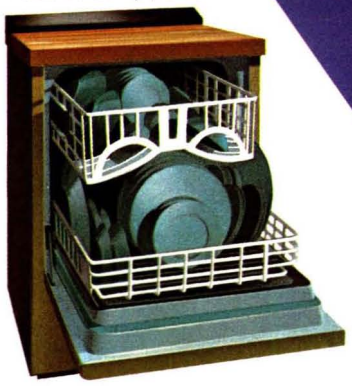
ECN 1299 resin improves chemical and solvent resistance.
Can be formulated into coatings with very high HDT. In combination with o-cresol novolac, produces coatings with excellent resistance to aggressive solvents. Withstands over six months immersion in methylene chloride.

0500 resin increases heat tolerance.
Due to low viscosity, allows formulation of solvent-free, room temperature cured coatings with outstanding resistance to aggressive solvents (metlylene chloride, MEK, Cellosolve).

EPN 1138 resin increases high temperature stability.
Improves chemical resistance.

tanker linings

hardeners for vinyl plastisols



Hardeners HT 939 and HY 940 improve adhesion of epoxy modified vinyl plastisols.
Remain stable six months after formulating. High latency. Cure rapidly—five minutes at 100°C.

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EPN 1139 provides for excellent solvent and chemical resistance. It can be formulated in high solids coatings recommended for hot crude oil storage tanks.

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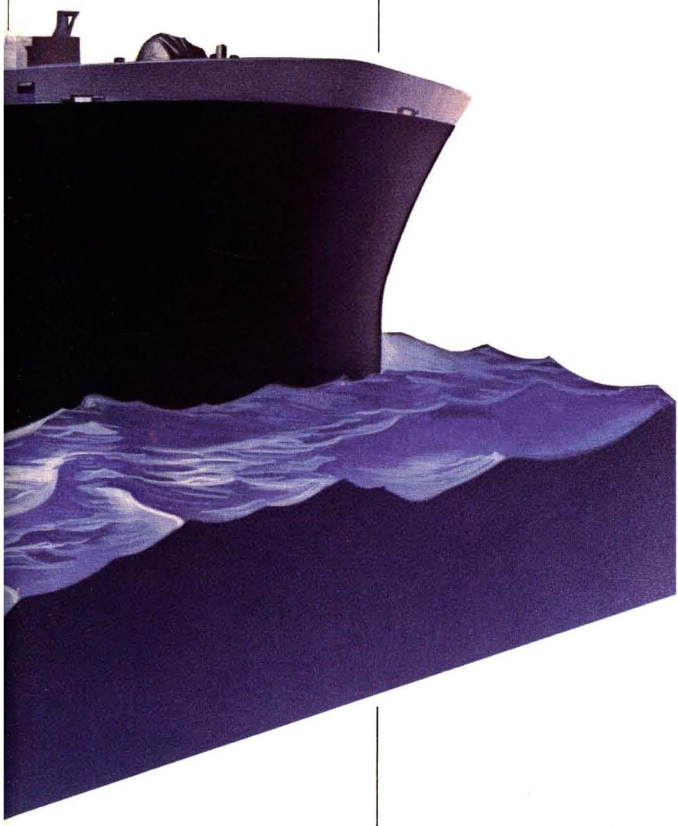
exterior coatings



For years, these special CIBA-GEIGY epoxy resins have been used in the electronics and electrical industries.

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jct JOURNAL OF COATINGS TECHNOLOGY

1315 Walnut St., Phila., Pa. 19107

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

Annual dues for Active and Associate Members of the Federation of Societies for Coatings Technology is $15.00. Of this amount, $10.00 is allocated to a membership subscription to this publication. Membership in the Federation is obtained through prior affiliation with, and payment of dues to, one of its 26 Constituent Societies. Non-member subscription rates are:

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$20.00	$33.00	$28.00
2 Years	$37.00	$63.00	$53.00
3 Years	$52.00	$91.00	$76.00

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

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

A Guide for Authors is published in each January issue.

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

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

Comment

Scholarship Dollars Hitting Target

For many years, the Federation has appropriated $10,000 to $15,000 annually for scholarships at universities with programs in polymers and coatings technology.

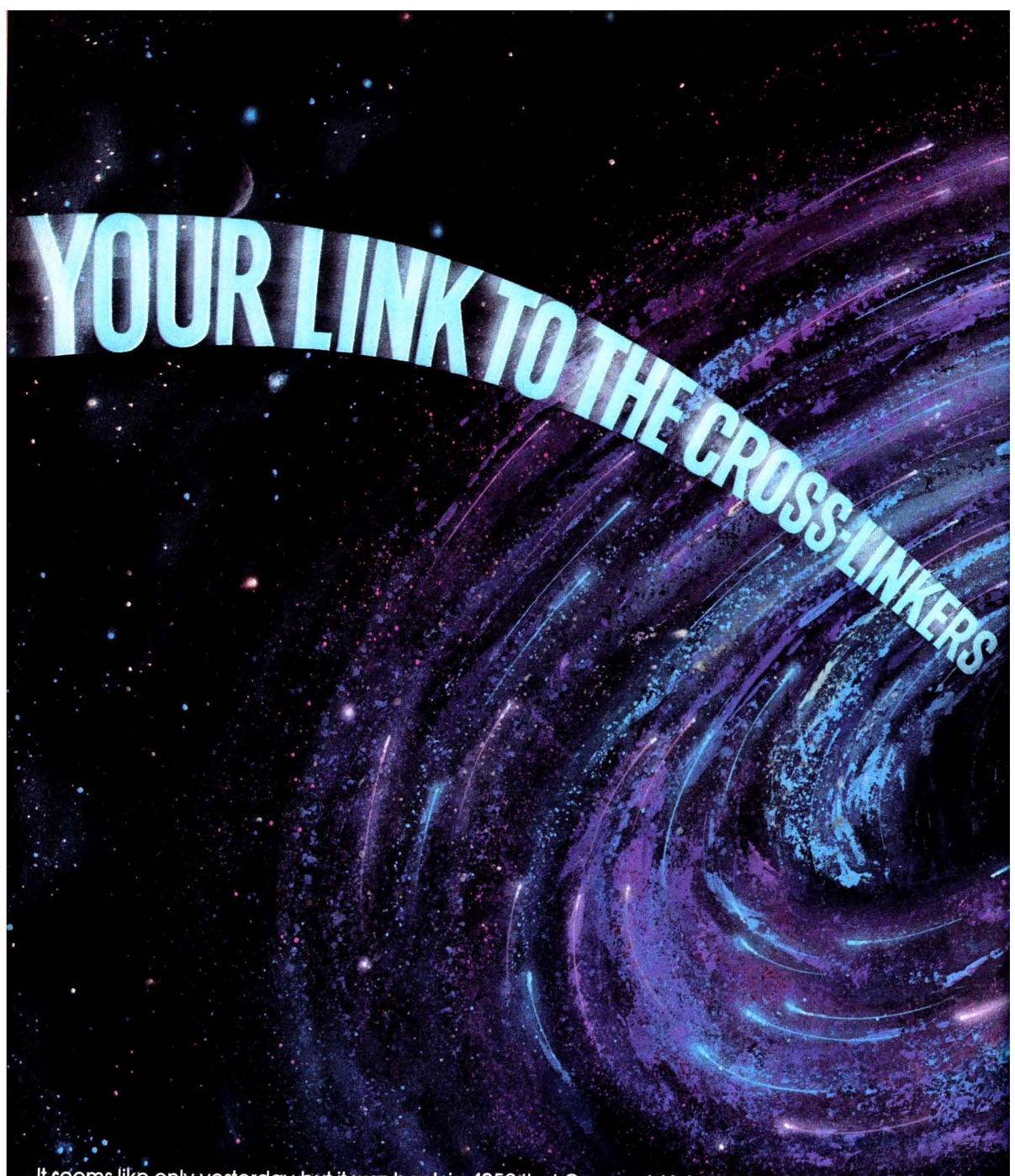
The objective, of course, has been to provide a continuing supply of well-educated technical personnel for our industry. There's a membership benefit here, too, as the funds are granted with the provision that eligible children of Federation members receive preference.

Schools presently receiving these grants from the Federation (and also from some Societies) are: University of Detroit, Kent State University, University of Missouri-Rolla, North Dakota State University, and University of Southern Mississippi.

Recent information from three of the schools regarding 25 of their graduates is encouraging. Three are employed by paint manufacturers, 15 are associated with raw material manufacturers in capacities directly related to coatings, and the balance is either uncommitted or bound for graduate school.

Education is an investment in the future and the return to the industry indicates that the Federation's dollars have been hitting the target.—FJB.

[*If you know of someone interested in applying for a scholarship at the five universities, please let us hear from you.*]



It seems like only yesterday, but it was back in 1959 that Cyanamid introduced its first resin for water-borne systems. Two years later a major breakthrough in coating resin technology was announced — hexamethoxymethylmelamine, the first high solids, fully methylated monomeric melamine cross-linking agent. It was followed by CYMEL® 1116 resin, the first melamine-formaldehyde designed specifically for electro-deposition. And the innovations just kept coming.

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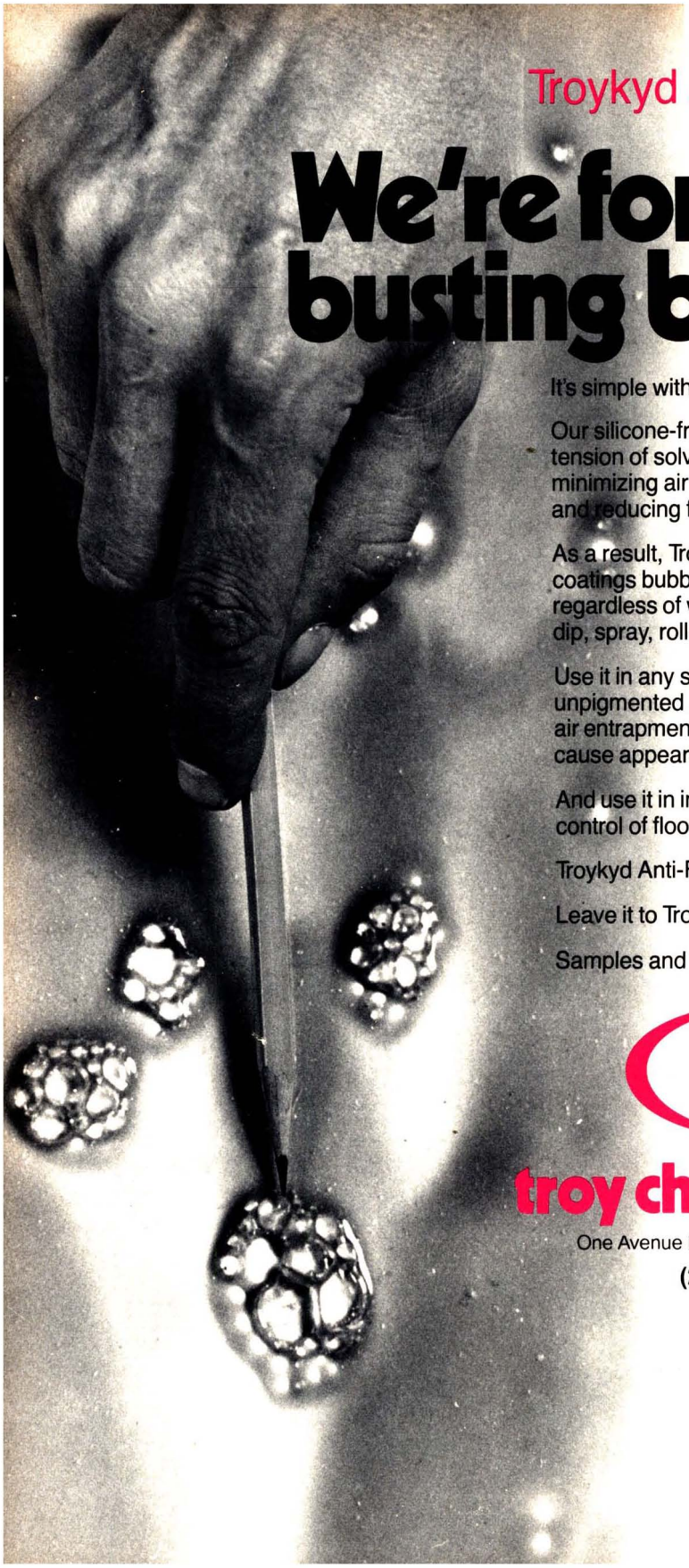

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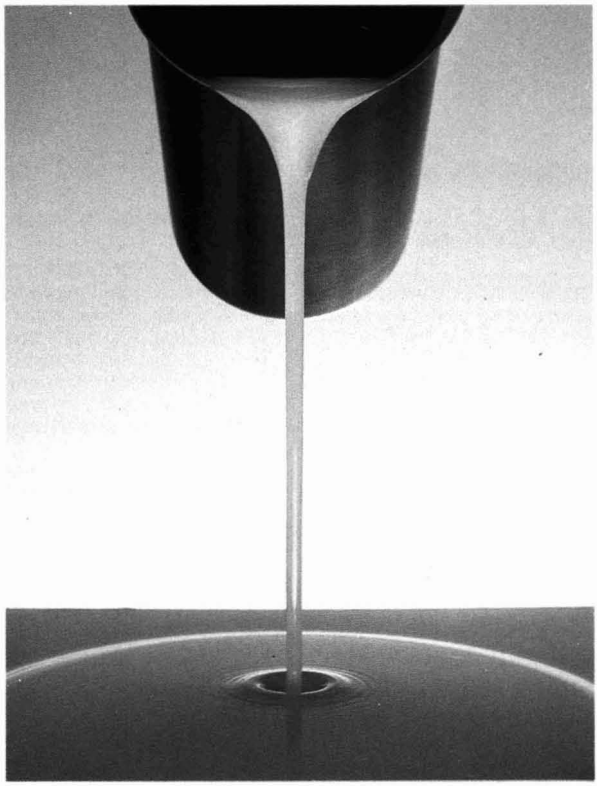

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Abstracts of Papers in This Issue

SURFACE TENSION OF SILICONE RELEASE PAPER COATINGS—M.J. Owen

Journal of Coatings Technology, 53, No. 679, 49 (Aug. 1981)

The treatment of contact angle data to determine the surface tension of silicone release coatings is discussed. The Kaelble approach, based on the use of the Owens-Wendt equation is preferred to the use of the Wu equation mainly because this latter approach gives unreasonably large values of the polar component of the surface tensions of the silicone coatings. The Kaelble approach gives values for the total surface tension of these coatings in the 18–22 mNm^{-1} range. These values are also compared to those obtained for Zisman's critical surface tension of wetting and Wu's new equation of state approach.

APPLICATION OF STATISTICAL METHODS TO THE SUBJECTIVE COMPARISON OF COATINGS—W.E. Craker and G.M. Deighton

Journal of Coatings Technology, 53, No. 679, 55 (Aug. 1981)

The need for subjective assessments is discussed and two methods of objective analysis of such assessments are presented.

One deals with the comparison of pairs of test panels and is illustrated by application to the appearance of semi-gloss latex paints and gloss alkyd paints. The other deals with the ordering of sets of paints or properties and is illustrated by application to problems of assessing both gloss and dispersion; it is also applied to a Market Research investigation.

It is demonstrated that the simple statistical analyses, when allied with careful experimental design, allows these subjective assessments to be used as powerful research tools.

Specifically, the examples demonstrate the important role of the energy which is scattered from the paint air interface.

CERAMIC COATINGS—G.J. Roberts

Journal of Coatings Technology, 53, No. 679, 65 (Aug. 1981)

The nature of glasses and their physical and chemical properties of importance when used as ceramic coatings are described. There are important constraints arising from the use of a brittle coating material on a substantially rigid backing. Organic and inorganic coatings are roughly compared on various counts. Crystallization from a glass coating during cooling is used for opacification and for decorative effects in glaze and porcelain enamels.

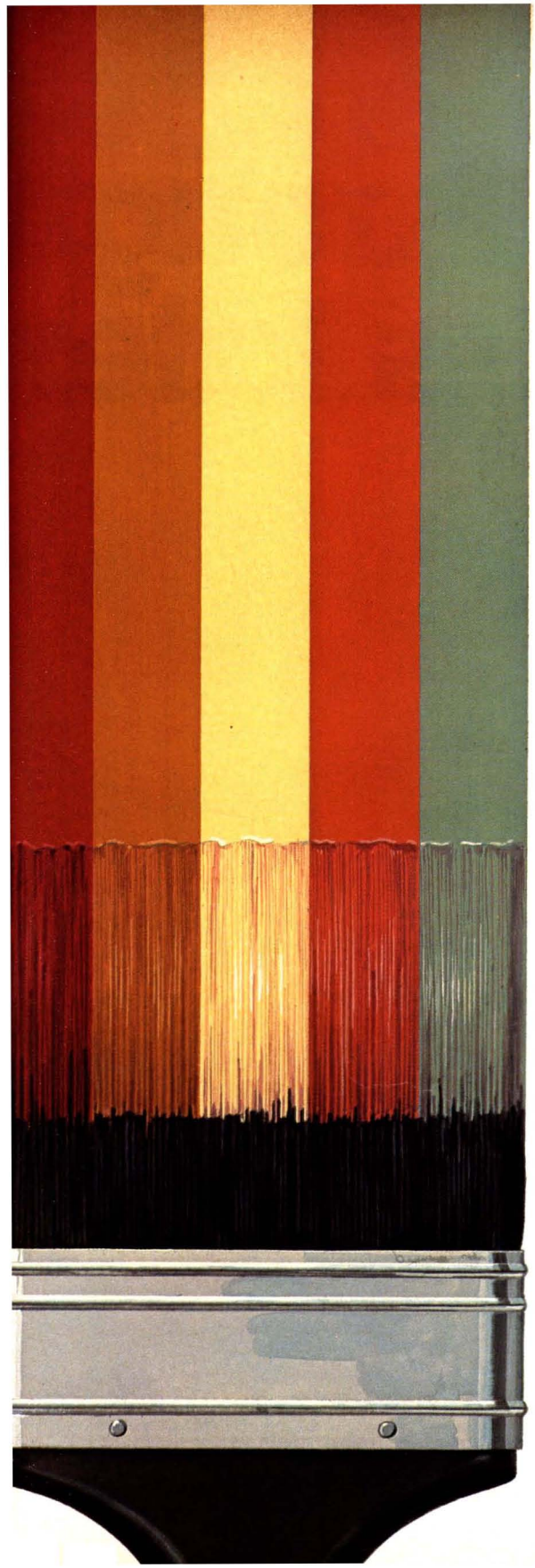
Ceramic glazes, porcelain enamels, and glass colors are all quite different families of compositions because they have to "fit" and adhere to different substrates within temperature limits dictated by the properties of these substrates.

Emphasis is placed on modern products and possible avenues for future development.

EFFECTIVE TREATMENT OF PAINT WASTE—J.A. Feledy and E.M. Antonucci

Journal of Coatings Technology, 53, No. 679, 71 (Aug. 1981)

In January 1980, the EPA issued revised effluent guidelines and standards for the Paint Industry. In order to meet these requirements, handling procedures are presented including suggested equipment needs. Various treatment methods are used in the industry. The types of methods include the use of inorganic salts, anionic flocculants, and cationic flocculants. Actual testing procedures are presented with supporting case histories and cost analyses. Each method results in certain trade-offs of the following properties, i.e., degree of solidification, clarity of supernatant, settling rates and resultant heavy metal content.



Pfizer Pigments are Key Colorants in Matching the 1981 Recommendations of the Color Marketing Group.

A highly regarded panel of diverse authorities, the Color Marketing Group, determines future color directions. From among the colors it expects to have wide demand in paints this year, Pfizer tested its oxide pigments in matching 13 of them. This was done with our computer-controlled spectrophotometer system. Close matches were obtained using up to 95% Pfizer pigments. A technical report on this is yours for the asking.

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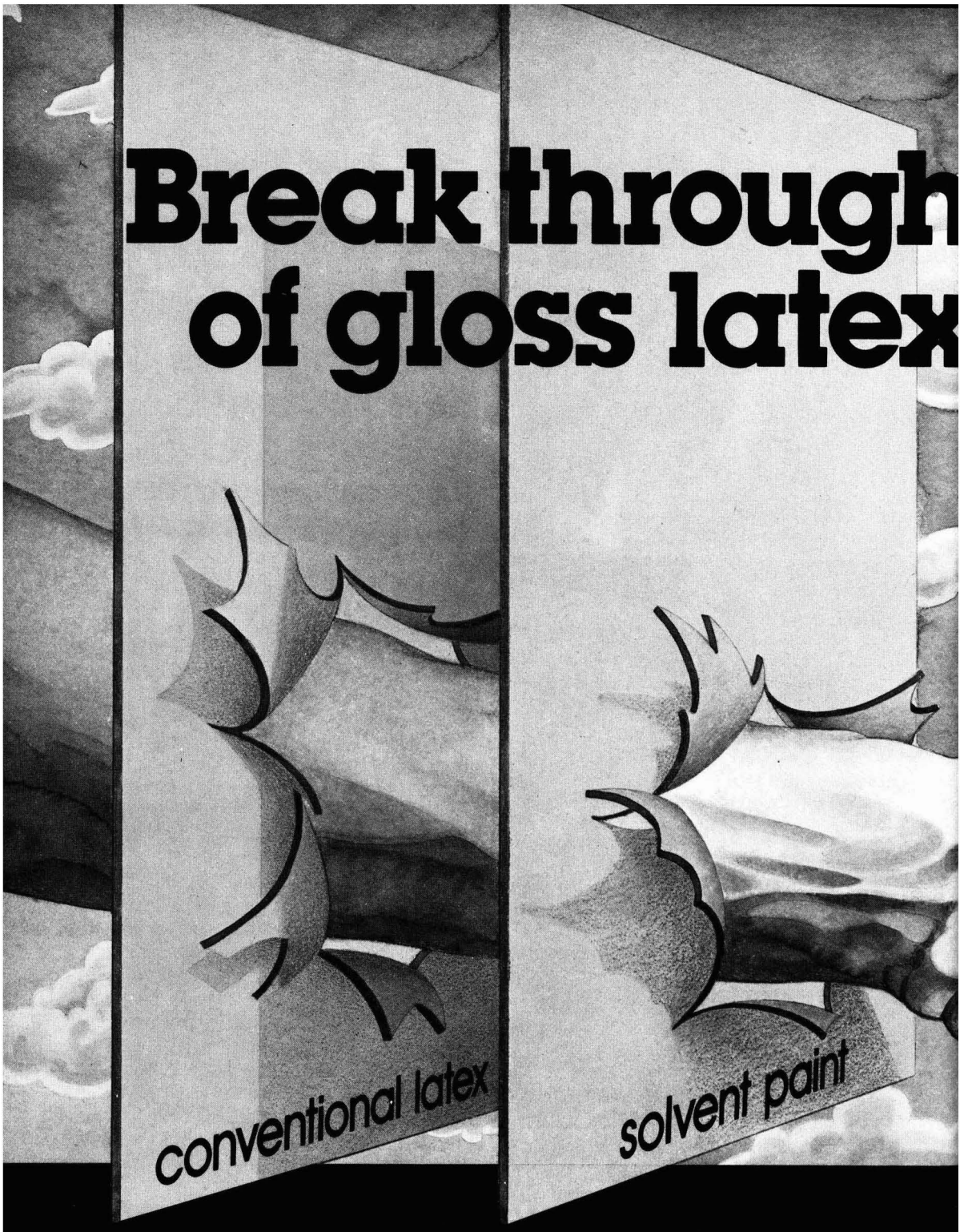
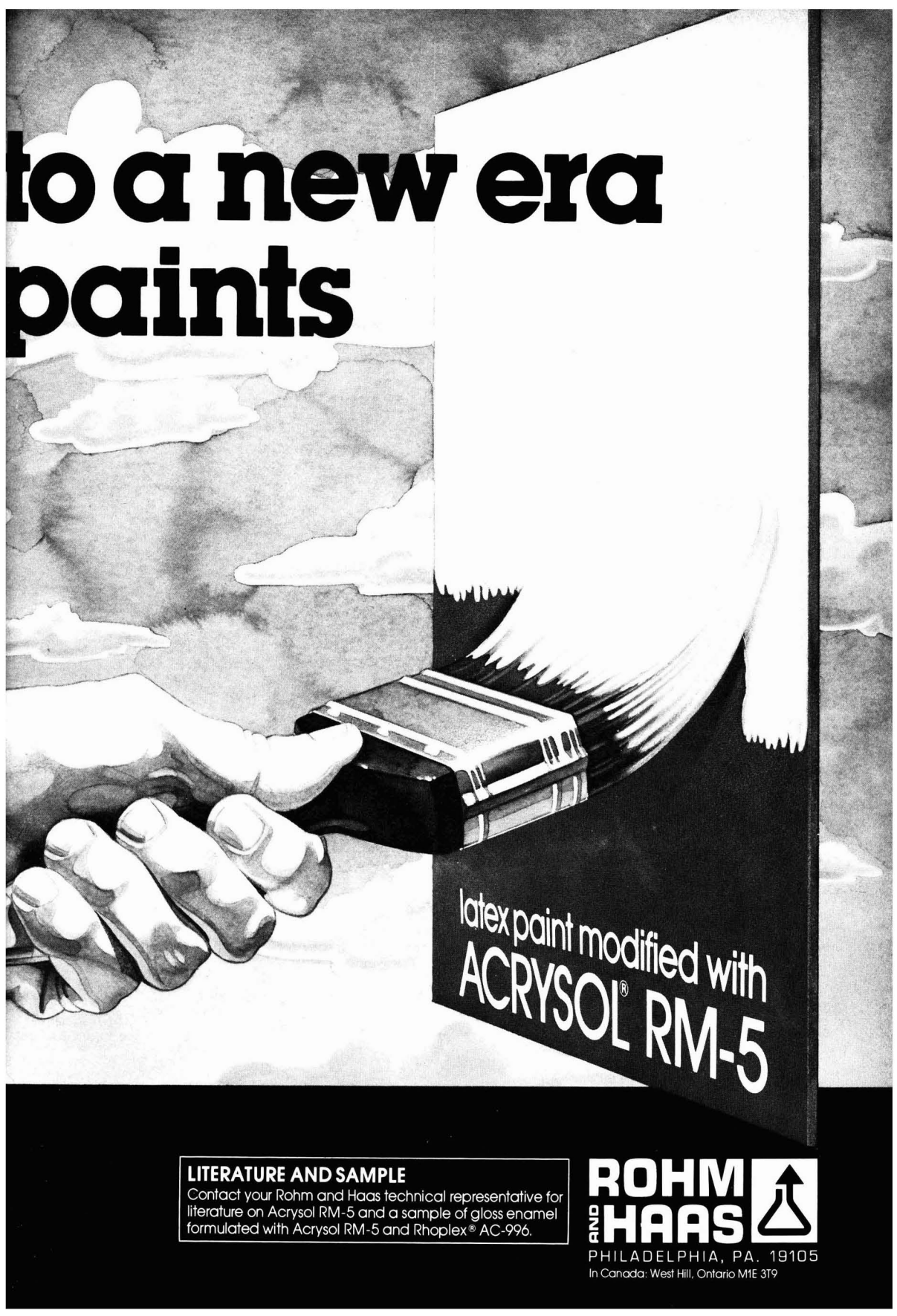


New ACRYSOL® RM-5 improves gloss, flow and film build.

ACRYSOL RM-5 rheology modifier helps you attain full performance in your latex paint formulations. Try it. And begin your new era of gloss latex paints.



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PRELIMINARY PROGRAM

1981 ANNUAL MEETING and PAINT INDUSTRIES' SHOW

Cobo Hall
October 28, 29, 30

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

Preliminary Program

WEDNESDAY, OCTOBER 28

OPENING SESSION
(10:00-10:30)

Fifty-ninth Annual Meeting of the Federation of Societies for Coatings Technology opened by President William H. Ellis.

Invocation and In Memoriam

Welcome: Gary Van de Streek, President of Detroit Society for Coatings Technology

Thomas J. Miranda, Chairman of the Program Committee

Jose Benavides, Chairman of the Host Committee

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

Introduction of Federation Officers

Introduction of Distinguished Guests

E. W. FASIG KEYNOTE ADDRESS
(10:30-11:30)

ENERGY OUTLOOK FOR THE 80'S -- John R. Thomas, President, Chevron Research Co., Richmond, CA.

INNOVATIONS IN COATINGS - I
(2:00-4:00)

DYNAMIC SURFACE EFFECTS IN COATING PROCESSES -- Ronald E. Smith, PPG Industries, Inc., Allison Park, PA

A PRELIMINARY INVESTIGATION OF ACYLUREA REACTIVE OLIGOMERS -- Gerry Noren, S.C. Lin, and Imogene Eldridge, DeSoto, Inc., Des Plaines, IL

RECOVERY OF GLYCOL ETHER SOLVENTS FROM ULTRAFILTER PERMEATE IN CATHODIC ELECTROCOAT OPERATIONS USING REVERSE OSMOSIS -- W. S. Springer, G. G. Strosberg, and J, E. Anderson, Manufacturing Processes Laboratory, Ford Motor Co., Detroit, MI

SHORT-TERM TESTING - NEW APPROACHES -- Raymond Tooke, Micro-Metrics Co., Atlanta, GA (A Roon Awards competition paper)

INNOVATIONS IN COATINGS - II
(2:00-4:30)

FACTORS AFFECTING METAL MARKING -- Leslie Simpson, BTP Tioxide Limited, Cleveland, England (Presented on behalf of OCCA: Oil and Colour Chemists' Association) (A Roon Awards competition paper)

HPGPC/HPLC ANALYSIS OF OLIGOMERS AND SMALL MOLECULES USED IN ENVIRONMENTALLY ACCEPTABLE COATINGS SYSTEMS -- C. Kuo, T. Provder, R. Holsworth, and Ann Kah, Glidden Coatings & Resins Div., SCM Corp., Strongsville, OH

PHYSICO-CHEMICAL INTERPRETATION OF PAINT FILM ADHESION AND TECHNIQUES USED FOR ITS MEASUREMENT -- Swaraj Paul, Soab AB, Molndal, Sweden (Presented on behalf of SLF: Federation of Scandinavian Paint and Varnish Technologists)

CORROSION AND A COMPLYING SYSTEM -- Golden Gate Society for Coatings Technology

COMPARATIVE CURE KINETICS AND THERMAL-MECHANICAL PROPERTY CHARACTERIZATION OF ORGANIC COATINGS BY DYNAMIC MECHANICAL ANALYSIS (DMA) AND DIFFERENTIAL SCANNING CALORIMETRY (DSC) -- T. Provder, R. Holsworth, and T. Grentzer, Glidden Coatings & Resins Div., SCM Corp., Strongsville, OH

THURSDAY, OCTOBER 29

RAW MATERIALS TO FINISHED PRODUCT - I
(9:00-11:30)

DETERMINATION OF ALLOPHANATES IN TWO-COMPONENT URETHANE COATINGS -- Detroit Society for Coatings Technology

WATER-BORNE INTUMESCENT COATINGS -- G. O. Fanger, Velsicol Chemical Corp., Technical Center, Ann Arbor, MI

EFFECT OF THE PIGMENT-VEHICLE INTERACTION ON MAGNETIC COATING FILM -- Yukihiro Isobe, Magnetic Recording Products, TDK Electronics Co., Ltd., Nagano, Japan

THE EFFECT OF LATEX FUNCTIONALITY ON THE RATE OF AUTODEPOSITION -- Cleveland Society for Coatings Technology

FINISH ENGINEERING WASTE SOLVENT STILL TECHNOLOGY -- H. David Bowes, Finish Engineering Co., Inc., Erie, PA

MANUFACTURING COMMITTEE SEMINAR
ON DISPERSION TECHNOLOGY
EQUIPMENT CAPABILITIES AND LIMITATIONS
(9:00-12:00)

A critical review of the tools available to the paint manufacturer, this session will discuss in detail the optimum utilization of existing dispersion equipment, including a review of the role of formulation.

Moderator -- Fred K. Daniel, Daniel Products Co., Jersey City, NJ

HIGH SPEED DISPERSION -- Speaker from DeSoto, Inc., Des Plaines, IL

HORIZONTAL AND VERTICAL SAND MILLS -- Leo Dombrowski, Chicago Boiler Co., Chicago, IL

S-W MILL -- Mike Fujimoto, The Sherwin-Williams Co., Chicago, IL

BALL MILLS AND ATTRITORS -- Elio Cohen and Ray Pineiro, Daniel Products Co., Jersey City, NJ

Moderator and speakers will assemble as a panel for a 45-minute open-discussion period to conclude seminar.

Presentation of the Morehouse Industries Golden Impeller Award will be made at this session.

PRI SEMINAR
ON CONTRIBUTIONS OF PRI FELLOWS TO THE COATINGS INDUSTRY
(9:00-12:00)

Moderator--Raymond R. Myers, PRI Research Director and University Professor, Kent State University, Kent, OH

MOLECULAR ORIENTATION IN SOLVENT-CAST POLYMERIC FILMS -- William M. Prest, Xerox Corp., Webster, NY

RHEOLOGICAL STUDIES AT GLIDDEN -- Richard R. Eley, Glidden Coatings and Resins Div., SCM Corp., Strongsville, OH

RESEARCH IN THE GRAPHIC ARTS -- William D. Schaeffer, Graphic Arts Technical Foundation, Pittsburgh, PA

RECENT DEVELOPMENTS IN COLOR MEASUREMENT -- James G. Davidson, Macbeth Div. of Kollmorgen Corp., Newburgh, NY

RAW MATERIALS TO FINISHED PRODUCT - II
(2:00-4:30)

PRACTICAL APPLICATION OF KUBELKA-MUNK THEORY FOR THE NEAR INFRARED REGION -- Dennis Osmer and Joseph Kettanecker, CIBA-GEIGY Corp., Ardsley, NY

RECLAIMING THE ENERGY VALUE OF COATINGS WASTES THROUGH PYROLYSIS -- Louisville Society for Coatings Technology. Presented by Dean Owen Harper, Dept. of Chemical and Environmental Engineering, University of Louisville, Louisville, KY

STABILIZING THE VISCOSITY AND THIXOTROPIC INDEX OF HARDENER FREE EPOXY RESIN SYSTEMS WITH FUMED SILICA -- Harold D. Stanley, Degussa Corp., Teterboro, NJ

POTENTIAL NEW BIOCIDES -- Chicago Society for Coatings Technology

HIGH SOLIDS AND WATERBORNE SILICONE RESINS FOR HIGH TEMPERATURE DURABLE PROTECTIVE COATINGS -- William T. Saad, Silicone Products Div., General Electric Co., Waterford, NY

RAW MATERIALS TO FINISHED PRODUCT - III
(2:00-4:30)

REACTIVE SILANE MODIFIED PIGMENTS -- Los Angeles Society for Coatings Technology

PIGMENT DISPERSIONS, ECOLOGY AND ECONOMICS -- Russell R. Koch, Universal Color Dispersions, Lansing, IL

PARAMETERS AFFECTING WEAR RATES IN SMALL MEDIA MILLS -- Toronto Society for Coatings Technology

THE EFFECTS OF FREEZE-THAW CYCLES OF COMMERCIALLY AVAILABLE LATEX AND EMULSION PAINTS ON THE MOLECULAR WEIGHT AND THE MOLECULAR WEIGHT DISTRIBUTION BY GEL PERMEATION CHROMATOGRAPHY -- James A. Vance, Vance Laboratories, Indianapolis, IN (A Roon Awards competition paper)

A NEW SOLUTION TO CREVICE CORROSION -- Walter Sniff, CRS Company, Orville, OH

FRIDAY, OCTOBER 30

IMPACT OF CORROSION - I
(9:00-10:30)

CORROSION: A COATINGS MANUFACTURER'S DILEMMA -- Dean M. Berger, Gilbert/Commonwealth, Reading, PA

SULFONATE AND PHOSPHATE CHEMISTRY TO IMPROVE CORROSION INHIBITING AND ADHESION -- W. A. Higgins, Lubrizol Corp., Wickliffe, OH

APPLICATION OF PHOTOGONIOMETER FOR THE CHARACTERIZATION OF COATINGS SYSTEMS -- T. H. Grentzer, T. Provder, R. Holsworth, M. E. Koehler, and S. A. Kline, Glidden Coatings and Resins Div., SCM Corp., Strongsville, OH

COLOR AND APPEARANCE
(9:00-10:30)

SYMPOSIUM ON COLOR AND APPEARANCE INSTRUMENTATION -- AN OVERVIEW -- Dennis Osmer, CIBA-GEIGY Corp., Ardsley, NY

BRUNING AWARD LECTURE -- Ralph Stanziola, Applied Color Systems, Inc., Princeton, NJ

MATTIELLO LECTURE
(10:30-11:45)

AMINO RESINS IN HIGH SOLIDS COATINGS -- Werner J. Blank, Manager of Resin Products at the Stamford Research Center of American Cyanamid Co., Stamford, CT

FEDERATION LUNCHEON
(11:45)

Ballroom A, Room 2001, Cobo Hall.

Presentation of the George Baugh Heckel and Paint Show Awards.

Winners of other Federation awards to be announced.

IMPACT OF CORROSION - II
(2:00-4:00)

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, Pittsburgh, PA

ORGANIC COATINGS FAILURE ANALYSIS -- R. M. Holsworth, Glidden Coatings and Resins Div., SCM Corp., Strongsville, OH

EXAMINATION OF WEATHERED COATINGS BY PHOTOELECTRON SPECTROSCOPY AND FOURIER TRANSFORM INFRARED SPECTROSCOPY -- Glenn Cunningham, PPG Industries, Allison Park, PA, and Charles M. Hansen, Scandinavian Paint and Printing Ink Research Institute, Horsholm, Denmark

SURFACE DEFECTS FACTORS AFFECTING THE DISTORTION OF IMAGES (DOI) OF PAINTED REINFORCED RIM -- D. Hart, General Motors Corp., Warren, MI

ANNUAL BUSINESS MEETING
(4:00-5:00)

Annual Business Meeting of the Federation.

Presentation of these awards: American Paint & Coatings Journal/A.F. Voss . . . Materials Marketing Associates . . . Program Committee . . . Armin J. Bruning . . . Roon Foundation . . . Ernest T. Trigg

Installation of Officers, 1981-82.

Paint Show Hours

Wednesday, Oct. 28
12:00 p.m. to 5:30 p.m.

Thursday, Oct. 29
9:30 a.m. to 5:00 p.m.

Friday, Oct. 30
9:30 a.m. to 4:00 p.m.

Cobo Hall (left foreground), site of the 1981 Paint Show

UCAR® ACRYLICS. GOOD NEWS FOR PEOPLE WHO HAVEN'T HAD ANY RECENTLY.

Your local Union Carbide Sales Representative will be glad to show you how the Acrylics of the Future can put a smile on your face and bucks in your pocket.

UNION CARBIDE

Coatings Materials

1981 Paint Show Exhibitors to Date

Aceto Chemical Co., Inc.
Air Products and Chemicals, Inc.
Aluminum Co. of America
C.M. Ambrose Co.
American Hoechst Corp.
Applied Color Systems, Inc.
Armstrong Containers, Inc.
Ashland Chemical Co.
Atlas Electric Devices Co.

B.A.G. Corp.
BASF Wyandotte Corp.
Beltron Corp.
Blackmer Pump Div., Dover Corp.
Brinkmann Instruments, Inc.
Brookfield Engineering Labs., Inc.
Buckman Laboratories, Inc.
Byk-Mallinckrodt Chem. Prod. GmbH

Cabot Corp.
Capricorn Chemical Corp.
Cargill, Inc., Chem. Prods. Div.
CDI Dispersions
CECOS International, Inc.
Celanese Chemical Co., Inc.
Celanese Plastics & Specialties Co.
CEM Corp.
Chemical & Engineering News (ACS)
Chicago Boiler Co.
Clawson Tank Co.
Color Corp. of America
Columbian Chemicals Co.
Commercial Filters Div., Kennecott Corp.
Continental Fibre Drum Co.
Cosan Chemical Corp.
Custom Chemical Co.

Daniel Products Co.
Degussa Corp.
Desert Mineral Products, Inc.
Diamond Shamrock Corp., Proc. Chems. Div.
Diano Corp.
D/L Laboratories
Dominion Colour Co., Ltd.
Dow Chemical USA
Draiswerke, Inc.
Drew Chemical Corp., Spec. Chems.
DSET Laboratories, Inc.

Eastman Chemical Products, Inc.
Ebonex Corp.
Eiger Machinery, Inc.
Elcometer, Inc.
Elektro-Physik, Inc.
Encapsulair, Inc.
Engelhard Minerals & Chemicals Div.
Epworth Mfg. Co., Inc.

Fawcett Co., Inc.
Federated Metals Corp.
Fed. of Societies for Coatings Tech.
Filter Specialists, Inc.
Freeport Kaolin (Message Center)
Fricke McCormick Engineering

GAF Corp.
Gardner Lab. Div., Pacific Sci. Co.
General Electric Co., Silicones
Georgia Kaolin Co.
W.R. Grace & Co., Davison Chem. Div.
Graco, Inc.

Halox Pigments
Harshaw Chemical Co.
Henkel Corp.
Hercules Incorporated
Hilton-Davis Chemical Co. Div.
Hockmeyer Equipment Corp.
Hooker Chemical Corp.
J.M. Huber Corp.
Hunter Associates Lab., Inc.

Ideal Manufacturing & Sales Corp.
Inmont Corp.
International Minerals & Chem. Corp.
Interstab Chemicals, Inc.
ISC Alloys, Ltd.

Johns-Manville

Kenrich Petrochemicals, Inc.
KTA-Tator Associates, Inc.

Labelette Co.
The Leneta Co.
Letica Corp.
Liquid Controls Corp.
Lorcon Chemicals, Inc.

3M Co.
Macbeth, Div. Kollmorgen Corp.
Manchem Incorporated
Matter Mixers, Inc.
McWhorter Resins, Div. of Valspar Corp.
Meadowbrook Corp.
The Mearl Corp.
Merck & Co., Inc.
MGI International, Inc.
Michigan Industrial Finishes
Mineral Pigments Corp.
Mini Fibers, Inc.
Mobay Chemical Corp.
Modern Paint and Coatings
Morehouse Industries, Inc.
Myers Engineering

Nalco Chemical Co.
National Assn. of Corrosion Engineers
National Paint and Coatings Assn.
Netzsch Incorporated
Neville Chemical Co.
New Way Packaging Machinery, Inc.
NL Chemicals/NL Industries
NYCO, Div. of PMI

Omya, Inc.
Ottawa Silica Co.

Paint Research Institute
Penn Color, Inc.
Pennsylvania Glass Sand Corp.
The Pfaudler Co.
Pfizer, Inc., MPM Div.
Photomarker Corp.
Polyvinyl Chemical Industries
Potter Industries
PPG Industries, Inc.
Premier Mill Corp.

Q-Panel Co.

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

Sandoz, Inc.
SCA Chemical Services, Inc.
Semi-Bulk Systems, Inc.
Sewell Plastics, Inc.
Shamrock Chemicals, Corp.
Shell Chemical Co.
Sherwin-Williams Co., Chems. Div.
Silberline Manufacturing Co., Inc.
Southern Clay Products
South Florida Test Service
Spencer Kellogg, Div. Textron, Inc.
Standard Container Co.
Steel Structures Painting Council
Sun Chemical Corp., Pigments Div.
SWECO, Inc.
Systech Corp.
Systech Liquid Treatment Corp.

Tenneco Chemicals, Inc.
Thibault & Walker Co.
Thiele Engineering Co.
Tokheim Meter Div.
Troy Chemical Corp.

Union Camp Corp.
Union Carbide Corp.
Union Chemicals Div., Union Oil Co.
Union Process, Inc.
Uniroyal Chemical Co.
United Catalysts, Inc.
United States Movidyn Corp.
Universal Color Dispersions
University of Detroit
University of Missouri-Rolla
University, North Dakota State
University of Southern Mississippi
U.S. Movidyn Corp.

R.T. Vanderbilt Co., Inc.
Vorti-Siv Div., M&M Machine

Wacker Chemical Co.
Warren Rupp Co.
Waukesha Div., Abex Corp.
Weathering Research Service Co.
Wellco Products Div., Itasco Ind.
Wilden Pump & Engineering Co.
Witco Chemical Corp.

Zorelco Limited

OTHER CONVENTION INFORMATION

PAINT INDUSTRIES' SHOW

The 46th Annual Paint Industries' Show will run concurrently with the Annual Meeting in Cobo Hall, Detroit. The only national exposition of materials and equipment used in the formulation, testing, and manufacture of coatings, the Show will be open from 12:00 pm to 5:30 pm on Wednesday, October 28; 9:30 am to 5:00 pm on Thursday, October 29; and 9:30 am to 4:00 pm on Friday, October 30.

Participating supplier companies will have their top technical representatives on hand to discuss the latest developments with registrants at this year's event, the largest in Paint Show history.

REGISTRATION

Registration fees for the Annual Meeting and Paint Show are on a Federation member and nonmember basis:

	Member	Nonmember	Spouses
Advance*	$40	$55	$25
In Detroit	$45	$60	$30
One-Day	$25	$35	-

*Special registration for retired members and their spouses only: Advance registration will be $20 each.

Registration form is included in this issue (see page 24) and has also been mailed to all members.

Note: Purchase of luncheon tickets is optional for both advance and on-site registration.

LUNCHEON

The Federation Luncheon will be held on Friday, October 30, at Cobo Hall.

Presentations will be made to the recipients of the George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation) and the Flynn Awards (firms judged to have the best exhibit booths in the 1981 Paint Industries' Show).

A celebrity guest speaker will be featured.

SPOUSES' PROGRAM

A schedule of activities has been planned each day for spouses attending the Annual Meeting, and a Hospitality Room will be maintained at both the Detroit Plaza and Book Cadillac hotels.

A get-acquainted Wine and Cheese Social is scheduled for Wednesday afternoon.

On Thursday, a continental breakfast will precede an all-day tour of Detroit.

Continental breakfast will be available again on Friday morning.

Registration fees for the Spouses' Activities are $25 in advance and $30 on-site.

HEADQUARTERS HOTEL

The Detroit Plaza will be headquarters hotel, and the Book Cadillac will be co-headquarters. Other hotels with blocks of rooms set aside for the Annual Meeting are the Downtown Travelodge, Howard Johnson's, Leland House, Pontchartrain, and Shorecrest in Detroit, and the Holiday Inn, National Traveller, Richelieu, and Viscount in Windsor, Ontario.

Shuttle bus service will be provided between participating hotels and Cobo Hall.

ROOM RESERVATIONS

All requests for rooms and suites must be sent to the Federation Housing Bureau on the official form provided by the Federation. These have been mailed to all members and are also included in this issue (see page 26). Additional forms are available from Federation Headquarters.

BOARD MEETING

The Fall Board Meeting of the Federation will be held on Tuesday, October 27, at Cobo Hall.

SPEAKERS' BREAKFAST

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

PUBLICATION OF PAPERS

The JOURNAL OF COATINGS TECHNOLOGY has prior rights to the publication of all papers presented at the Annual Meeting.

NPCA MEETS SAME WEEK

The National Paint and Coatings Association will hold its annual meeting from October 26-28 at the Detroit Plaza Hotel.

NPCA badges will be honored for admission to the Federation Annual Meeting and Paint Show on Wednesday, October 28.

PROGRAM STEERING COMMITTEE

Chairman—Dr. Thomas J. Miranda, of Whirlpool Corp., Benton Harbor, MI; *Vice-Chairman*—John C. Ballard, of Kurfees Coatings, Inc., Louisville, KY; Darlene Brezinski, of DeSoto, Inc., Des Plaines, IL; Percy E. Pierce, of PPG Industries, Inc., Allison Park, PA; Peter Hiscocks, of Canadian Industries, Ltd., Toronto, Canada; Theodore Provder, of Glidden Coatings & Resins Div., SCM Corp., Strongsville, OH; and Walter Stuecken, of Grow Group, Inc., Troy, MI.

MEETINGS COMMITTEE

Members of the Detroit Society are serving on the Meetings Committee under General Chairman Jose G. Benavides, of Ford Motor Co. Chairing the various subcommittees are: Information Services—Bohdan (Dan) Melnyk, of Chrysler Corp.; Program Operations—Taki Anagnostou, of Wyandotte Paint Products, Inc.; Publicity—Jack Dentler, of Pfizer, Inc., MPM Div.; Luncheon—Fred F. Boehle, of Boehle Chemicals, Inc.; Society President—Walter Stuecken, of Grow Group, Inc.

Co-chairing the Spouses' Activities Committee are Mrs. Fred (Rosemary) Boehle, Mrs. Walter (Lorraine) Stuecken, and Mrs. Jose (Lorraine) Benavides.

FSCT Annual Meeting and Paint Show

Federation Member	ADVANCE REGISTRATION	Non-Member
$40.00	COBO HALL, DETROIT, MICHIGAN October 28–30, 1981	**$55.00**

IMPORTANT: **REGISTRATION AND FULL PAYMENT MUST BE IN THE FEDERATION OFFICE NO LATER THAN THURS., OCTOBER 1, 1981 TO QUALIFY FOR THIS OFFER.**

PLEASE PRINT EXACTLY as you wish registration badge prepared

NICKNAME

FIRST NAME LAST NAME

BUSINESS AFFILIATION

STREET

CITY STATE *(U.S. only)*

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

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

PLEASE CHECK ONE BLOCK IN EACH CATEGORY

YOUR COMPANY *(Check One):*

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

YOUR POSITION *(Check One):*

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

***Special registration for Retired Federation Members and their spouses $20.00 each in advance only.**

MAIL TO: Federation of Societies for Coatings Technology
1315 Walnut Street • Philadelphia, Pa. 19107

ANNUAL MEETING AND PAINT INDUSTRIES SHOW

REGISTRATION FEES

	Member	Non-Member	Spouses Activities
ADVANCE	**$40.00**	**$55.00**	**$25.00**
ON SITE (FULL TIME)	**$45.00**	**$60.00**	**$30.00**
ON SITE (ONE-DAY)	**$25.00**	**$35.00**	**—**

Spouses Activities

An interesting program has been planned for the spouses.

There will be a get-acquainted wine and cheese social in the Detroit Plaza Hotel on Wednesday, October 28. Continental breakfasts will be available on Thursday and Friday mornings in the Plaza and the Book Cadillac.

On Thursday, the spouses will be conducted on a sightseeing tour of Detroit and to the magnificent Meadow Brook Estate, home of the late Matilda Dodge Wilson. This estate, of over 100 rooms, exemplifies the elegance of 18th century England, and contains an abundance of antiques, wall hangings, and original Regency furniture. Luncheon will be served in the elegantly appointed dining room overlooking the green meadow.

The Annual Federation Luncheon will be held on Friday in Cobo Hall.

IMPORTANT: **REGISTRATION AND FULL PAYMENT MUST BE IN THE FEDERATION OFFICE NO LATER THAN THURS., OCTOBER 1, 1981 TO QUALIFY FOR THIS OFFER.**

SPOUSES ACTIVITIES ▪ ADVANCE REGISTRATION

NICKNAME

$25.00

FIRST NAME LAST NAME

STREET

CITY STATE *(U.S. only)*

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

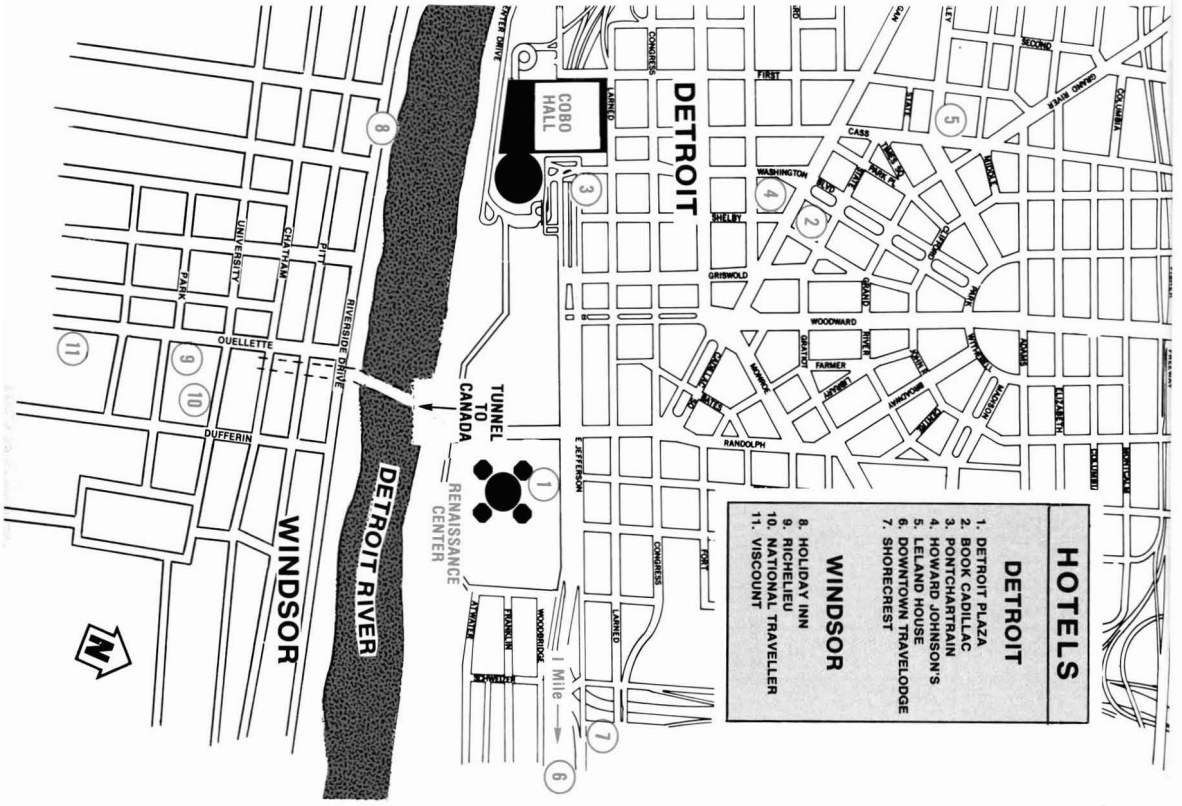
MAIL TO: FSCT, 1315 WALNUT ST., PHILADELPHIA, PA 19107

HOTEL INFORMATION AND RATES

All room rates in Detroit are subject to an additional 4% charge—a Detroit tax. There is no hotel tax in Windsor.

Hotel	Singles	Doubles (D) Twins (T)	Parlor & 1 Bedroom	Parlor & 2 Bedrooms
		Hotels in Detroit		
BOOK CADILLAC*	$50	$58 (D) 70 (T) (DD)	$175/250	$225/300
DETROIT PLAZA	59/69/79	71/81/91	170/190/280	240/270/365
DOWNTOWN TRAVELODGE	38	40 (D) 42 (T)	—	—
HOWARD JOHNSON'S	40	52 (DD) 50 (T)	—	—
LELAND HOUSE*	30 to 45	35 to 55 (D) 40 to 55 (T)	45 to 65	65 to 85
PONTCHARTRAIN	64/69/74/79	79/84/89/94	140 to 225	200 to 285
SHORECREST	25 to 34	27 to 38 (D) 33 to 44 (T) 50 (DD)	65 to 90	—
		Hotels in Windsor, Ontario, Canada (All Rates in Canadian Dollars)		
HOLIDAY INN	49	59 (D) 63.50 (T)	—	—
NATIONAL TRAVELLER	36	41 (D)	—	—
RICHELIEU	46 to 52	52 to 60 (D)	—	—
VISCOUNT*	40/42	42/44 (D) 46/48 (T) 50 to 62 (DD)	—	—

* These hotels require a one night's room deposit.



FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1981 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
COBO HALL, DETROIT, MICHIGAN
OCTOBER 28, 29, 30
(Wednesday, Thursday, Friday)

MAIL TO: **Coatings Federation Housing Bureau**
100 Renaissance Center, Suite 1950
Detroit, MI 48243

APPLICATION FOR ACCOMMODATIONS

Please indicate below the type of accommodations requested and your choice of hotels. Room reservations cannot be guaranteed unless this form is received by October 1. All reservation requests must be in writing and processed through the Housing Bureau. Phone requests will not be accepted.

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

CHOICE OF HOTELS:
(see below)
1st
2nd
3rd
4th

Hotel assignments will be made in the order received, and in accordance with availability. The Housing Bureau will send you an acknowledgment which will state the hotel to which you have been assigned. The confirmation of your reservation will come to you directly from the hotel, to whom you must direct all of your inquiries.

Note: Reservations for the Detroit Plaza will be accepted for arrival beginning Wednesday, October 28, only. Any requests for Plaza accommodations prior to Wednesday will be assigned to another hotel.

Please fill in the names and addresses of all occupants of the rooms you have reserved. (Bracket those rooming together.) Incomplete information will delay assignment of rooms. Type additional names on reverse side of this sheet. Please give accurate arrival and departure dates.

Type of Room	Name	Address	Dates of Arrival	Dates of Departure

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

TELEPHONE _____

(For Convention Bureau use only)

RESERVATION FOLLOW-THRU	DATE & INITIAL
Received at Housing Bureau	
Processed to Hotel/Motel	
Received at Hotel/Motel	
Confirmed to Guest	
Returned to Housing Bureau	

Four Solid Reasons to Talk to Faribo Industries

Before Making Any Decision on Oil-Free Polyesters, Resins and Varnishes

By Henry N. Bittner, President

I'd like to tell you about an unusual company that really understands your production problems and manufacturing requirements and knows how to help you.

Have you heard of Faribo Industries, Inc.?

We're not the biggest — but we could possibly be the most valuable supplier you'll ever discover for specialized polyester resins and varnishes.

We built this company backwards — around the needs of our clients and not the needs of our stockholders.

The result is a totally professional technically superlative company that knows how to provide supreme service, custom formulation, technical creativity — and most important of all — absolute confidentiality.

Even though we serve as "high tech" custom formulators, our prices are, on average, 10% lower than the mass producers.

So, it will come as no surprise to you that we're growing like a weed.

One of the technical gaps we're filling consists of the new products necessitated by the stringent rules and regulations of the EPA. As you well know, there is a great need for products which conform to very rigid demands. Now Faribo Industries can create the exact product your company requires. And we do it with the utmost discretion. Any product we create for you is not revealed to anyone else.

Our reputation for integrity in this area is unblemished. If you favor us with your product requirements *you can trust it will remain confidential.*

Since customer service is the cornerstone of our business, we are always willing to go that extra mile!

Many Faribo customers consider us a "high-class" department store of graphics arts and industrial coatings supplies. We work very hard towards this end. We try to offer you one quality source for everything from the varnishes, alkyd and polyester resins, to the flushed colors, dispersions and dry colors for the ink, paint, textile and coating related industries.

You may also want to know our ideas on service personnel. We have highly skilled, technically superior individuals who possess thorough knowledge of your specific industry.

We excel at producing high-quality custom products. We are not into the "commodity" type mass products business. We are known nationwide as a moving force in the "high-tech" product development field. Our complement of prestigious customer names readily attests to this fact.

We are strategically located with access to all major transportation routes.

We believe you'll select Faribo Industries custom products for the following compelling reasons:

1. **All our products are manufactured to strict standards of quality control.**
2. **They are researched, developed and manufactured by technically superlative people with creative genius for effective problem solving.**
3. **Our lofty quality standards are as high when you order a tank car load as they were when we sent you the original one gallon sample.**
4. **I put my reputation as a stickler for consistent quality on every product that leaves our dock. You have my personal guarantee of satisfaction on every order you ever place with Faribo. If there's ever any problem with a product not meeting the standards listed on our technology sheets, you may call me directly and I'll personally see that it's solved to your satisfaction.**

We now offer an unduplicated line of custom-formulated products.

For example, we produce the only 100% NVM polyester resin with a Y-Z viscosity on the market able to be made into a high solids coating which can be sprayed using conventional equipment. This low viscosity material eliminates the need to purchase the expensive new equipment which is often necessary with conventional polyesters.

Other recent Faribo developments include a special polyester resin which allows high-gloss and which performs under adverse weather conditions, letting O-T bends be achieved on coil coating with high "pigment to bender" ratio. In addition, our development of special additives that promote adhesion to substrates for the printing inks and coatings industry have been widely praised.

Faribo also enthusiastically creates "high-grade" varnishes and alkyds for our customers at refreshingly appealing prices. And though our prices are modest, we insist they adhere to the very same quality standards as our custom products.

It's important to us — because we use our own quality varnishes and alkyds as raw material for some of our own important products.

In summary, I honestly believe you may be making a mistake if you don't talk to us first — before you buy any resins, polyesters or varnishes.

Call or write me personally, or contact our distributors listed below. You'll find Faribo Industries the innovative leader in what oftentimes can be an unresponsive industry.

Filling *your* needs is our daily business. And we're fully prepared to expertly solve any creative formulating dilemma you may ever pose. Please take us up on our offer.

Faribo Industries, Inc.
A Subsidiary of Investment Rarities Incorporated
2989 N.W. First Avenue
Faribault, Minnesota 55021
WATS #1-800-533-0462

Representatives:

T.H. Hilson Company
P.O. Box 224
Wheaton, Ill. 60187
312-533-0730

Boehle Chemicals Inc.
19306 W. Ten Mile Rd.
P.O. Box 2001
Southfield, Mich. 48037
313-444-4980

Sunbelt Chemical, Inc.
2639 Walnut Hill Lane
Suite 108
Dallas, Texas 75229
214-357-6218

Lawlor Distributors
6114 Broadway
Cleveland, OH 41127
216-883-7038

California Representative:
Double R Company
1140 Spring Meadow
West Covina, CA 91791
213-332-3134

Cemsac Chemicals
1678 Ansonborough Dr.
Chesterfield, MO 63017
314-532-4330

PRI Paint Research Institute
of the Federation of Societies for Coatings Technology

PROCEEDINGS/NUMBER 146

PRI's Ongoing Research To Overcome the Problem Of Mildew Defacement of Painted Surfaces

A Summary

Roy A. Brown
Trustee, Paint Research Institute

INTRODUCTION

The Paint Research Institute's work on the problem of mildew defacement of painted surfaces is presently funded by a Consortium of the following companies and organizations: Buckman Laboratories, Inc.; Calgon Corp. (Merck); Cosan Chemical Co.; du Pont Co.; Glidden Coatings and Resins Div., SCM Corp.; PPG Industries, Inc.; Rohm and Haas Co.; Troy Chemical Corp.; and the National Paint and Coatings Association in cooperation with PRI. The Program Manager is Dr. Charles Yeager, of Registration Consulting Associates, Inc.

EARLY BASIC PRI RESEARCH

When research into the mildew problem was begun by PRI several years ago, it was quickly discovered that the industry really knew very little about the microorganisms which cause mildew. We didn't understand fully their growth patterns, the nature of their cell structure, and the biochemistry involved when mildewcides inhibited their ability to exist on paint films. A number of grants, funded by PRI, were given to researchers in several universities, and a tremendous amount of basic information necessary for a scientific approach to the problem was developed.

Many ideas came out of this research work. Questions were generated, such as:

(1) From what we have learned about the mildew-causing organisms, can we find a way to interrupt their life cycle at some stage?

(2) Can we incorporate a mildewcide in the film which will "fight-back" when attacked by the mildew organism? In other words, find a way to keep the mildewcide in the paint film until such time as mildew organisms penetrate the film, allowing the fungicide to be liberated.

(3) Can we chemically bond a fungicide to some basic element of the paint film so that it is released slowly and only as the structure of the paint film gradually breaks down and erodes from exposure to sunlight and weather?

(4) Can the fungicide be anchored to the polymer backbone of the paint film so that it remains in the film? If so, will the fungicide still function as an effective agent in killing mildew organisms and/or preventing their growth?

(5) Can the mildewcide be encapsulated so that a "time-release" mechanism is established which will prevent mildew growth for the useful life of the paint film?

RELIABLE ACCELERATED EVALUATION TEST NEEDED

Research work by Dr. Robert A. Zabel, of the State University of New York, College of Environmental Science and Forestry, funded by a grant from the Mildew Consortium of PRI, has resulted in the development of a new procedure for growing the *Aureobasidium pullulans* organism on fresh latex paint films, axenically, in the laboratory. This procedure which appears readily adaptable to testing the effectiveness of amounts and kinds of fungicides in paint films, may be the accelerated test for

Mr. Brown is Vice-President—Technical of the National Paint & Coatings Association, 1500 Rhode Island Ave. N.W., Washington, D.C. 20005.

which we are searching. Considerable work is now being done to verify the test and to correlate results with test fence exposures.

The Zabel test procedure is fully documented and described in an article by R.A. Zabel and W.E. Horner in the April 1981 issue of the JOURNAL OF COATINGS TECHNOLOGY.

POLYMER-BOUND BIOCIDES

Dr. Charles Pittman, of the University of Alabama, a well-known scientist in the field of polymer chemistry, has done a great deal of research in chemically anchoring biocides to monomers and polymers. Funded by PRI grants, Dr. Pittman has been successful in preparing a number of polymer-anchored fungicides. The Consortium Steering Committee is concentrating on an acrylate polymer to which the fungicide pentachlorophenol has been anchored. Pentachlorophenol, a broad spectrum fungicide known to be an effective mildewcide, but fugitive from paint films, was chosen as ideal for determining the efficacy of the "polymer-anchored fungicide" theory.

Ample quantity of pentachlorophenol acrylate is now being prepared, on Dr. Pittman's formula, to permit the preparation of sufficient exterior latex paints for field testing in several geographical areas.

Paints will be prepared with the PCP acrylate polymer together with control paints containing the same amount of PCP physically added as a mildewcide. The Technical Committees of several local Federation Societies have volunteered to prepare paints, panels, and exterior exposures. The work will be coordinated by the Federation Technical Advisory Committee. Latex polymers and paint formulas will be furnished to the local Societies by the Mildew Consortium.

An article by Dr. Pittman describing his work was published in the *American Chemical Society Preprints*, Vol. 44, 1981, Division of Organic Coatings and Plastics Chemistry.

OTHER RESEARCH PROJECTS UNDERWAY

The Mildew Consortium has other research projects started with plans to investigate some unusual avenues toward solving the mildew problem:

(1) A literature survey entitled, "A Review of Microbial Defacement of Painted Surfaces" is being done by Dr. Douglas Eveleigh, of Rutgers University. This will be completed in 1981.

(2) Dr. Richard Crang, Director of Electron Microscopy at the University of Illinois, will undertake a study which will take a close-up look at the mildew-causing organisms. Using electron microscopy, the study will determine the native cell structures, find out what parts of the cell are being attacked by mildewcides, and gain knowledge on the concentration of mildewcide which prevents 50% mildew growth. This is an attempt to understand better the chemical action of mildewcides on organisms.

(3) Dr. Donald Siehr, of the University of Missouri-Rolla, continues his work on melanin formation. Melanin is the black coloration formed by *A. pullulans*—it is the black mildew growth we see on paint films. Little is known about melanin and its formation. Dr. Siehr is studying the cell wall regeneration—identifying the biochemistry involved. Perhaps a mutant can be found to inhibit melanin formation, rendering *A. pullulans* growth white or colorless.

Controlled Release and Encapsulation Mechanisms

Two proposals, one from Massachusetts Institute of Technology and one from the National Bureau of Standards are being studied. These are studies relating to controlled-release mechanisms for mildewcides. Other proposals for research into controlled release fungicides will be sought.

A search for companies or organizations doing microencapsulation work is being made by members of the Mildew Consortium. This may be another way to retain mildewcide effectiveness in paint films for a longer period of time.

CONSORTIUM APPROACH EFFECTIVE

Mildew research by PRI is controlled by a Steering Committee made up of those companies and organizations who contribute $5,000 per year to this project. These representatives are experts in the type of research being done. They guide the academic researchers along lines they know are practical and which will be beneficial if the research is successful. They control the directions of the research for which their company's money is being spent. This system adds a practical dimension and a management approach to the research project. Consortium Steering Committee representatives agree that if the effectiveness of new principles, theories, and scientific approaches to the problem can be demonstrated by PRI-sponsored research, then commercial products will be developed individually by interested companies.

THE PROGNOSIS IS GOOD

The problem of mildew growth on paint didn't develop overnight. It has been with us for several hundred years and we have not yet solved it. It is probably the one problem which causes the greatest number of complaints on architectural paints in the United States today.

PRI-sponsored research on mildew is encouraging and has brought us a long way towards solution of the problem—we are getting closer. The final solution is not yet at hand, but when it is you can bet that some carefully planned research will have been responsible.

The consortium approach will be discussed by Dr. Charles Yeager, Program Manager, in next month's JCT.

Spring 1981 Board of Directors Meeting

Thirty-four members attended the Spring Meeting of the Board of Directors of the Federation of Societies for Coatings Technology on May 15, 1981, in Denver, CO.

The following were present:

Officers

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

Society Representatives

Baltimore ..... Alex Chasan
Birmingham ..... David Lovegrove
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
St. Louis ..... Herman Lanson
Toronto ..... Kurt F. Weitz
Western New York ..... Eugene LeVea

Other Members

Milton A. Glaser ..... Chicago
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

Dr. C. Robert Hiles and Larry Thomas, President and Executive Director, respectively, of the National Paint and Coatings Association.

The following Past-Presidents of the Federation: Newell P. Beckwith (Detroit); Neil S. Estrada (Golden Gate); and James A. McCormick (Baltimore).

Peter Robinson and Dr. Raymond R. Myers, President and Research Director, respectively, of the Paint Research Institute.

Steve Crouse, Vice-President of the Rocky Mountain Society.

The following Society officers who attended the orientation meeting the previous day: Nelson W. Barnhill, of C-D-I-C; Don Emch, of Northwestern; John E. Fitzwater, of New England; John Flack, of Montreal; Michael Gillen, of Pittsburgh; F. Robb Holt, of Golden Gate; Romer Johnson, of Los Angeles; Willis A. Johnston, of Philadelphia; Donald E. Keegan, of Baltimore; Layton F. Kinney, of Chicago; Carl J. Knauss, of Cleveland; William Martin, of Western New York; Fred Newhouse, of Louisville; Sara M. Robinson, of Piedmont; William Truszkowski, of St. Louis; Gary Van De Streek, of Detroit; Bill Wentworth, of Dallas; and Ted Young, of New York.

Staff

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

Mr. Borrelle called the roll of members and reported all present except: William F. Holmes, of Dallas and Bobby D. Moore, of Southern.

The report of the Fall 1980 Board of Directors meeting was approved as published in the January 1981 JOURNAL OF COATINGS TECHNOLOGY.

Reports of Officers And Staff

PRESIDENT ELLIS

The Federation is healthy in virtually all respects. The many activities sponsored by the Federation and the individual Societies are moving ahead well. In recent years, the Federation has improved its role in coordinating activities of the local Societies and increasing the exchange of ideas, information, and support among them. Meetings of the Technical Committee Chairmen, recently elected Society Officers, and the Education Committee Chairmen are examples.

Meanwhile, the Federation has developed meaningful liaison with other coatings industry organizations, both domestic and international. Officers attend meetings and conventions of the: National Paint and Coatings Association; Canadian Paint and Coatings Association; Asociacion Nacional De Fabricantes De Pinturas Y Tintas, A.D.; FATIPEC (biennially); and Oil and Colour Chemists Association (biennially).

The Joint Paint Industry Coordinating Committee brings together once a year officers and staff of the Federation, NPCA, Painting and Decorating Contractors of America, and the National Decorating Products Association. Also, annually, is a meeting of the International Coordinating Committee, which comprises representatives of technical organizations from a number of countries.

The Federation is in excellent financial condition. The budget again exceeds one million dollars. The investment transfer from Pittsburgh National Bank to Girard Bank, in Philadelphia, has been completed. Also, the annuity and insurance plans for the Federation staff have been completely changed, through the efforts of Howard Jerome, and the programs are greatly improved.

Geographic expansion and realignment are also occurring. The Baltimore Society has established a Virginia section; the Southern Society has established a Memphis section, and the Southern Society is asking for the annexation of the State of Arkansas.

Travelling is a major activity of the Federation President, especially if he lives on the West Coast. During the first half of my term, I have attended the following meetings and functions, accompanied by other officers and staff members and sometimes my wife: Finance and Executive Committee Meetings, in Las Vegas; Toronto, Mexico, Chicago, and Kansas City Society and Executive Committee Meetings; Southern, Western Societies, and Pacific Northwest Symposia; Montreal Society 50th Anniversary celebration; and NPCA Board of Directors and JPICC Meetings.

Visits to the Mexico and Montreal Societies had special meaning. This was the first official visit of the Federation Officers to the Mexico Society. Although language difference was a minor problem, it was no barrier to final understanding. The meeting, I am sure, brought a closer relationship between the Federation and the Society. Furthermore, Mexican hospitality proved outstanding. The visit to the Montreal Society was a special occasion because it celebrated the 50th Anniversary of the organization. This milestone was appropriately recognized, and the event was memorable—as it should be.

Although many activities have taken place during the first six months of our Federation year, many lie ahead; and I look forward to them with enthusiasm, knowing that the members, officers, directors, committees, and staff will continue their dedicated efforts to make 1980–81 an outstanding year. I would like to express my personal thanks for the generous support of everyone.

WILLIAM H. ELLIS,
President

PRESIDENT-ELECT JEROME

The months since taking office have been both interesting and busy. The Federation travel schedule is heaviest during the early part of the year. I have attended the Philadelphia Society Executive Committee meeting and have met with CDIC, Piedmont, and Dallas Societies. In addition, I attended a meeting of the Correspondence Course Review Board, the Symposium on Color and Appearance Instrumentation, the Technical Advisory Committee meeting and the Joint Paint Industry Coordinating Committee meeting. My wife, Gene, and I together with other Federation officers and wives represented the Federation at the West Coast Symposium and Show and by the time you read this we will have attended the Pacific Northwest Society Symposium.

On March 19, 1981, I had the privilege of representing the Federation at the New England Society panel discussion on "Paint Quality." This was an extremely well attended program and the proceedings only served to reinforce my thinking that the subject of paint quality is a subject whose time has come.

I appreciate the warm reception and hospitality extended to officers and staff wherever we have made an appearance. I hope the opportunity to discuss all aspects of Federation operations is considered as important to Society members as it is to us. The opportunity for personal meetings with Society members provides an insight into our organization that can be obtained in no other way. I feel it is well worth the time, effort and money that is put into it. Few will appreciate the effort expended by our staff in handling the traveling details. I feel fortunate in being associated with this group of highly motivated and dedicated individuals.

HOWARD JEROME,
President-Elect

TREASURER BOYCE

As the newest officer to the Federation, my first months have been spent familiarizing myself with the duties of office.

A visit to Federation Headquarters was made in January, where one finds a friendly staff that is most helpful. Our staff in Philadelphia is well organized and does an excellent job of administering the daily Federation business.

At our January Financial Meeting we passed a balanced budget for 1981 exceeding one million dollars. We are within budget for the first quarter and barring any unforeseen circumstance will end the year within budget.

Part of your Treasurer's duties is to serve as a Trustee and Treasurer of PRI and I have attended two Trustee meetings to date this year. PRI is endeavouring to improve its research track record and hopefully the future will be brighter and the new efforts bear fruit.

I have had the good fortune to visit with the Toronto, Cleveland, and Montreal Societies and each reception was most cordial. Montreal is most enthusiastic about hosting the first Federation Convention outside of the USA in 1983. In March, along with B. Ellis, H. Jerome, and F. Borrelle, I attended a Joint Paint Industry Coordinating Committee Meeting—a joint meeting between FSCT, NPCA, NDPA, PDCA.

CLARKE BOYCE,
Treasurer

EXECUTIVE VICE-PRESIDENT BORRELLE

The new decade has gotten off to a good start for the Federation. The first year was very successful, as the financial statement and other reports will indicate. 1981 looks good, too. This report will reflect Federation and staff activities since Fall 1980.

First Visits

I was privileged to make the first Federation visit to two new Society Sections: Virginia (Baltimore) and Memphis (Southern). Attendance and interest were good and from all reports, both groups are off to a good start.

With President Bill Ellis, I was also proud to make the first Federation visit to a Mexico Society meeting (February 26). It, too, was an interesting meeting with attendance about 100. Our stay was co-hosted by the Society and the Mexico Paint Manufacturers Association. We extend our thanks to them for their kind and generous hospitality.

Publications

JCT: Advertising income ended up just shy of the 1980 budget. Total pages (editorial and advertising) published during the year were 1,184 (46 less than 1979).

The new "Humbug" column by Herb Hillman has added a refreshing new dimension in readership. And also a new reading habit for those who now open the JCT from the back.

Soon, you will receive the JCT (on a regular basis) during the same month of issue. In order to accomplish this, the JCT staff pushed hard to produce two issues simultaneously. Under the expedited schedule, the closing date for news-type copy must become six weeks prior to the first of the month of issue.

Year Book: The 1981 edition was released in late February, a few weeks earlier than in 1980. The Society Treasurers made this possible and we thank them for their good cooperation.

Series on Coatings Technology: In various stages of processing are the following proposed additions: Statistics for Coatings Industry, Simplified Chemistry for Coatings Technologists, Inorganic Zinc Rich Primers, and updates of Units 5 (Resins) and 6 (Solvents). One or two may be published this year.

Newsletter: This continues its dual distribution: (1) to key Federation/Society personnel by direct mail and (2) later in the JCT.

Dictionary: Sales are steady. About 3,000 copies have been sold.

Glossary of Color Terms: Our newest publication is this special compilation of color-related terms, extracted from the Dictionary.

Infrared Book: Sales of about 1,000 copies have been registered to date.

Pictorial Standards Manual: This photographic binder continues to be popular. More than 200 have been purchased since it was revised in 1979.

Other Services

Color-matching Aptitude Test Set: Sales have averaged about 75 sets per year. The first production of the 1978 edition is running out. Munsell Color Co. has been contracted to produce another 400 sets, using the remainder of the color chips purchased in 1973.

Audio-Visual: We are now offering two new programs: "Introduction to Resin Operations" by the Toronto Society and "The Setaflash Tester" by the Birmingham Club. We thank them for the excellent presentations. Birmingham is now working on an "Introduction to the Paint Industry."

File of Society Meeting Talks: As reported to you previously, this quarterly service to Societies continues. But little interest is shown.

SCAI: The second Symposium on Color Appearance and Instrumentation, held March 24–26, will be covered in Tom Kocis' report.

Membership

1981: The list of 6,616 members (Active—4,616, Associate—1,678, Other—322) was published in the 1981 Year Book. Even though the overall gain was only 50 from the previous year, three Societies (Mexico, Southern, and Toronto) have grown appreciably during the past two years.

Processing of New Memberships: Because I have been asked about this several times during recent months, I repeat the statement which was included in my report of October 1979:

It is our practice to neither process nor bill for any new members whose applications are received after June 30. Any received after that date are held for the new year and it is assumed that their names will be included in the Society's roster for the coming year.

For those applications received prior to June 30, our practice is to initiate the JCT membership subscription with the next issue to be published. However, we do not send back issues, unless specifically requested to do so.

Annual Meeting and Paint Show

Registered attendance at the 1980 AM&PS was 5,133 (Members—1,465; Non-members—1,075; Exhibitors—1,516; Spouses—541; NPCA members—473; and Complimentary—63). The 1979 figure was 4,780 (the FSCT and the NPCA did not meet together that year.

Again, I am pleased to report that this year's Paint Show will be a record-breaker. In 1980, there were 141 paid exhibitors in 34,350 net paid square feet. So far this year, we have 157 paid exhibitors (17 are new) in 36,550 net paid square feet.

In addition, the Federation has given complimentary exhibit space to the following: Universities—Detroit; Missouri-Rolla; North Dakota State; and Southern Mississippi; Industry Organizations—NPCA, NACE, SSPC, and, of course, PRI and the FSCT.

PRI

We have prepared and distributed the enclosures and accompanying letter (approved by the PRI President) soliciting contributions for 1981. A new staff responsibility is to write the minutes of PRI Trustees meetings.

FSCT Exhibits

Tom Kocis and I tended to the Federation's exhibit at the Western Coatings Societies' Show in March. The space was donated by the duPont Co. Rosemary Falvey and Dick Gross represented the Federation at our complimentary exhibit at the Baltimore "Coatings Show" also in March. Bob Ziegler prepared a Federation display board for the 50th anniversary meeting of ISCC which he attended in New York.

Officer/Staff Visits

Officer/Staff visits to Societies so far this year have included: the Virginia and Memphis Sections; Philadelphia (Executive Committee only); Baltimore; Toronto; Mexico; West Coast Symposium; Southern; CDIC; Piedmont; Cleveland; Chicago; Kansas City; and Dallas.

Coming up are: Detroit; Pacific Northwest; Montreal (50th Anniversary); and the joint St. Louis-Kansas City meeting.

Other staff travel has included: PRI meetings; Chicago Society's SYMCO; NPCA Scientific Committee; Ad Hoc Committee on PRI; and meetings of the Corrosion, Manufacturing, and Technical Advisory Committees. The latter will be covered in more detail by Tom Kocis.

JPICC

The Officers and I attended the annual meeting of the Joint Paint Industry Coordinating Committee in April. JPICC is

composed of the FSCT, NPCA, PDCA, and NDPA. Main topics discussed were: (1) promotion of paint products to consumers and (2) more cooperation/communication between locals of the four groups. With regard to these two items, the Federation was asked to: (1) offer sales-promotion ideas to NPCA and (2) encourage our Societies to attempt joint programming, such as is practiced by the New England and St. Louis Societies.

Future AM&PS

The schedule of AM&PS from 1982–1990 was approved by the Board of Directors at the October 28, 1980 meeting and a slightly-revised schedule was attached to the January 1981 Executive Committee minutes. Copies were forwarded to NPCA.

New Service Equipment

The Federation office now employs another telephone system (Sprint) for most of its long-distance calls. The rates are about 30% less than "Ma Bell," which is used locally and for long-distance calls to areas not covered by Sprint.

With the objective of improving our service and holding costs down, we will purchase a more efficient photo copier and a word-processor.

Frank J. Borrelle,
Executive Vice-President

DIRECTOR OF FIELD SERVICES KOCIS

Committee Liaison

Technical Advisory—A meeting of the TAC with Society Technical Committee Chairmen was held March 26 & 27, in Louisville, to which 16 Societies sent representatives. Focus of discussions was Society projects underway and suggestions for work that might be undertaken to supplement current activities.

Based on current work being done, five Societies (Chicago, Cleveland, Golden Gate, Louisville, and Toronto) expressed intent to present papers at 1981 Federation Annual Meeting.

Among the Society projects that generated much interest was the Southern Society's undertaking to develop a Consumer Guide to Trade Paint Quality; a rough sample of a proposed brochure was presented, which visually depicts hiding power and stain removal qualities. The objective of the guide is to educate the consumer on quality criteria and an awareness of the limitations of lower-priced products. The brochure, which will be recommended to the Federation Board for its consideration in publishing and distributing, received the unanimous backing of the Society Technical Committee Chairmen and TAC members in attendance.

Among the projects suggested for Society undertaking were the mildew and fungicidal studies, based on work being done by PRI (this has been discussed previously and generated much interest but has been delayed pending development of suitable fungicides for testing. It is anticipated that these will be available this summer; eight Societies have expressed desire to take part in this effort. Other major project topics included corrosion control (rust-inhibitive topcoats; variations in application conditions) and computer applications in paint industry (New York Society has responded to this suggestion and plans a survey of the industry to determine number of companies using computers, type used, and extent of usage).

Reports of Society Technical Committee activity were submitted to the Federation office and will be published in a forthcoming issue of JCT.

Manufacturing—Committee met February 10, in Toronto, to discuss current and proposed programs.

The Committee will sponsor a seminar at the 1981 Annual Meeting on milling/dispersion (aimed at the smaller to medium-sized paint producers), which will focus on Utilization-Optimization-Formulation for existing equipment, i.e., "getting the most out of what you've got."

Production work was completed on the Toronto Society's A/V program, "Introduction to Resin Operations," and it has been added to Federation library of available audio/visual presentations. The Committee reviewed newest submission (by New York Society), "A Batch-Operated Mini-Media Mill." It has been referred to the Federation office for further review and subsequent production.

Two earlier A/V's ("Sand Mill Operation"—Kansas City and "Cartridge Straining"—Houston) are being revised and updated for resubmission to the Federation.

Committee has offered its assistance to Kansas City Society Manufacturing Committee which plans survey of filtration procedures used in resin manufacture.

Corrosion—Committee met in Toronto, April 8 (in conjunction with convention of National Association of Corrosion Engineers).

The Committee has been actively cooperating with both the Technical Advisory Committee (developing suggested topics for project work in the corrosion area) and the Annual Meeting Program Committee (lining up several papers for the full-day symposium planned on corrosion control for the 1981 AM).

Included in future activities of the Committee are establishing liaison with other coatings-related organizations to monitor and report on work they are doing.

Educational—Correspondence Course being developed in conjunction with University of Southern Mississippi is behind schedule, basically due to faculty changes at USM. One of the authors, George Bufkin, has left the school to join the coatings industry, and his loss has put a burden on the remaining authors (Bob Burks, Gary Wildman, and Shelby Thames). Initial timetable called for availability of the course by September 1981; current status points to earliest availability being September 1982.

Annual update of "Guide to Coatings Courses, Symposia, and Seminars" has been published and distributed.

Number of booklets from Federation Series on Coatings Technology are being revised and updated; one ("Solvents"—#6) has been completed and is being reviewed. Newest submission is "Simplified Chemistry for Coatings Technologists," which is also being reviewed.

Promotion of career opportunities in coatings industry is a key area of Committee activity, and literature and slides are being planned to assist in presentations by Society personnel at local schools.

FSCT Educational Steering Committee will host Society Educational Committee Chairmen at June 26 meeting in Kansas City.

Program—Planning for 1981 Annual Meeting program began at organizational meeting of Committee held last September and at follow-up meeting held at 1980 Convention in Atlanta.

Theme for the 1981 AM in Detroit is "Challenge, Change, and Opportunity," and Committee plans three full days of presentations devoted to its various aspects. Tentative programming slots the following topics for each of the three days of sessions: Innovations in Coatings (Wednesday); Raw Materials to Finished Product—Challenge of Compliance (Thursday); and Coatings Failure—$70 Billion Challenge and Opportunity (Friday).

Early indications are that the Committee will again have the pleasant task of selecting from an abundance of submissions.

Audio/Visual Programs

Work on two A/V programs was completed and programs added to those available for sale from the Federation: Introduction to Resin Operations (Toronto) and The Setaflash Tester (Birmingham).

Currently being reviewed are A Batch-Operated Mini-Media Mill (New York) and Hiding Power of Paints (Kansas City).

Symposium on Color and Appearance Instrumentation

This Symposium, sponsored by the Federation, in conjunction with the Inter-Society Color Council and the Manufacturers Council on Color and Appearance, was held March 24–26 in Louisville, KY. It was a follow-up to the initial SCAI event, held in March 1978, in Cleveland.

Format for the meeting was morning and afternoon general sessions on the first two days (technical papers were presented at each session), followed by four concurrent workshops, at which newly developed instrumentation equipment was on display. Each of the workshops focused on one of four topics (Gloss and Other Appearance Measurements, Color Formulation, Color and Spectrophotometry Measurements, and Sample Preparation and Presentation). The registrants rotated in attending the workshops until all four had been covered.

Total attendance was 148 (vs. 198 in 1978). Included were attendees from England, Sweden, France, Hong Kong, and Canada.

A modest surplus of income over expenses will accrue to the Federation for its work in providing money to initiate preliminary work on the Symposium, as well as for attending to the planning, promotion, and registration needs.

Dennis Osmer, Chairman of the Federation's ISCC Committee, was in charge of the general programming and he and his Committee arranged for all the paper presentations. The workshops and instrumentation exhibits were handled by MCCA. Both groups did an excellent job, and the success of the Symposium reflects the good work they did.

Interest was quite high throughout the event, and the comments of the registrants indicate that SCAI '81 was an overall success and generally well received.

Contributing to the success of the Symposium was the support of the Louisville Society membership, who helped generate interest and attendance (24 registrants were from the Louisville area) and offered assistance as needed.

Miscellaneous

Assistance was provided in arranging for and attending PRI Ad Hoc Committee meeting in Chicago, April 14 & 15 . . . "Glossary of Color Terms" booklet, based on terms and their definitions extracted from "Paint/Coatings Dictionary," has been published, 96-page booklet contains some 400–500 color-related terms . . . Annual update of "Talks Available to Constituent Societies" is being readied for publication; will be distributed sometime in May.

Thomas A. Kocis,
Director of Field Services

Comments from Guests

Dr. Robert C. Hiles, President of the National Paint and Coatings Association, and Larry Thomas, Executive Director of NPCA, commented on the following subjects:

Dr. Hiles indicated that the "Picture It Painted" campaign was underway with a press conference in New York in April. Attending were representatives of several magazines which published articles featuring the use of paint in home decorating in their May issues.

He then discussed NPCA's involvement in implementing the Hazardous Materials Indentification System (HMIS), saying that the current administration's stay of regulations has produced the question if any such system is necessary. In answer, he stated that without HMIS stricter regulations could be in effect in the future.

Dr. Hiles made the comment that following the NPCA Scientific Committee's evaluation of the proposed Joint Coatings Industry Technical Program, it could not recommend it to the NPCA Executive Committee. But he hopes that the Scientific Committee can be helpful to PRI efforts.

Mr. Thomas discussed further the role of HMIS. NPCA is currently holding eight seminars to explain the workings of HMIS. He said that neither NPCA nor any individual body could take responsibility to rate hazardous chemicals, but that some general instructions could be made to raw materials suppliers. Since injury prevention and, accompanying that, the prevention of law suits is of such importance, everyone will need to become involved.

On the subject of paint quality, Mr. Thomas stated that the term is immediately equated with a standards and certification program in the consumer product area. The NPCA Executive Committee is not interested in launching a major standards and certification program. It is very costly and the federal government tends to become involved in any industry self-regulation, he said. Efforts will continue in trying to educate the consumer through NPCA's Trade Sales Steering Committee.

[*Mr. Penny moved that the Federation Board endorse Mr. Thomas' response to the April 12, 1981 article in the* New York Times *entitled "Toxic Paint Chemicals Raise Alarm as Threat to Health of Workers." The motion was seconded by Mr. Rook and unanimously approved.*

Following is the text of Mr. Thomas' letter which was published as a Letter to the Editor in the May 14, 1981 issue of the Times:]

To The Editor:

Sunday's article on paint chemicals and worker health was both unfair and discouraging to a paint and coatings industry which is, in fact, helping to lead the way for American industry in a number of important worker health and safety areas.

The story leads one to believe that paint products are causing an epidemic of cancer and neurological disease while the industry either fights, or accepts grudgingly, federal efforts to protect workers. Nothing could be farther from the truth.

The wrong impressions were conveyed because the *Times* chose to omit from the article crucial information provided well in advance by the National Paint and Coatings Association. Specifically:

- A three year, $750,000 mortality study of some 17,000 paint and coatings manufacturing workers, exposed daily to combinations of over 1500 chemicals used in paint production, concluded that such workers face "no significant risk to health" on the job. Funded voluntarily by the paint industry, the study was conducted by the independent research firm of SRI, International under the direction of Dr. Robert Morgan, one of the world's foremost epidemiologists. The final draft report of the study was reviewed by Professor Sir Richard Doll of Oxford University, Dr. Richard R. Monson of Harvard University, and Dr. Philip E. Enterline of the University of Pittsburgh.

The *Journal of Occupational Medicine* considered the study important enough to publish it as the lead article in its January issue. But the *Times*, for some unfathomable reason, ignored it and instead quoted the results of several smaller studies, none of which have been published or are available for review, including one completed as far back as 1936.

- Far from ignoring the need for chemical safety labeling, the paint industry has devised, and is now implementing, a new Hazardous Materials Identification System (HMIS) which will be among the most effective, and yet simplest to use, of its kind in the United States. At a glance, the HMIS

label tells a manufacturing worker the type of hazard a chemical presents, the degree of hazard, and exactly how to protect himself.

Moreover, NPCA's Industrial Labeling Guide provides vital information on early symptoms of overexposure to chemicals, and on methods of early treatment.

- While the *Times* is incorrect in stating that Material Safety Data Sheets (MSDS) are required by law to provide information to workers exposed to chemicals, the paint industry none the less advocates, uses, and continually updates its MSDSs for the benefit of workers' safety and health.
- The *Times* is incorrect in implying that the paint industry is reducing the amount of solvents in its products only because solvents are becoming more expensive. In fact, solvent reduction is part of a major paint industry effort to reduce air pollution and meet environmental regulations.

Additionally, it's worthwhile noting that:

- The paint industry is a leader in research to demonstrate the effectiveness of breathing respirators in protecting worker health, and in improving respirator fit test methods.
- The toxic chemical benzene, despite the *Times'* statements to the contrary, is not used in paint and coatings production, and appears only as a trace impurity in some solvents.

The record shows that the paint and coatings industry has not only been a leader and an innovator in efforts to protect workers, but we have done so on our own initiative, under no pressure or requirement from government. NPCA and the paint industry will, of course, continue efforts to help protect workers and develop sound scientific data regarding worker health hazards. Unfortunately, inaccurate and discouraging articles like the one printed on Sunday promote an adversary relationship among industry, labor, and government and make it more difficult to engender the support from all parties which is so necessary to further our efforts.

Sincerely,

Larry Thomas, Executive Director
National Paint and Coatings
Association

Paint Research Institute

PRESIDENT ROBINSON

The Board of Trustees of PRI receives funds which have to be effectively administered and efficiently managed. Accordingly, the Board is moving away from largely a scientific supervisory role towards a business management orientation.

The Trustees are considering how PRI might increase its responsiveness to the needs of the medium-sized companies. There are pros and cons to this medium-company focus. A principal danger is that PRI might lose its support of the larger paint companies. This is because the research needs of the larger companies are apparently not the same as those of the medium-sized ones. A consortia approach in which several companies support specific work appears to satisfy the needs of all companies.

The Board of Trustees has redefined its function. The Board believes that it should translate the identified future business needs of the paint industry into scientific goals. These scientific goals are communicated to the Research Director who establishes the necessary scientific activity to accomplish them. The Board will evaluate the managerial performance of the Project Managers identified by the Research Director in order to make sure that PRI funds are being used effectively. At the completion of the project it is the responsibility of the Board to translate the scientific results obtained into a form usable by the industry.

The Board of Trustees of PRI has established modern mechanisms for project selection, project management, and project evaluation. It is the intention of the Board to use these managerial tools in identifying and controlling project activity carried out on behalf of the Board. A job description of the Research Director has been constructed which is compatible with the project management mechanism described earlier.

PRI funding continues to decline, and in constant dollar terms, is only half of what it was in 1970. Current PRI funding, if expended in a commercial paint or chemical company, would only provide for two man years of effort per year. Many paint companies will spend 10, 15, or 20 times this much on research. If PRI is to continue to function on behalf of the Paint Industry, it is essential that larger funding is made available quickly.

The Board of Trustees feels that the PRI image was not projected adequately by previous PRI booths at the Paint Show. Vice-President Mal Hendry is leading a project to upgrade the quality and communicative properties of the PRI booth at the 1981 Show in Detroit. The Trustees feel that their current business focus should be communicated to the local Societies and a mechanism for this will be established.

Dr. Ray Myers, Research Director, has submitted his scientific report and no further scientific comment will be forthcoming from the President of PRI.

The consortia approach mentioned earlier certainly seems to be a valuable one and the Board of Trustees feels there will be more in PRI. One might be the establishment of a consortium to study application science of compliance coatings.

PETER V. ROBINSON,
President

[*Mr. Robinson addressed the Board, detailing the proposed changes in the management of the Paint Research Institute. These included the areas of project selection; project design and proposal writing; project management; project evaluation; job description of the Research Director; and PRI communications.*

His presentation was very well received and plans are underway to record (on videotape) a repeat presentation by Mr. Robinson and to make the tape available to the Societies and others interested in the work of PRI.]

RESEARCH DIRECTOR MYERS

The mildew consortium is operating well, having contracted for an outside firm to prepare pentachlorophenylacrylate which will then be converted into fungus-resisting polymer by John Vanderhoff at Lehigh. Quantities large enough to be shared with individual Societies for technical committee evaluation are expected. The consortium has completed and evaluated a test protocol which will be supplied along with the samples.

Two additional supporters have joined the consortium. Membership has now reached nine, as follows: Buckman Laboratories, Cosan Chemical, duPont Company, Glidden Coatings & Resins, Merck & Co., National Paint & Coatings Assoc., PPG Industries, Inc., Rohm & Haas Co., and Troy Chemical Co.

New grants are being negotiated and their locations will have been established by the time of the board meeting. Charles Yeager continues as program manager.

The aqueous program has not yet become a consortium. Edward Glass, who recently joined NDSU after a career at Union Carbide's Charleston Laboratories, became the program manager on April 1. At this writing he had not yet taken the helm, and as a consequence the decision on renewing the grants in the aqueous program has been delayed. Trustee action is expected on April 22, and this will be reported orally.

High solids are the focus of our next anticipated effort. Our encounter session was judged a success by those attending and a prospectus written as a result of the encounter appears in the

May JCT. Reprints will be sent to academic department chairmen and selected faculty. Our experience with this approach to launching programs in mildew and corrosion has been favorable (although the corrosion program subsequently died); in the case of high solids we expect to focus on oligomers at least at the start.

Corrosion control has not been abandoned. Judging our earlier effort as too esoteric, despite the fact that it resulted in a corrodescope which reveals patterns of localized anodes and cathodes, we adopted a different approach. Henry Leidheiser was commissioned to write a critical survey on "The Mechanism of Corrosion Inhibition with Special Attention to Inhibitors in Organic Coatings" which included ideas for research supplementing those contained in our prospectus. This survey has been completed and was refereed by a subcommittee of the Trustees. It will appear in the July JCT. Whether it results in a new flurry of proposals on corrosion control is a question. Either way, follow-up measures are planned.

With a limited budget the only way PRI can properly support the above programs is via outside support. Until now consortia have developed from programs already started. The corrosion program may take a different approach and not be started until subscriptions have attained a predetermined level.

The PRI session at the 1980 Federation convention covered all of the technical aspects of our program. Charles Yeager and Charles Pittman spoke on mildew; Zeno Wicks on high solids; and I on the aqueous program. President Robinson keynoted the session (see January 1981 JCT).

You may see a more professional PRI exhibit as part of the Federation booth. Trustee Mal Hendry has volunteered to supervise this activity.

The main educational offering of PRI is the symposium on stability and stabilization of coatings systems scheduled for May 4–5 at Battelle, Columbus Laboratories. Reservations are far ahead of last time (1979) with over a month to go.

RAYMOND R. MYERS,
Research Director

Preliminary Report Of Ad Hoc Committee On PRI

In accordance with a directive from the Federation Board to undertake a comprehensive, in-depth study of the Paint Research Institute, the members of the Ad Hoc Committee on PRI visited 23 Societies (3 will be surveyed by mail) for discussions with interested members on the research needs of the coatings industry generally, the perceived current role of the Paint Research Institute in addressing that need, and suggestions and recommendations for improving efforts in that regard.

A standardized questionnaire was developed to uniformly survey areas of discussion with each Society. In addition, comments were solicited on any and all aspects of the PRI program.

It should be emphasized that this report attempts to summarize faithfully the consensus of Society views of the Paint Research Institute, and is not to be interpreted as representing, at this time, the final conclusions and recommendations of the Ad Hoc Committee.

TENTATIVE CONCLUSIONS

The following are the tentative conclusions which represent the consensus response of those participating:

The overwhelming majority of the members of the Societies contacted:

(a) Know very little about PRI and how it operates;

(b) Are unhappy about PRI projects, the reporting of these projects to Federation members, and the practical applications of the research results to the needs of the medium-sized and smaller companies in our industry;

(c) Strongly criticized the poor management, poor communications, and poor public relations emanating from both the Federation and PRI, on PRI programs, progress, etc.;

(d) Believe that future Federation research activities should emphasize participation of local Societies and members—from project selection, assignment at nearby universities, monitoring, and even financial support for research projects carried out in their area.

(e) Expressed unanimous willingness to support Federation research, even to significantly increased level of funding, provided membership was convinced of the practicality of the work, that projects were well managed, and reports were understandable.

(f) Expressed strong reluctance to solicit or accept government funding.

(g) Would like to hear about the progress of PRI projects on a regular basis, and in language that the average paint chemist can understand.

Majority of Society members were in favor of changing current PRI objectives from "basic" to "practical."

INTERIM RECOMMENDATIONS

Based on the conclusions listed above, the Committee recommends the following:

(1) Federation publish, on a regular basis, a list of all prior PRI Proceedings (excluding Research Director's Report) and their availability via a request from the Federation office;

(2) Study feasibility of reviewing selected PRI publications, these to be rewritten in language understood by the average reader of JOURNAL OF COATINGS TECHNOLOGY;

(3) Regular visits to Constituent Societies by representatives of the Paint Research Institute, to solicit Society membership for ideas and proposed projects, to report on and discuss PRI research programs and progress, and to establish an ongoing dialogue on these efforts;

(4) Improve communications between PRI and Societies (In this regard, Committee requests that tentative conclusions included in this report be published in the earliest available Federation Newsletter);

(5) Federation re-examine tax-exempt status of PRI in light of current regulations and how they impact on research undertakings;

(6) In view of Society members' expressed desire that they be consulted on project selection, Committee requests that the Federation Board of Directors consider FSCT Technical Advisory Committee representation on the PRI Board of Trustees.

More input is being sought from others in the industry who can identify ways in which the research effort can be improved. This includes, among others, PRI Trustees (past and present), technical directors of various coatings firms, researchers who have worked on PRI grants, as well as a study of the programs of overseas coatings research groups and those serving other industries — all designed to develop a data base resource to draw upon for further recommendations.

A subsequent report will be submitted to the Board for its meetings on October 27 in Detroit.

JAMES A. MCCORMICK,
Chairman

Chairman McCormick then called upon the other members of the Ad Hoc Committee (Federation past-Presidents

Newell P. Beckwith, Neil S. Estrada, Milton A. Glaser, and John J. Oates) to present their personal observations and comments regarding the committee's work and findings to date. Their statements follow.

Mr. Beckwith

The members of the Federation have now all had an opportunity either directly or through their local Society Representatives to express their opinions to the Ad Hoc Committee on the concept and practice of Federation Research (PRI in particular, if you will).

These opinions were overwhelmingly a negative criticism of PRI and there was a remarkable consistency in the comments from Society to Society.

But, those offering positive alternatives were in a very small minority. The standard phrase for an alternative was "practical research" without definition of how "practical research" could be worked realistically into a viable Federation research program.

For all of the 41 years that I have been closely associated with Federation research, we have been striving for "practical research," and we are no closer to that rainbow goal now than we were 40 years ago.

You and I have been transforming paint art into coatings technology throughout that 40 years—primarily through the development of technical knowledge, understanding and harnessing of the forces, potentialities and disciplines which characterize and control the materials we use. I define this as "practical research."

Now isn't it time that we really address ourselves to the realities of our problem? *Now isn't it time* that we abandon the hopes that some agency can be developed or employed to do the work of "practical research" that will answer all of our current "bench" problems? *Now isn't it time* that we put aside belief in a never-never land where we can put in an order to Federation research people for six tons of technology, two-thirds paid for by the 10 largest companies, delivered to our exact specifications, wrapped in a form where we can simply apply it to a "bench" problem, without material modification, to produce "widgets" specifically competitive with those 10 companies?

By no means have all facets of the forces, disciplines and potentialities controlling our materials been discovered. It's going to take inspiration, dedication, hard work, hard thinking, patience and understanding for us to mine them out, shape them and fit them to produce our own superior coatings of the future.

We can agree that most of the publication and communication of new technology by Federation research endeavors is poorly and unexcitingly presented, masked in scary language, peppered with unfamiliar differential equations and laced with complex and confusing charts. The Ad Hoc Committee feels that there is much to be done in communication, simplification of language, interpretation and suggestion in data and in control of Federation research.

But we also believe there is much to be done by members of the Federation in casting aside "The Easy Way" wishes that "practical technology" can be obtained on order. Our members must accept the challenge which calls for vastly greater personal effort to get down to the hard brain work, reeducation and dedication which will be necessary for the winners in future competition within and without our industry.

Mr. Oates

Our interim report summarizes what we learned from the Constituent Societies and is strongly critical of the PRI—particularly in its failure to communicate effectively with the members we have interviewed to date.

This raises the question as to whether there exists within our industry a silent minority of serious paint chemists, whose major contact with our Federation has been almost exclusively through receiving the JCT, who have read and appreciated the published proceedings of the PRI, and who would acknowledge PRI's value to them.

It is conceivable that such a minority's technical and career interests are not being adequately met by their local Societies, and as a result they don't attend meetings or participate in local committee work.

In the course of discussions with Society Officers, Committee Chairmen, etc., it is possible that our Ad Hoc Committee would never have received input from such a minority.

As part of its continuing responsibility, the Ad Hoc Committee should inquire if such a minority does indeed exist within our industry, and solicit input from them. And not just because such input relates to the PRI problem presently under consideration, but because such input is critical in resolving the even more significant problem of preserving and expanding our Societies' and our Federation's influence as effective technical entities.

Mr. Glaser

I have been assigned to speak briefly on the "Educational Aspects" of the in depth PRI study being conducted by the Ad Hoc Committee.

Frankly, I was both surprised and saddened when, in the course of my Ad Hoc Committee visits to Societies, so many members said that they *couldn't understand* PRI papers. Now *I* can understand many of the PRI papers and therefore I am certain that *most* Federation members *can* understand these papers if they will only take the time to read them and *make the effort* to understand them. Today you have already heard a few cases about the considerable benefits derived by some Federation members from PRI research. The inferences for each of us are obvious. More adequate funding for PRI, via our Societies and our companies, may well be assured if positive results from PRI research are more widespread and more visible.

With the excellent new management practices now being introduced by PRI President Peter Robinson, it seems logical that we may look forward to more symposia, more encounter sessions, more "critical surveys" on new technologies,—more of these fine and necessary educational activities which were introduced by PRI Research Director, Ray Myers. In addition to these "external" educational opportunities, I respectfully suggest that we also require "internal," or "self-education" activities. We must discipline ourselves to read PRI papers and where necessary to ask colleagues, friends, PRI professors, anyone who can help us understand some of the newer technologies and the mathematics. By this sort of mind-stretching, we shall find out that we *can* indeed understand most of the PRI publications, and that this knowledge can be extremely valuable to us in our work as professional scientists and to our companies, too.

I submit that we must both as an industry and as individuals—learn how to use the new, more sophisticated technologies if we wish to *SURVIVE*. I'm referring to the survival of the coatings industry as well as our individual survivals with good jobs through which we can support ourselves and our families.

We can be confident that, with the new approaches being instituted by the Paint Research Institute, the value of its Research to the coatings industry will be increasingly important. Perhaps in the near future we can look forward to Dr. Hiles and the National Paint and Coatings Association again participating in the funding of Research for the Paint Research Institute and thus for the entire Coatings Industry.

Mr. Estrada

The list of PRI Proceedings will be published in the JOURNAL OF COATINGS TECHNOLOGY, as requested by most of the Societies contacted by the Ad Hoc Committee. A review of the various papers published shows a commonality on a number of subjects. Paper No. 2, "Synthesis of Uniform Particle Size Styrene and Styrene-Butadiene Latexes for Paint Formulation Research," by A. H. Loranger, et al, *Official* DIGEST, April, 1959, was the first of a series of papers relating to monodisperse emulsions, some nine in all, that generated further work by a commercial company that resulted in their use of microvoids to reduce titanium dioxide content of paints at a significant cost saving.

In a similar vein, Paper No. 80, "Mildew Defacement of Organic Coatings," by Ray Myers, JOURNAL OF PAINT TECHNOLOGY, July 1971, initiated a series of related papers, seventeen in all, that has led to the successful Mildew Consortium. Other general subjects have been addressed with recognizable results, if a longer range view is taken.

It is easily understood that the "average" paint chemist, in a medium or small company, burdened with the usual problems of formulation, production, service problems and complaints may not keep current on changes in the research technology of our industry. However, if we are to be considered as more than technicians, if we are to be considered as professionals, then it is necessary that we maintain our scientific competency by personal effort. Without this effort, it appears inappropriate for members to comment on the character of PRI research.

[*Chairman McCormick requested that the Board appropriate additional funding so that the Ad Hoc Committee may continue its work.*

Mr. Penny moved that sufficient funding be provided so that the Ad Hoc Committee may complete its assignment. Seconded by Mr. Chasan and approved.]

Amendments To By-Laws

This report summarizes the actions of the Federation Board of Directors with regard to the Proposed Amendments to the By-Laws and Standing Rules presented at their meeting of May 15, 1981.

ADOPTED

The following amendments to the Standing Rules (Article SR I—Constituent Societies) were adopted.

Article SR I—Constituent Societies

WHEREAS the Southern Society has requested that the State of Arkansas be included within its boundaries and

WHEREAS the Dallas Society has agreed to transfer the State of Arkansas from within its boundaries to the boundaries of the Southern Society, be it

RESOLVED that Standing Rules Article SR I, Section B, be revised as follows:

"Dallas Society—That part of the States of Texas and Louisiana lying north of the 31st parallel, plus the entire State of Oklahoma."

"Southern Society—All of the following States: Arkansas, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, and all of Louisiana east of the Mississippi River and south of the 31st parallel."

WHEREAS the Baltimore Society has requested that additional territory in the State of Virginia be included in its boundaries and

WHEREAS the Piedmont Society has agreed to transfer this territory from within its boundaries to the boundaries of the Baltimore Society, be it

RESOLVED that Standing Rules Article SR I, Section B, be revised as follows:

"Baltimore Society—The State of Maryland, District of Columbia, and that portion of the state of Virginia east of a north-south line through Roanoke and north of a line from the northeast corner of Roanoke to a point defined by the junction of the Virginia & North Carolina borders at the Atlantic Ocean."

"Piedmont Society—All of the State of North Carolina, plus that part of the State of Virginia west of a north-south line through Roanoke and south of a line from the northwest corner of Roanoke to a point defined by the junction of the Virginia & North Carolina borders at the Atlantic Ocean."

* * * * * * * *

GIVEN FIRST READING

The following amendment to the By-Laws (Article VI—Annual Meeting) was given first reading. It will be presented for adoption at the Board of Directors meeting of October 27, 1981.

Article VI—Annual Meeting

WHEREAS By-Laws Article III, Section B, Sub Paragraph (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."

* * * * * * * *

TABLED

Because of the continuing review of PRI activities/organization by the Federation Ad Hoc Committee on PRI, the following amendment to the By-Laws (Article III—Organization) was tabled. *(It had received first reading at the October 28, 1980 meeting).*

Article III—Organization

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

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

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

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

* * * * * * * * *

DEFEATED

The following amendment to the By-Laws and Standing Rules (re equal voting and office-holding privileges for all members) was presented for first reading and was defeated. The vote was 17 against, 15 for. (24 is required for approval).

Amendment to By-Laws and Standing Rules Re Equal Voting and Office-Holding Privileges

WHEREAS the Pittsburgh Society has proposed that the existing Federation By-Laws and Standing Rules be amended to extend equal voting and office-holding privileges to all Federation members while still maintaining the existing classes of membership, be it

RESOLVED that the Federation By-Laws and Standing Rules be amended wherever applicable in order to extend voting and office-holding privileges to all members, regardless of class of membership.

FRED G. SCHWAB, *Chairman*
By Laws Committee

Nominations

The Nominating Committee places the following persons in nomination for office with terms to become effective November 1, 1981:

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).

Elections will take place during the Board of Directors meeting on October 27, 1981, in Detroit, MI.

Members of the Nominating Committee are: Ruth Johnston-Feller, Eugene LeVea, A. Gordon Rook, Fred G. Schwab, and the Chairman.

ELDER C. LARSON,
Chairman

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 meetings of November 1, 1980, and January 23, 1981) were included with the minutes mailed previously to the Board of Directors. The actions of the May 13, 1981 meeting were presented to the Board during the present meeting.

The actions are as follows:

NOVEMBER 1, 1980

That $26,000 be appropriated to Federation committees (Account #677), 1980-81, for the purposes outlined in the minutes.

That $8,400 be appropriated to the Educational Committee (Account #750), 1980-81, for the purposes stated in the minutes.

That Mr. Jerome continue his study of pension plans for the purpose of seeking a plan for Federation Staff with better benefits at the same cost.

That Federation Staff salaries be increased, effective November 6, 1980, and that the salary budget for 1981 be set at $238,000.

JANUARY 23, 1981

That the estimated statement of income ($1,092,714) and expense ($1,038,018) for 1980 be accepted.

That the PRI Statement of Income ($112,000) and Disbursements ($92,088) for 1980 be accepted as presented.

That the PRI budget of Income ($125,000) and Disbursements ($125,000) for 1981 be accepted as presented.

That the Federation's Pension Plan for Staff be withdrawn from Provident Mutual Life Insurance Co., Philadelphia, and placed with Financial Design Consultants, Inc., St. Louis.

That JOURNAL OF COATINGS TECHNOLOGY advertising rates be increased by 20%, effective April 1981.

That the single copy price of the *Year Book* be increased to $20.

That the *Paint Show Program* advertising rates be increased by 10%, effective with the 1981 edition.

That the ticket price of the Friday Luncheon during the 1981 Annual Meeting and Paint Show be increased to $15.

That the Federation purchase another 400 Color-matching Aptitude Test Sets from Munsell Color Co.

That the price of the Color-matching Aptitude Test be increased to $400 effective April 1, 1981.

That the production of the 400 CAT sets be financed from cash flow and/or assets as required.

That the Federation's Investment Trust at Girard Bank remain as is until further notice: 30% in Girard Fiduciary Income Bond Fund and 70% in U.S. Government Guaranteed Money Market Instruments, and that the bank be advised accordingly.

That the Federation appropriate $40,000 to PRI in 1981 (the sum requested by PRI).

That the 1981 budget of income ($1,103,500) and Expense ($1,092,500) be approved.

MAY 13, 1981

That the Executive Committee investigate the acquisition of long term disability insurance program for the Federation staff.

That the request from the Federation Delegates to IUPAC—for $2,000 so that a delegate can attend the IUPAC meeting in the Netherlands this October—not be granted in 1981.

[*Mr. Lovegrove, of the Birmingham Club, indicated that he plans to attend the IUPAC meeting and will be glad to represent the Federation.*]

That the 1982 President and his wife (Howard and Gene Jerome) represent the Federation at a meeting of the Birmingham Club and also at the XVIth FATIPEC Congress in Liege, Belgium, May 1982.

That the Federation support appropriate efforts to increase consumer awareness of various qualities of architectural paints.

[*Larry Thomas, Executive Director of the National Paint and Coatings Association, commented that NPCA could support such a resolution on paint quality.*]

[*All of the above actions of the Executive Committee were approved by the Board of Directors.*]

New Business

FEDERATION HONORARY MEMBERSHIP FOR PAST-PRESIDENT HERBERT L. FENBURR

Herbert L. Fenburr, a Past-President of the Federation (1967-68) and the C-D-I-C Society, was proposed by the Society for Federation Honorary Membership. As specified in Standing Rules II, the Secretaries of each Society and the Board of Directors were advised of the nomination.

By unanimous vote, the Board of Directors elected Dr. Fenburr a Federation Honorary Member.

Committee Reports

CORROSION

The Corrosion Committee has had two meetings since the last report. One meeting was on October 29, 1980 at the Federation meeting in Atlanta and a second meeting was held on April 8, 1981 in Toronto, in order to coincide with the annual meeting of the National Association of Corrosion Engineers (NACE).

The meeting of October 1980 was devoted primarily to a discussion of the input the Corrosion Committee could have at the 1981 Federation meeting. Thomas Miranda (Program Chairman) was invited to attend, and he indicated that the Friday session would be devoted to a program on corrosion and, of course, the Committee was in support of this program concept. Suggestions were made regarding topics for presentation and, it was agreed that the Corrosion Committee would recommend potential speakers for Program Committee consideration. (This was done subsequent to the meeting. The committee sent its recommendations to the chairman who compiled a list of names and forwarded them to Tom Miranda). Additionally, one member of the Corrosion Committee, Dean Berger (Phila.), volunteered to present an "overview" paper on corrosion, its problems and solutions.

Tom Ginsberg (New York) responded to the announced need for a Federation delegate to NACE Technical Advisory Group ISO/TC 35/SC 12, "Preparation of Steel Substrates Before Application of Paint and Related Products," by volunteering for the position. The group is a technical liaison to the International Standards Organization, on the development of standards on surface preparation.

The meeting of April 8, 1981 included a report on the participation of the Committee with the Technical Advisory Committee, an update on the Federation program and a discussion of future committee activities.

Federation technical committees responded to suggestions of the Corrosion Committee to work on related topics. The following committees are working on "corrosion" topics:

Louisville—Non-lead corrosion inhibiting pigments.

New England—Effect of surfactants on corrosion inhibition.

Chicago—Reliability of the salt fog cabinet to predict serviceability of water based primers.

Golden Gate—Corrosion inhibition of CARB vs non-CARB primers.

In addition, other topics for study by technical committees were suggested including:

(1) Comparison of commercial water-based vehicles in mildly corrosive environments.

(2) Effectiveness of rust inhibiting products recommended for application over rusted steel.

(3) Use of combining the exposure of paint films in more than one accelerated testing device, as a means of predicting the performance water-based paints.

(4) Evaluation of the ingredients used in water-based paints in relation to their effect on corrosion protection.

(5) The use of moisture vapor permeability as a tool to predict corrosion inhibition of water-based paints.

(6) The effect of thixotropy on the protection of edges and other sharp areas of steel.

Future activities of the Corrosion Committee will include the contacting of various other coating related organizations to begin to establish liaison (Richard Max, of New York, volunteered to initiate contact on behalf of the Committee). Additionally, the chairmen will write to the presidents of the Societies seeking out recommendations of names of people to join the Corrosion Committee. The purpose of this thrust is to both broaden the base of the Committee as well as to involve other members of the Federation in committee activities.

The next meeting of the Committee is scheduled for October 28, 1981 in Detroit.

SAUL SPINDEL,
Chairman

ENVIRONMENTAL CONTROL

DELEGATE TO NPCA AND GOVERNMENTAL AGENCIES (ENVIRONMENTAL CONTROL)

This will be a combined report because the activities of the Committee and the Delegate have been carried on simultaneously.

Through the efforts of Mr. Harry Schwartz, of the Baltimore Society, and Mr. Thomas Kocis, of the Federation Staff, an Environmental Newsletter was prepared and distributed covering the temporary suspension of Paint Waste Testings. Four paint manufacturing waste testings and two paint user waste testings were temporarily suspended from EPA's Federal Hazardous Waste Regulations pending further study by the EPA. This means that all paint wastes are not considered hazardous or toxic per se. If they meet any of the EPA's cirteria for hazard or toxicity, e.g., flammability, then they are regulated. This suspension is being followed by the NPCA Task Force on Waste Disposal to make the deletion of these wastes from the EPA listings.

At the present time activities of the Committee with regard to regulations are dormant. This is due to President Reagan's moratorium on Federal Regulations of January 29, 1981 which directed federal agency administrators to postpone for 60 days

the effective date of all regulations that have been issued and are scheduled to become effective during the 60 day period. One controversial regulation that has been withdrawn is the OSHA Hazard Identification and Labeling standard that it had proposed on January 16, 1981.

The Environmental Committee and the Delegate will continue to work with NPCA so that our members can be kept current on Regulatory problems.

S. LEONARD DAVIDSON,
Chairman and Delegate

INTER-SOCIETY COLOR COUNCIL

The major project of the ISCC delegation was the Symposium on Color and Appearance Instrumentation held March 24–26 in Louisville, Ky. The planning, organizing and arranging for this meeting has been a major concern for the delegation for the past two years, primarily spear-headed by Messrs. Kocis, Marcus, Osmer, and Sotorrio. This was indeed a very successful event although the attendance turn-out was not as large as originally expected. Our most important speaker was Dr. David Wright who talked about the experimental origins of the 1931 CIE system.

This Symposium followed a similar format to the 1978 SCAI held in Cleveland. A questionnaire will be sent out to all participants providing us with feedback so that a third SCAI, to be held in 2–3 years, might be even more successful in meeting the needs of our industry.

Part of the registration for SCAI package was a glossary of color terms which was separated from the Federation's coatings dictionary.

The annual Inter-Society Color Council meeting is to be held in New York April 26th through 28th and the ISCC Committee of the Federation will meet during this time. At this point, there are no major projects currently contemplated by the committee, only the wrap-up of papers presented at SCAI for publication in the JOURNAL OF COATINGS TECHNOLOGY.

DENNIS OSMER,
Chairman

MMA AWARDS

Three letters announcing the MMA Awards and soliciting Society entries have been sent to each Society President and each Federation Board of Director member. The mailings were dated December 12, 1980, February 5, 1981, and March 16, 1981.

We have received several Society letters announcing their intention of submitting entries for consideration in the MMA awards competition.

The MMA committee is ready to do their judging and will announce the winners at the annual meeting.

TERRYL JOHNSON,
Chairman

MANUFACTURING

The Steering Committee met February 10, 1981 in Toronto. The minutes of that meeting were sent to Society Manufacturing Committee Chairmen with a request for their comments.

The prime topic of discussion at the meeting was planning for the Manufacturing Committee program at the Annual Meeting in Detroit. The Committee agreed on a presentation aimed at smaller-to-medium sized paint producers on the topic of dispersion. This is envisioned as an effort keyed to utilization-optimization-formulation for all types of equipment so the manufacturer can get the most out of what equipment he has.

Fred Daniels has agreed to be Moderator of the program and Richard Max has met with him to outline the objectives of the program. Speakers are now being contacted and we will arrange a preliminary meeting of the speakers so all presentations will be coordinated.

Also discussed at the meeting was the Kansas City survey on Filtration. The Committee approved of the project and offered its assistance in any way possible.

The current status of Slide/Tape programs was reviewed. The New York Society program on "A Batch Operated Mini-Media Mill" was shown. Two other programs are still being prepared: "Sand Mill Operation" (Kansas City) and "Cartridge Straining" (Houston). Mike Beatty of Baltimore has informed us that his Society is considering preparation of a program.

DONALD J. FRITZ,
Chairman

MEMBERSHIP

In examining Constituent Society membership figures based on the 1979–1981 Year Books, we note the following:

(a) The overall membership has increased about 0.7% per year to a total of 6616 in 1981.
(b) There has been a decrease in active members of 1.1% (50) based on the total number of active members listed in 1980.
(c) There has been an increase in associate members of 5.5% (92) based on the total number of associate members listed in 1980.

This may explain the current trend in many local societies to allow associate members to vote and serve as officers of their Societies.

Three Society Membership Chairmen should be singled out for "Atta Boy" awards. They are: R. H. "Ted" Stevenson, Toronto Society (increased membership from 261 in 1980 to 383 in 1981, an increase of 122 members); Bill Maxwell, Southern Society (increased membership from 434 in 1980 to 500 in 1981, an increase of 66 members); and Antonio Guevara, Mexico Society (increased membership from 63 in 1980 to 112 in 1981, an increase of 49 members).

Other Societies showing an increase in membership in 1981 are: Birmingham; CDIC; Dallas; Louisville; Pacific Northwest; Piedmont; Pittsburgh; Rocky Mountain; St. Louis; and Western New York.

One of the best sources for names of potential members for a local Society is the list of attendees at various symposia and conventions. Earlier this year, a list of names of non-members who attended a recent PRI symposium, was submitted to individual Society Membership Chairmen for follow up.

In addition, the Federation staff has sorted out the names of approximately 1,000 non-members who attended the 1980 Atlanta convention. From these, the names of approximately three hundred prospective members were obtained. The Federation Membership Committee is in the process of sorting these names according to geographical location. When this is completed, the information will be forwarded to the individual societies for follow up. Similar information from other symposia and Coatings Courses is being sought.

We solicit your help in seeing that this information is put to good use.

A. GORDON ROOK,
Chairman

[During the meeting, Mr. Rook distributed to the Society Representatives the registration forms of non-members who attended the 1980 Annual Meeting. The Societies were requested to check out the names for potential membership.]

METRIC SYSTEMS

Due to the present tardiness in the U.S. conversion program and the inactivity of NPCA's Metric Task Force during 1980–81, this committee also showed little activity, most of the preparatory work already being completed.

On the Canadian scene there is better progress. Recently this committee was able to assist in the conversion process of trade-sales dealerships by suggesting a new conversion method for tinting stock, in addition to the methods already presented earlier by this committee. In brief, the nature of the suggestion was:

The imperial gallon size, i.e., 4.54 L, will change to the 4 L size on conversion, i.e., there will be a drop of approximately 12% in can contents. Therefore:

(1) To tint 4L of paint to the same shade as the old imperial gallon the same amount of colorant is used, but the strength of the colorant is reduced to 88% of original, i.e., the colorant must be changed to the weaker type.

(2) If this weaker colorant were added to the full amount of mill-base in an old imperial can a weaker shade would result. To overcome this, about 10% of the mill-base in an imperial gallon can is removed in the dealers store before tinting. This can be done by using a throw-away plastic or paper cup of the proper capacity (450 mL). Only 10% rather than 12% is removed because pastel and deep shade bases contain different amounts of mill base and 450 mL, a nominal 10%, seems a good average to suit all. The mill base removed is saved in a suitable container. Several containers will be needed, e.g. one for gloss bases, one for semi-gloss, one for latex. The can is then tinted as if it were a 4 L can and is sold as 4 L paint, *not* 1 gallon.

(3) The mill bases saved in the containers are either sold by the dealer as a "special white" or arrangements are made between dealer and paint manufacturer to return the saved bases for credit.

(4) Treated similarly are one imperial quart cans. Here, approximately 100 mL of mill base will be removed and the can is then sold after tinting as 1 L of paint, *not* 1 quart. The advantages of this suggested method are: Very little expense is incurred in the conversion. No alterations of tinting machines are required. There is no problem with carrying metric and imperial stock by the dealer since the method automatically and instantly converts imperial stock to metric. The color shade obtained on tinting remains essentially unaltered and is the same whether metric or imperial stock is used. Mistintings and mismatchings are unlikely to occur.

The disadvantages of some "messiness" due to removing mill base from imperial cans and the necessity of either selling or returning the removed mill-bases are only temporary and are outweighed by the cheapness of the method and the fact that it removes the "double stock" problem.

E. L. HUMBURGER,
Chairman

PROGRAM

The Program Committee was organized and a theme for the National Convention developed, "Challenge, Change and Opportunity." Symposium themes for each day are: Innovations in Coatings—Wednesday; Raw Materials to Finished Product—Thursday; Coatings Failure—Friday.

Abstracts have been received and reviewed by the Steering Committee. Additional papers of specific topics have been solicited from a number of sources.

A tentative schedule of paper positions on the program has been developed and will be updated as required.

Roon Award papers are being received and slotted. Society papers will be assigned as received.

THOMAS J. MIRANDA,
Chairman

PUBLICATIONS

The Publications Committee is planning a meeting for May 5 at the Federation Headquarters. This meeting involves policy, updates, recommended changes in composition of the Committee and the Editorial Review Board and a survey of matters critical to the Journal.

Manuscript flow has been good but in speeding up publication dates we are somewhat tight on manuscripts. We are still soliciting manuscripts from ACS and other conventions.

The new feature "Humbug from Hillman" was implemented as a humor and assorted wit contribution to readers. We plan to continue if Herb's supply of trivia and related nonsense holds up. Contributions are hereby solicited from Board members and friends of JCT.

THOMAS J. MIRANDA,
Chairman

DELEGATE TO THE NATIONAL ASSOCIATION OF CORROSION ENGINEERS

The annual meeting of the National Association of Corrosion Engineers, which has become known simply as "CORROSION" took place during the week of April 6–10, 1981 at the Sheraton Center Hotel, Toronto, Canada. As usual, an extremely varied program of conferences, symposia, technical committee meetings, and exhibits, was offered on numerous topics related to corrosion, out of which coatings is only one.

The groups of papers more closely related to coatings was presented during a symposium entitled, "Underfilm Corrosion," which took place on April 6. A well-balanced variety of papers was presented: "Solid State Chemistry Principles As Applied to Delamination of Organic Coatings"; "Dispersion X-Ray Analysis by Scanning Electron Microscopy"; "Influence of Abrasive Cleaning on the Corrosion Resistance of Coated Steel"; "Are Modern Coatings and Their Methods of Application Giving Optimum Performance"; "New Developments in Anti-Corrosion Protection and Repair Techniques to Offshore Structures"; "Permeation and Underfilm Cutting of Coatings in Hostile Environments"; and "A New Dimension in Corrosion Protection." Numerous other papers, although not so directly related to coatings, were of considerable interest, especially in specific problems such as atmospheric, underground, underwater, or pipeline corrosion.

Just as the FSCT has working Committees, NACE has Technical Groups, which study specific corrosion-related topics. There were numerous meetings of committees and sub-committees of Group T-6, involved primarily with protective coatings and linings. Among those meeting in Toronto were:

(1) T-6A on coatings and lining materials for immersion service;

(2) T-6A-44 which is reviewing publication No. 2 of the Technical Practices Committee;

(3) T-6G which is studying topics related to surface preparation for protective coatings;

(4) T-6G-12 which is evaluating visual standard for centrifugally blasted clean surfaces;

(5) T-6G-19 which is developing techniques and procedures for field measurement of surface profiles on metal;

(6) 6T-6H, concerned with coating materials for atmospheric service;

(7) T-6H-15 which studies the effect of surface preparation on service life of protective coatings; and

(8) T-6Q which is developing information on the quality assurance of protective coating materials and their application.

It should be pointed out that although these technical committee meetings cover a variety of subjects under their

respective general topics, the context of these meetings is generally limited to the reporting and approval of conclusions reached by the same committee during what is called the "Fall Committee Week." During these Fall committee meetings, most of the actual discussion and consensus is developed in a smaller setting, more conducive to reaching conclusions than at large committee meetings. Therefore, the Fall Committee Week is a more appropriate environment for those interested in the discussion and drafting of documents. The 1981 Fall Committee Week will take place September 20–25th at the Denver Hilton Hotel in Denver, Colo. The attendance to these meetings is open, and anybody interested in participating will be cordially received.

A new group met during CORROSION '81 in Toronto: the Technical Advisory Group (TAG) to ISO/TC35/SC12, "Preparation of Steel Substrates Before Application of Paint and Related Products." ISO is the International Organization for Standardization, which is attempting to draft internationally accepted standards in a variety of topics related to coatings. One of these relates to surface preparation. This is an area in particular need of international standards, since nowadays various countries use different standards. For example, in the U.S. the SSPC standards are more generally accepted; in Europe, the Swedish standards; in the Orient it is the Japanese standards, etc. The Technical Advisory Group from the U.S. is composed of representatives of various institutions involved with coatings, including the Federation (from which the writer is official representative), Steel Structures Painting Council, and other organizations. Three working groups were appointed to develop recommended guidelines to be provided to the U.S. representative to ISO, on surface profile, surface cleanliness, and methods of evaluation. The overall Technical Advisory Group met on April 9; the recommendations of the working groups were approved, and will be conveyed to the U.S. delegate.

As usual, CORROSION '81 was enriched by an exhibit which provided an opportunity to learn the latest offerings of industry in the field of corrosion evaluation, monitoring and protection.

Despite its name, NACE is a truly international association, with members all over the world. The CORROSION meetings are usually well attended by overseas visitors; taking place in Canada provided an added measure of international emphasis.

THOMAS GINSBERG,
Delegate

DELEGATE TO NPCA SCIENTIFIC COMMITTEE

The NPCA Scientific Committee met in Denver on March 18–19, 1981. Jack Lynch, of Benjamin Moore & Co., is the current Chairman of this committee and Len Afremow, of Midland-Dexter Co., is the Vice-Chairman.

One of the more interesting aspects of this meeting was the tour of the Adolph Coors Co. Can Manufacturing Plant.

COMMITTEE CHARTER AND OBJECTIVES

This was one of the better meetings of the NPCA Scientific Committee. There was a great deal of philosophical soul searching discussions concerning the role of the NPCA Scientific Committee. A draft of rewrite of the objectives was overwhelmingly rejected by the committee. It was viewed as too passive and not activist enough. It was generally felt by the committee members that the NPCA Scientific Committee must seize the initiative and define its own charter of objectives and then see if they are acceptable by the NPCA Board rather than wait for the NPCA Board to define the objectives. Immediate past NPCA Scientific Committee Chairman, Bob Bailey, was appointed to head a new Charter and Objectives Subcommittee to formulate a new charter and objectives in time for the Fall NPCA Scientific Committee meeting.

TECHNOLOGY PROGRAM (CI—TEP)

The Research Subcommittee of the Scientific Committee has been working on a proposal for doing cooperative research by the paint industry over the past two years. The programs and questionnaire related to it was discussed by many of the Scientific Committee members with their Chief Executive Office. Some qualitative conclusions are as follows:

There is a need for technological innovation.

A large number of class A members are relying on class B members for innovation.

Most CEO's—*strongly don't want* government involvement in their organizations.

As a result of the survey, the NPCA Scientific Committee voted two to one *not to present* the CI-TEP proposal in its present form to the NPCA Executive Committee.

As a result of this questionnaire, Al Ross of the Research Subcommittee proposed three options for discussion.

(1) NPCA Scientific Committee itself invest funds for a specific research project.

(2) Go to the Paint Research Institute (PRI) and as committee, work more closely with PRI and advise them on projects to aid them in and increase PRI support.

(3) Quit altogether.

The Waste Recovery Treatment was suggested as a possible joint project with PRI in which fundamental and pragmatic work could be done.

The sense of the committee was to work on the first and second options. Therefore, the Research Subcommittee was charged with reviewing the industry needs in their subcommittee with regard to specific projects and funding. This subcommittee would consult with the FSCT ad hoc Committee which is involved with evaluating PRI.

PRI DISCUSSION

Out of the preceding discussion involving CI-TEP, there was much discussion and criticism of PRI. John Oates, a member of the ad hoc committee of the FSCT charged with evaluating the PRI made a number of points:

Project selection by PRI needs to be improved; perhaps the NPCA Scientific Committee could advise;

PRI reports in the Journal of Coatings Technology are too difficult to read by the bench chemists. They need to be broken down to improve understandability; and

The PRI work is *not being adequately* communicated to the FSCT membership.

T. PROVDER,
Delegate

DELEGATE TO SSPC

The three day working meeting, held at the Pittsburgh Airport Holiday Inn, December 2–4, 1980 was attended by 136 technical personnel representing manufacturers of paints and allied materials, raw material suppliers, paint users, government agencies and industry associations. Of these, about 30% are members of FSCT.

Meetings of the following Advisory Committees were reported by the committee officers:

Chlorinated Rubber—Acting Chairman—R. Wint; and Secretary—William C. Richter (New York).

(1) A round robin study was organized to evaluate alternate

corrosion inhibiting pigments to replace basic lead silico chromate and zinc chromate in SSPC Paint Primer 17-78.

(2) Four subguides for SSPC Painting Guide 15.00 were reviewed with respect to surface preparation, number of coats and film thickness. These subguides cover four specific environments for the Painting Guide, which is designed primarily for use by architects and engineers specifying paint systems for corrosion protection.

Latex Paints for Steel—Acting Chairman—Arnold J. Eickhoff (New York).

(1) It was recommended that SSPC postpone including a requirement for volatile organic compounds (VOC) in the Latex Metal Primer and Topcoat specifications until California and possibly other states have more definitive requirements on the VOC limits to be specified.

(2) A better procedure for testing flash rusting and early rusting of latex primers was agreed upon, namely, to expose the freshly painted panels to 70 to 80% RH at 50° F for three hours, then to 100% RH at ambient temperature overnight.

Water Borne Epoxies—Co-Chairmen—Dr. Edward G. Bozzi (New York);—David L. Roberson (Southern); Acting Secretary—Clifford F. Dukes (Louisville).

(1) 14 companies have submitted 28 paints to SSPC for evaluation in the PACE program. Salt fog exposures are under way. Exterior exposures will begin this spring.

(2) All who attended the meeting will receive the performance data submitted by the 14 companies under code names.

(3) VOC limits will not be decided upon until the results of the PACE study.

Water Miscible Coatings—Co-Chairmen—Clifford F. Dukes (Louisville); David B. Norby (Western New York); Acting Secretary—W. Kurnik.

(1) The scope of the committee is the consideration of ambient drying, single package, maintenance coatings which are rendered water-miscible via ionic solubility.

(2) Ten companies will submit samples for round robin testing following tests to be developed by a task group.

(3) SSPC will be asked to solicit soluble water-borne coatings, through the trade journals, for evaluation in the PACE program.

Silicone Alkyd Coatings—Chairman—William A. Finzel (Detroit).

(1) The scope of the committee will be broadened to include all Silicone-Containing Coatings. These will include water-borne, high-solids, and heat resistant types.

(2) The chairman will circulate a heat resistant coating selection guide for comments.

Level of Zinc—Chairman—G. Evarts.

(1) This new committee was formed to investigate the effect on corrosion protection when percentages of zinc dust in a zinc-rich primer are replaced by an extender pigment.

(2) Generic formulations will be investigated. Vehicles will include two inorganic vehicles; a self-curing solvent type and a water-reducible type, plus two organic vehicles; an epoxy-polyamide and a phenoxy type. Extenders to be investigated will include barytes, zinc oxide, zinc molybdate, zinc phosphate, ferrophos, mica and calcium silicate. Zinc levels will not be lower than 50% of the total pigment and substitutions will be made in 12½% steps.

Ship Paints—Chairman—Hugh E. Peck (Baltimore); Secretary—Robert J. Martell (New England).

(1) The scope of the committee covers the revision and updating of SSPC specifications and manual sections which pertain to the protective coating of steel vessels and structures in marine environments, as well as surface preparation for marine use.

(2) The committee voted to delete all Volume II sections no longer used by the marine industry, namely Section No. 6 of Table 5 and specifications 6.01, 6.02, 6.03. These will be replaced by a guide to be prepared.

(3) Specifications will also be drafted to cover surface preparation of preconstruction primers and previously painted steel.

Zinc Rich Guide—Chairman & Acting Secretary—Kenneth B. Tator (Pittsburgh).

(1) The first draft was reviewed and titled "Guide No. PSX12.00X, Zinc-Rich Coating Systems." Its scope covers "Zinc-rich coatings designed to prevent corrosion of steel by sacrificial characteristics of the zinc dust." It includes surface preparation, application and topcoating of primers as required.

(2) Zinc-rich coatings covered include (a) single coating systems, (b) primers, and (c) weldable prefabrication primers.

Topcoated Zinc-Rich Coatings—Acting Chairman—Dr. Bernard Appleman (Baltimore); Secretary—G. Tinklenberg.

Preparation of a guide is being initiated. It will include factors that influence topcoatings, characterization of the zinc-rich coating to be topcoated, selection of the topcoat, surface preparation and application of the topcoat.

Painting Weathering Steel—Co-Chairmen—R. Knight; G. Tinklenberg; Secretary—W. Gallagher.

Efforts were concentrated on the painting of A588 steel, especially when chloride contaminated as a result of acid rain, in order to prevent the pitting which occurs. The effort will be continued.

Zinc-Rich Performance Specifications—Chairman—G. Evarts; Secretary—D. Cozart.

Accelerated methods of testing were discussed. SSPC was asked to prepare a set of panels for round robin testing.

Highway Research, Projects—Chairman—Dr. Bernard Appleman (Baltimore).

(1) The Federal Highway Administration (FHwA) has initiated a project to study "Coating Systems for Corrosion Protection of Highway Structural Steel." A new study is anticipated to investigate "Improved Field Reliability of High Performance Coating Systems." Specific areas to be investigated include laboratory and field tests, quality assurance of zinc-rich and water-borne coatings, application procedures, contract provisions, identification of field failures and zinc-rich coating problems.

(2) FHwA is now developing a training course for bridge painting inspectors.

Surface Preparation—Co-Chairmen—K. Trimber; J. Flahery (Acting Secretary).

(1) TC-35, the Technical Committee on Paints & Varnish in the International Standards Association (ISO) met in Tel Aviv, Israel. They are considering an international round robin to evaluate stylus, microscopic and comparator methods for evaluating surface profile.

(2) The Society of Naval and Marine Architects (SNAME) is interested in surface preparation standards for steel coated with zinc-rich primers.

(3) Committee T6-12 of NACE is working on the development of standards to represent 4 grades of centrifugal blast cleaning.

(4) Revised Specifications SP-1, SP-2, SP-3, SP-5, SP-6, SP-7, SP-8, and SP-10 received overwhelming majority approval in the last ballot although quite a number of comments, mostly editorial, were submitted. The editorial

revisions will be made and the documents will be submitted to the SSPC Advisory Committee for final review.

(5) New Task Groups will prepare drafts of specifications for "Bright Metal Power Tool Cleaning" and "Water Blasting."

Volume II Revision—Overview—Chairman—A. Levy; Secretary—Sidney Lauren (Cleveland).

(1) The Volume will include a Chapter 8 "Safety and the Environment" in view of the increasing regulations by OSHA, EPA, DOT and RCRA (Resource Conservation and Recovery Act) as well as many States and local governments.

(2) The New Painting System Specifications will also include a Zone Chart Recommending painting systems for different environmental conditions.

Volume II Revision—Paints and Systems—Co-chairmen—P. Litzsinger; W. Johnson; Secretary—Sidney Lauren (Cleveland).

(1) The new format for paint specifications will include the following: (1) Scope, (2) Definitions, (3) References, (4) Composition, (5) Properties, (6) Packaging, (7) Safety, (8) Inspection.

(2) Inactive types of paint, e.g. fractionated oil paints, will be omitted.

(3) Some mention will be made that paints formulated to meet government regulations may not perform as well as the conventional equivalent products.

(4) Products specifications not yet updated will be reviewed by members of the committee.

Volume II Revision—Paint Specifications—Co-chairmen—W. Johnson; P. Litzinger; Secretary—Sidney Lauren (Cleveland).

(1) The silicone paint specification will be broadened to include silicone copolymers and blends.

(2) A bar chart recommending paints for exposures to increasing service temperatures will be considered for inclusion in Volume II.

(3) Paint specifications not yet updated will be reviewed by members of the committee.

Volume II Revision—Paint Application—Chairman—F. Couch; Secretary—W. Johnson.

(1) The Paint Application Foreword in the present section will be revised and renamed a "Guide".

(2) Draft No. 5 has been approved with minor editorial changes. It will be submitted to SSPC for circulation.

Volume II Revision—Paint Thickness Measurement—Chairman—F. Couch; Secretary—W. Johnson.

(1) "Dry Film Thickness Tolerance—Maximum and Minimum Per CoatTable 1" in the Appendix will be deleted since the limitations are too stringent for the wide variety of generic coatings available.

(2) Section 3.1.1 for measuring areas to be painted will be revised as follows: "Measure three 100 sq ft areas selected at random for the first 100 sq ft painted and then measure 100 sq ft areas selected at random for each additional 1000 sq ft of area."

Volume II Revision—Safety—Chairman—M. Hughes; Secretary—W. Johnson.

SSPC PA 3 will be modified to change instructions from the imperative to indicative language.

Volume II Revision—Maintenance Painting—Chairman—M. O'Connor; Secretary—Robert J. Martell (New England).

The committee is preparing a chapter entitled "Guide to Maintenance Painting". An attempt will be made to expand the guide to include the newer sophisticated paints.

Volume II Revision—Future Plans—Chairman—A. Levy; Secretary—W. Johnson.

All Chapters should be essentially completed by mid-year and will be forwarded to A. Levy for compilation.

SIDNEY B. LEVINSON,
Delegate

The next Board of Directors Meeting will be held on Tuesday, October 27, at Cobo Hall in Detroit.

Government / Industry

CMA Requests Relaxed Regs on Low-Risk Chemicals

The Chemical Manufacturers Association has recommended that the Environmental Protection Agency streamline its premanufacturing notification requirements for new chemicals by allowing certain limited exemptions for low-risk compounds.

Commenting on the proposals submitted to the EPA, CMA President Robert A. Roland said the less-stringent notification standards on these types of new chemicals would allow the agency to focus its full attention on specific substances "whose health and environmental effects may require closer scrutiny. EPA thus would be able to devote less attention to classes of new chemicals that have little or no potential for harm."

CMA added that such a procedure would "eliminate unnecessary manufacturing costs and delays that have adversely affected commercial innovation in the chemical and allied industries."

The premanufacture notices—called PMNs—are required under the Toxic Substances Control Act (TSCA) and are used to monitor the development of new chemical products. The EPA, however, was given authority by Congress in Section 5 of TSCA to grant notification exemptions.

However, since premanufacture notification became mandatory in mid-1979, the EPA has applied the same level of requirements to all new chemicals regardless of their volume, uses and risk, a level of scrutiny CMA holds is "neither scientifically or economically justified."

In the nearly two years since notification became mandatory, CMA noted that it has become "increasingly clear that many new chemicals pose very limited risks to health and the environment and are manufactured and used under conditions of very low exposure."

Since 1979, CMA noted, EPA has found it necessary to prohibit or limit the manufacture of a new substance only on two occasions. During that time, more than 600 PMNs have been filed with the agency.

Therefore, CMA recommends that the EPA grant exemptions to: site-limited intermediates (compounds made and used within a single plant, for example); chemicals manufactured in volumes of less than 25,000 pounds per year and which do not have acute toxic effects; and, many polymers, which are intrinsically non-toxic.

The CMA proposal also would provide for industrial certification of the absence of chronic health effects, based on available information, of any new substance for which the exemption is sought.

In addition, the CMA proposal would allow the EPA to revoke exemptions where there may be a danger to health or the environment, thus preserving the agency's ultimate authority over such matters and ensuring against reduced protection of the public and the environment.

SSPC DEVELOPING NEW SPEC FOR ZINC-RICH PRIMERS

The Steel Structures Painting Council Advisory Committee on Zinc-Rich Performance Specifications is developing a new specification for zinc-rich primers. The existing spec calls for at least 86% zinc dust by weight in the dry film and is considered by some to be too restrictive in view of recently reported technological developments.

As a part of this effort, laboratory tests on known standards of the industry as well as newer types of zinc-rich primers will begin later this year. The committee is attempting to establish a reasonable level of accelerated lab and exterior exposure performance for a reliable zinc-rich primer.

Paint manufacturers are invited to provide samples of their zinc-rich products, either standard or new types, for participation in the testing program. Those interested may contact Dr. Joseph A. Bruno, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213.

CMA to Research Glycol Ethers

A new research program, administered by the Chemical Manufacturers Association, will examine the toxicological aspects of several glycol ethers. Glycol ethers are widely used as industrial solvents and as ingredients in coatings.

An already completed phase of the program involved an assessment of available toxicological information on the ethers to identify gaps in existing data. That assessment provided the groundwork for a multi-phase research program designed to provide scientific data which can be used to better assess the potential effects of repeated human exposure.

Chemicals included in the first phase of the research program are ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, and ethylene glycol monobutyl ether. Current plans are to include studies of ethylene glycol monoethyl ether acetate and propylene glycol monomethyl ether in the second phase of the research program.

CMA administers a number of special programs, such as this one on glycol ethers, which enable interested manufacturers and users to support collective research on specific chemicals. It is felt the scientific information developed through such programs promotes the health and safety of the workers involved in manufacturing and processing of these chemicals and of the general public.

For more information, contact Chemical Manufacturers Association, 2501 M St., N.W., Washington, D.C. 20037.

Hazardous Materials Exposition To Be Held Sept. 27–30

Suppliers of systems and services for managing hazardous substances and waste materials will display their wares at the first annual "Hazardous Materials Management Exposition," September 27–30, at the Ohio Center, Hyatt-Regency Hotel in Columbus, Ohio.

Sponsored by the Ohio Environmental Protection Agency and the Liquid Industrial Control Association, the exposition and conference will be the world's first major exposition and workshop-format meeting devoted to the management and operational problems of handling and disposing of hazardous substances.

For more information, contact The Hazardous Materials Management Association, 1406 Third National Bank Building, Dayton, OH 45402.

Formula 81
The Multi-Coloured Trade Fair

This international trade fair for the paint, paint products and printing-ink industries is now to be held for the second time. In 1980, the fair attracted nearly 4000 visitors.

The visitor to Formula 81 will gain an overall view at this fair, of the latest technological developments in the paint and printing-ink industries. The exhibition programme will also include materials, patent products and mechanical aids for the treatment and regeneration of water, air and waste matter.

Broad orientation

Formula is to be held simultaneously with Eurofinish/VOM and Euromaintenance. This will give the visitor to Formula the chance to acquaint himself with all that is new in the way of finishing products, maintenance materials and techniques.

Congress

During Formula, a three-day international congress is to be organized. Its theme is: developments and research in the paint and printing-ink industries. The speakers at the congress will focus on practical issues. They will discuss such subjects as the applications of surface treatment techniques in the building trade, the chemical industry and the car industry. Paint research institutes from the Federal Republic of Germany, Belgium, Great Britain and The Netherlands will also cooperate in the congress.

International trade fair for the paint, paint products and printing-ink industries.

Surface Tension Of Silicone Release Paper Coatings

Michael J. Owen
Dow Corning Corporation*

The treatment of contact angle data to determine the surface tension of silicone release coatings is discussed. The Kaelble approach, based on the use of the Owens-Wendt equation is preferred to the use of the Wu equation mainly because this latter approach gives unreasonably large values of the polar component of the surface tensions of the silicone coatings. The Kaelble approach gives values for the total surface tension of these coatings in the 18–22 mNm^{-1} range. These values are also compared to those obtained for Zisman's critical surface tension of wetting and Wu's new equation of state approach.

INTRODUCTION

The use of cured polydimethylsiloxane (PDMS) coatings as release liners for adhesive coated items, such as labels, is well known. The need to characterize the surface tension of such coatings is self-evident. The most significant previous work in this area is that of Gordon and Colquhoun.[1] They concluded that Wu's[2] approach to the treatment of contact angle data was a useful approach to this problem. Moreover, they showed that release performance of silicone coatings in contact with an SBR adhesive could be predicted from the surface tensions of the two materials although the correlation did not hold when an acrylic adhesive was used. The promise of this approach and the difficulty in rationalizing some of the data has prompted us to re-examine the treatment of contact angle data in this important area. This paper deals with the characterization of the coatings only; correlation with release force will be dealt with elsewhere.

The most familiar way of characterizing polymer solid surface tension is Zisman's[3] critical surface tension of wetting, σ_c. This is not useful for predictive purposes as it tells us nothing about the unknown factor in the contact of two solid phases, the interfacial tension. This problem is avoided by using one of a variety of semi-empirical equations of which the Wu equation is one. These are all of the form

$$\sigma_{12} = \sigma_1 + \sigma_2 - F \qquad (1)$$

where σ_{12} is the interfacial tension between two phases 1 and 2 whose surface tensions are respectively σ_1 and σ_2. The form of the correction factor F for six of the more familiar of these equations is given in *Table* 1. In this table use is made of the concept of dividing the surface tension into two components, one arising from dispersion forces (London, van der Waals), common to all matter, designated σ^d, and the other arising from polar interactions (permanent dipoles, hydrogen bonding, etc.), designated σ^p. ϕ is the Girifalco-Good[5] interaction parameter.

The table is not complete. It ignores approaches such as those of Dann[9] and Tamai[10] which yield σ^d but not σ^p. These offer no advantages over the basic Fowkes approach.[7] Also not included are the newer nonsymmetrical equations such as Fowkes recent use[11] of acid-base interactions to determine the polar component. The necessary parameters have not yet been sufficiently developed to allow this approach to be used in the present case although this new direction is most promis-

* Fluids & Lubricants Research, Midland, MI 48640.

Table 1—Various Correction Factors for the Interfacial Tension Equation

Correction Factor F	Authors	Ref.
$2\sigma_1$ or $2\sigma_2$	Antonow	4
$2\phi(\sigma_1\sigma_2)^{1/2}$	Girifalco/Good	5
$\sigma_1^d + \sigma_2^d$	Zettlemoyer	6
$2(\sigma_1^d\sigma_2^d)^{1/2}$	Fowkes	7
$\frac{4\sigma_1^d\sigma_2^d}{(\sigma_1^d + \sigma_2^d)} + \frac{4\sigma_1^p\sigma_2^p}{(\sigma_1^p + \sigma_2^p)}$	Wu	2
$2(\sigma_1^d\sigma_2^d)^{1/2} + 2(\sigma_1^p\sigma_2^p)^{1/2}$	Owens-Wendt	8

ing. We wanted an equation that was straightforward to work with, had at least some theoretical justification, gave values that bore some resemblance to σ_c, gave polar and dispersion force components of reasonable magnitude, and involved several liquids.

In our opinion the Owens-Wendt equation[8] best satisfies these criteria. As used by Kaelble,[12] it can be combined with the Young equation and rearranged to give a very straightforward graphical solution. The geometric mean form has some justification for the dispersion force component whereas the harmonic mean form of Wu has no justification. As will be seen later, the Owens-Wendt equation yields comparable values to σ_c and reasonable polar and dispersion force components. The simple graphical approach enables any number of liquids to be used. Many of the reports in the literature use only two liquids but, in our experience, this can be misleading since one of the liquids will often swell or otherwise interact specifically with a chosen substrate.

The combined Owens-Wendt/Young equation is

$$\frac{\sigma_1(1 + \cos\theta)}{2(\sigma_1^d)^{1/2}} = (\sigma_2^d)^{1/2} + (\sigma_2^p)^{1/2}\left(\frac{\sigma_1^p}{\sigma_1^d}\right)^{1/2} \quad (2)$$

where θ is the contact angle.

If the subscript 1 refers to the contact angle test liquids and subscript 2 to the solid, it can be seen that the surface tension of the solid can be obtained from the intercept and slope of a plot of $\sigma_1\ (1 + \cos\theta)/2(\sigma_1^d)^{1/2}$ vs $(\sigma_1^p/\sigma_1^d)^{1/2}$. These quantities contain only known or measureable properties of the contact angle test liquids. We used σ^p and σ^d values in Kaelble's publications with the exception of α-bromonaphthalene and glycerol. He did not use the former and his values for the latter give odd results in our hands—this data point is almost always furthest from the median line in our plots. Values for these two liquids come from Panzer.[13] His data is based on an approach that splits the surface tension into three components: dispersion, polar, and hydrogen bonded. We have assumed that the sum of the latter two equates to σ^p.

Table 2—Contact Angle Test Liquids

Liquid	Measured σ_1 mNm^{-1} (at 23°C ± 1°C)	σ_1^p mNm^{-1}	σ_1^d mNm^{-1}
Water	70.8	49.6	21.2
Glycerol	63.2	42.7	20.5
Methylene iodide	50.7	2.3	48.4
α-Bromonaphthalene	43.7	1.6	42.1
n-Hexadecane	27.1		
n-Dodecane	24.9		
n-Decane	23.3		
n-Octane	21.4		
Dioctylphthalate	30.9		

From the numerous liquids used in the literature we have chosen five that are readily available, easily purified, and with no toxicity problems. These are the top five liquids in *Table* 2. The other liquids listed were used for Zisman critical surface tension of wetting determination. The n-alkanes are the preferred series of liquids. In our experience, dioctylphthalate usually falls on the same line as the n-alkanes and was used as a "pseudo-alkane". Presumably the ester groups are well shielded by the bulky hydrocarbon groups.

Many of the unusual properties of polydimethylsiloxane can be explained by accepting that there are low intermolecular forces acting between the molecules.[14] These are expected to be mostly of the dispersion force type with very little polar component from the siloxane backbone. This is a key difference favoring the use of the Owens-Wendt equation over the Wu equation for silicone substrates. The former gives the expected low polar component, the latter does not. In situations where high polar components are expected, such as with silane coupling agents, the Owens-Wendt equation adequately reflects this according to Sacher.[15]

The theory of Good and Girifalco gives

$$\sigma_c = \phi^2\sigma_2 \quad (3)$$

For regular interfaces the interaction parameter is unity. Such interfaces are those in which the dominant cohesive and adhesive forces are of the same type. This is expected to be so for polydimethylsiloxanes, where we believe dispersion forces dominate, and the n-alkanes, which are solely dispersion force liquids. This is why we chose the n-alkanes, as the σ_c derived from them should be close to the surface tension, σ_2, derived by the Kaelble approach.

Wu[16] has recently proposed the following equation of state based on a combination of the Young equation and that of Girifalco and Good:

$$\sigma_c,\phi = (1/4)(1 + \cos\theta)^2\,\sigma_1 \quad (4)$$

where σ_c,ϕ is the critical surface tension of wetting determined by using a contact angle test liquid of surface tension σ_1. The subscript ϕ recognizes that σ_c is a function of the liquid chosen. Plots of σ_c,ϕ against σ_1 for a series of liquids will be scattered, since σ_c,ϕ is a function not only of σ_1, but also of ϕ. However, a smooth curve can be drawn just to encompass all the points below the curve. Since ϕ cannot be greater than unity the maximum in this curve will be the point at which $\phi = 1$. Hence by equation (3) the value of σ_c, ϕ at this point will be σ_2, the surface tension of the solid.

EXPERIMENTAL

Contact Angle

The contact angles were determined using a Rame' Hart contact angle goniometer. Results quoted are the average of determinations on both sides of at least three drops. In all cases the contact angle was determined as a function of time and in those cases where a change was observed, the value extrapolated to zero time was used. The justification for this is that time changes are more likely to be due to interaction with the substrate (softening, swelling, chemical reaction) than to orientation equilibrium adjustment for such simple liquids. In each case the advancing contact angle on a previously unwetted surface was used. The measurements were made at laboratory temperature (23°C ± 1°C) and humidity without using the controlled environment chamber. Sufficient duplicates were performed to ensure that this was an acceptable procedure.

The contact angle test liquids were the best purity available. Surface tensions were checked using a Rosano Wilhelmy plate surface tensiometer. Liquids whose surface tensions did not agree with accepted literature values, or did not maintain such a value for at least several hours, were redistilled until agreement was obtained.

Silicone Coatings

The following commercially available paper coatings were used: Syl-off® 7069, Syl-off® 7044, Syl-off® 1171, Syl-off® 291, Syl-off® 292, Syl-off® 294, and Syl-off® 23. The first two materials are solventless materials, crosslinked by ≡SiH/≡SiVinyl curing chemistry, the rest by ≡SiOH/≡SiH curing chemistry. Syl-off 1171 is applied as an aqueous emulsion, Syl-off 291, 292, 294, and 23 are solvent-based products (hexane and xylene). The solventless products are catalyzed by a rhodium compound, while the rest are catalyzed by a tin compound. All of these materials, with the possible complication of the surfactants used to stabilize the Syl-off 1171 emulsion, should provide a polydimethylsiloxane surface. The biggest difference between the coatings is in crosslink density, a factor shown by Bey[17] to be important in the release mechanism. The release coatings are arranged in diminishing order of crosslink density in the tables. In bulk form these crosslink densities vary from over one per 30 dimethylsiloxane units to less than one per 1500 units.

The coatings were applied to super-calendered 40 lb kraft in a similar manner to that described by Gordon and Colquhoun.

RESULTS AND DISCUSSION

Table 3 lists the surface tensions of the silicone coatings calculated using the Kaelble approach for the five chosen contact angle test liquids and the Zisman approach for the n-alkanes and dioctylphthalate. The figure in parentheses in the σ_c column is the number of liquids used in the determination. The agreement between σ_c and σ_2 improves as the number of liquids increases and is excellent for the two solventless paper coatings. Less liquids could be used with the other less highly crosslinked coatings because the lower molecular weight alkanes penetrated the coatings too rapidly.

Table 3—Surface Tensions of Silicone Coatings

	Zisman Approach		Kaelble Approach			
	σ_c mNm^{-1}	Correlation Coefficient (r^2)	σ_2^p mNm^{-1}	σ_2^d mNm^{-1}	σ_2 mNm^{-1}	Correlation Coefficient (r^2)
Syl-off 7069	22.0(4)	0.997	0.6	20.8	21.4	0.81 (0.57)
Syl-off 7044	22.6(4)	0.999	1.7	20.3	22.0	0.94 (0.95)
Syl-off 1171	23.1(3)	0.997	2.5	17.6	20.1	0.97 (0.89)
Syl-off 291	—	—	0.6	17.1	17.7	0.70 (0.57)
Syl-off 292	23.4(3)	0.982	0.7	20.9	21.6	0.82 (0.61)
Syl-off 294	24.2(2)	1.00	1.5	16.6	18.1	0.78 (0.73)
Syl-off 23	23.3(3)	0.987	0.7	19.9	20.6	0.64 (0.57)

These coatings span more than a fiftyfold variation in crosslink density. There is no significant variation in either the Zisman or Kaelble surface tension in *Table* 3 that might help explain Bey's[17] correlation of crosslink density and release force. The Zisman critical surface tension values are all in the 22-24 mNm^{-1} range close to the accepted value of 24 mNm^{-1} for polydimethylsiloxane.[18] The values span the 23 mNm^{-1} quoted for paraffin wax[8] consistent with the anticipated close-packed methyl surface. The liquids used for the Kaelble calculation can be used for a Zisman type calculation. However, this results in a very much more scattered plot that renders extrapolation to $\cos\theta = 1$ meaningless.

The surface tensions in *Table* 3 were generated by fitting the data to a linear least-squares regression plot. Also included in the table is the correlation coefficient, r^2, to indicate the quality of the fit. The figures in parentheses are the correlation coefficients calculated using Kaelble's values of σ_1^d and σ_1^p for glycerol. It is clear that the Kaelble value gives a poorer fit in every case but one, Syl-off 7044.

Table 4—Various Solid Dimethylsiloxane Surface Tensions

Substrate	Authors	σ_2^p mNm^{-1}	σ_2^d mNm^{-1}	Method of Calculation
PDMS on glass	Zisman/Kaelble	1.6	20.5	Owens/Wendt
	Zisman/Owens/Wendt	1.1	21.7	Owens/Wendt[a]
PDMS gum	Gordon/Colquhoun	4.7	17.6	Wu[a]
Plasma polymerized tetramethyldisiloxane on mylar	Yasuda et al.	0.8	24.9	Owens/Wendt
PDMS paper coatings (av. excl. Syl-off 1171)	Present Work	1.0	19.3	Owens/Wendt

(a) Using water and methylene iodide values only.

Syl-off is a registered trademark of Dow Corning Corp.

Table 5—Comparison of Owens–Wendt and Wu Calculations

	Owens/Wendt Equation				Wu Equation			
	Water/Methylene Iodide		Water/Hexadecane		Water/Methylene Iodide		Water/Hexadecane	
	σ_2^p mNm^{-1}	σ_2^d mNm^{-1}	σ_2^p mNm^{-1}	σ_2^d mNm^{-1}	σ_2^p mNm^{-1}	σ_2^d mNm^{-1}	σ_2^p mNm^{-1}	σ_2^d mNm^{-1}
Syl-off 7069	1.2	20.5	0.8	23.2	3.8	22.1	3.5	23.3
Syl-off 7044	1.5	17.8	0.8	21.7	4.1	19.8	3.4	22.0
Syl-off 1171	3.6	16.9	2.8	19.8	6.7	19.8	6.6	20.2
Syl-off 291	1.1	19.0	1.0	19.8	3.4	20.9	3.6	20.2
Syl-off 292	1.4	21.1	1.7	19.4	4.0	22.5	4.8	19.9
Syl-off 294	3.5	16.6	3.0	18.2	6.5	19.4	6.7	18.9
Syl-off 23	1.4	23.1	2.3	18.7	4.3	24.2	5.8	19.2

If we ignore Syl-off 1171, whose surface might contain emulsifier molecules, the average values agree well with Kaelble's calculations[19] from Zisman's study[20] of polydimethylsiloxane (PDMS) baked onto a glass slide. This is shown in *Table* 4 together with Gordon and Colquhoun's data on polydimethylsiloxane gum and Yasuda's[21] figure for plasma polymerized tetramethyldisiloxane. It is striking that the average total surface tension of the PDMS coatings in the present study (20.3 mNm^{-1}) agrees so closely with the liquid surface tension of PDMS at the highest measurable molecular weights, 20.4 mNm^{-1} at 20°C according to Roe.[22] This implies that very similar orientations are possible both in the liquid and crosslinked solid state. Such a situation is consistent with the unique flexibility of the polydimethylsiloxane chain. The data in *Table* 4 should also be compared to Fowkes'[7] value of σ^d for low molecular weight liquid polymethylsiloxanes of 16.9 mNm^{-1} with an inferred value of σ^p of 2.1 mNm^{-1}.

Table 5 shows the dispersion and polar contributions to the surface tension calculated using the Owens-Wendt equation and only two liquids. This has been done for water and methylene iodide and water and hexadecane. The same has also been done using the Wu equation.

There are several points to note. Firstly, the spread of the results is greater when only two liquids are used compared to five. Secondly, the choice of liquids dictates the relative order of surface activity. For instance, Syl-off 23 has the highest surface tension using water and methylene iodide and almost the lowest surface tension using water and hexadecane. This suggests a specific interaction with one or more of the liquids and is the reason why several liquids are preferred. An absurd choice of two liquids would be glycerol and water which in some cases would yield a negative polar component. A third and important point to note is that the Wu approach gives values of the partial parameters from 1 to 3 mNm^{-1} higher than the Owens–Wendt equation. This virtually doubles the polar component and takes it into a regime that, in our opinion, is unlikely in view of the general surface properties of polydimethylsiloxanes. Consequently, we favor the use of the Owens–Wendt equation.

It should be noted that the use of the Wu equation rather than the Owens–Wendt equation is only part of the reason for the difference between the values reported by Gordon and Colquhoun and those reported here. While both studies indicate values of ~100° using water, the values for methylene iodide are quite different, ~90° for Gordon and Colquhoun compared to ~75° in the present study.

Table 6 lists the maximum value of σ_c, ϕ calculated from Wu's equation of state (equation (4)). Also given is the liquid which produced this maximum value. With the exception of Syl-off 1171 and 7069 these maxima occur at either methylene iodide or α-bromonaphthalene, liquids with small but finite polar components to the surface tension. This implies a similar situation in the solid surfaces in accord with the values obtained by use of the Owens–Wendt equation. The maximum at n-dodecane for Syl-off 1171 may be indicative of the presence of hydrocarbon surfactant in this surface and is the reason why this substrate has not been included in any average figures discussed in this report.

Wu compared various methods of deriving the surface tension. *Table* 7 gives the values for polytetrafluoro-

Table 6—Wu Equation of State

Substrate	(σ_c, ϕ) Max mNm^{-1}	Position of Maximum
Syl-off 7069	23.2	n-Hexadecane
Syl-off 7044	22.7	α-Bromonaphthalene
Syl-off 1171	22.2	n-Dodecane
Syl-off 291	20.1	Methylene Iodide
Syl-off 292	23.0	α-Bromonaphthalene
Syl-off 294	19.2	Methylene Iodide
Syl-off 23	24.5	Methylene Iodide

Table 7—Comparison of PTFE and PDMS

	Zisman σ_c mNm^{-1}	Wu Equn. of state (σ_c, ϕ) max. mNm^{-1}	From Liquid Homologs σ^1, mNm^{-1}	Wu Harmonic Mean Equn. σ_2, mNm^{-1}	Owens/Wendt Geometric Mean Equn. σ_2, mNm^{-1}
PTFE	18	22.6	23.9	22.5	19.1
PDMS	23.1	22.1	20.4	25.8	20.3

ethylene (PTFE) taken from Wu's paper together with average values of the polydimethylsiloxane coatings investigated here. This table is included to help place PDMS relative to PTFE in the scale of surface energy. It is interesting that the newer methods suggest these two polymers to be closer in surface tension than with the Zisman approach.

SUMMARY

The Kaelble approach to the treatment of contact angle data appears to be the most appropriate for siloxane release coatings. It is straightforward to employ, avoids the pitfalls of using only two test liquids, and gives values that are reasonable and in good agreement with other established approaches. There is good agreement between values derived in this way and from the Zisman critical surface tension of wetting. In particular the Kaelble approach gives smaller polar components to the total surface tension than does the Wu approach. These smaller polar components are more consistent with the accepted picture of a polydimethylsiloxane surface consisting of relatively close-packed methyl groups with low intermolecular forces between polymer chains. This view is also consistent with the familiar use of these coatings as paper coatings for the release of pressure-sensitive adhesives.

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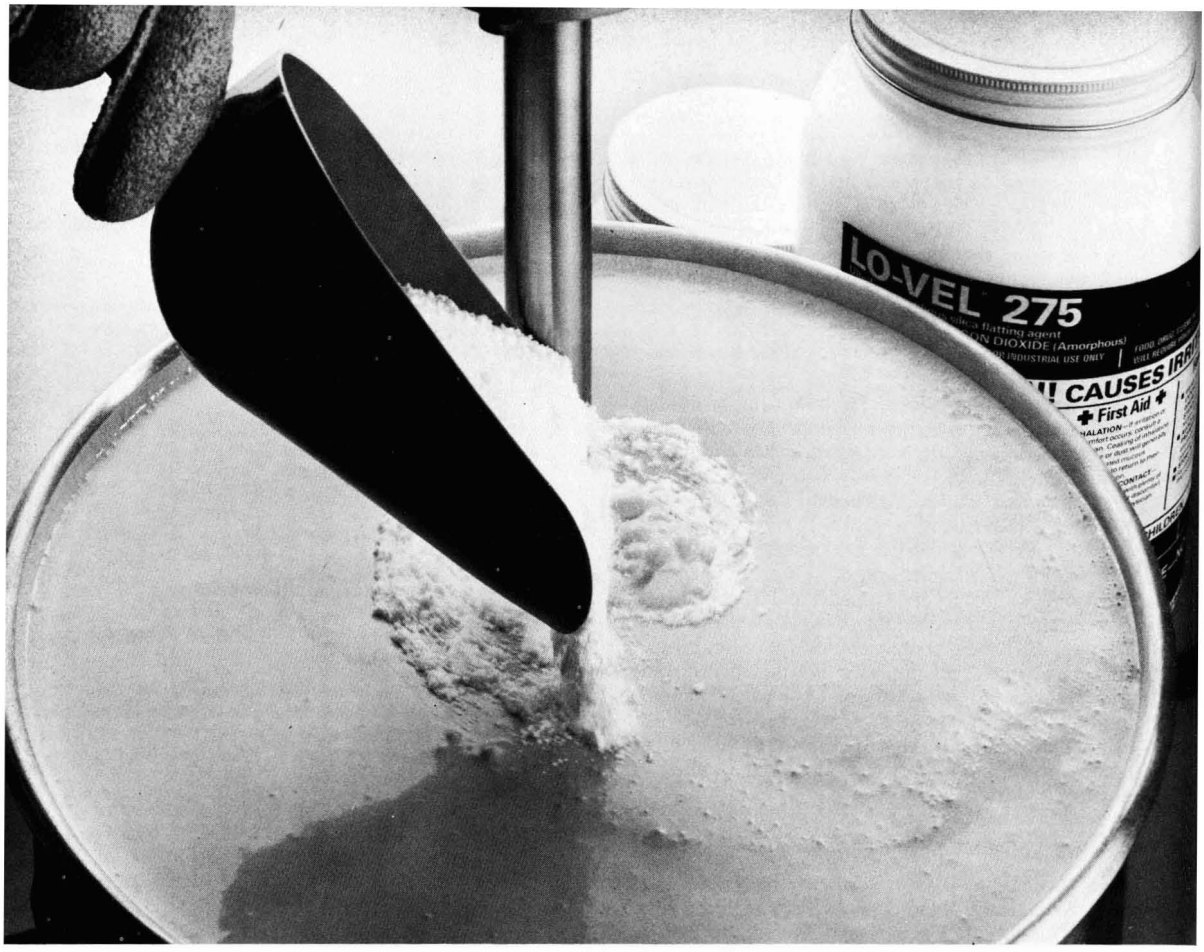

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Application of Statistical Methods to The Subjective Comparison of Coatings

W.E. Craker and G.M. Deighton
Laporte Industries Limited*

The need for subjective assessments is discussed and two methods of objective analysis of such assessments are presented.

One deals with the comparison of pairs of test panels and is illustrated by application to the appearance of semi-gloss latex paints and gloss alkyd paints. The other deals with the ordering of sets of paints or properties and is illustrated by application to problems of assessing both gloss and dispersion; it is also applied to a Market Research investigation.

It is demonstrated that the simple statistical analyses, when allied with careful experimental design, allows these subjective assessments to be used as powerful research tools.

Specifically, the examples demonstrate the important role of the energy which is scattered from the paint air interface.

INTRODUCTION

Despite the modern, highly developed instrumental methods of analyzing paint performance, there is still some reliance on the informed opinion of skilled technologists. Sometimes this is used to confirm the objective measurements, but in some circumstances the informed opinion is the final acceptance/rejection criterion. Such use of subjective judgements is probably correct because the ultimate test of paint is carried out by the customer who wants to decorate and/or protect some article. Or the surface coating may be used as a marketing aid in which case the purchaser is influenced, possibly subconsciously, by the appearance. These ultimate "tests" of paint performance, carried out without instruments, justify the use of subjective assessments as a routine part of quality control in the production of paint and its constituent materials.

Even though skilled technicians are very powerful comparators, their sensitivity gives rise to problems which are specific to subjective judgements. The preferences of technicians may not be the same, even though they produce a consensus, and those preferences may change without the individuals realizing it. Further, even skilled operators are not always able to relate their assessments to parameters which can be measured objectively. Hence, even though the need for subjective assessments is accepted it is desirable to relate them to parameters which can be measured objectively. Before such relationships can be established it is necessary to adopt methods of scaling subjective assessments in a quantitative manner.

One extreme of the comparison of paint films occurs when only two paints are involved and the assessor is required to state a preference for one or the other. However, the two paints are frequently so nearly identical—there is no point in using skilled technicians if the differences are obvious—that a *no difference* statement is allowed. Hence, the comparison of two paints, A and B, gives rise to three response states: *for A*; *for B*; and *no difference*. The other extreme case is when more than two paint films are to be placed in an order excellence; once the number becomes high, more than six, it becomes difficult for the assessor to arrive at any ordering. Therefore, it becomes essential to know that the ordering

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Table 1—Comparison of Two Paints by N Assessors

No. of Assessors	F_{Min} [a]	F_{Max} [b]
4	—	—
6	5	—
8	6	—
10	7	0(?)
12	8	0
15	9	1
20	11	2

(a) F_{Min} is the minimum number of times a particular outcome must be chosen before it can be taken that there is a consensus in its favor.

(b) F_{Max} is the maximum number of times a particular outcome may be chosen and still take it that there is a consensus against it.

of any one assessor is not simply a chance event and, assuming a number of orderings have been obtained, to ensure that they constitute a significant consensus.

This paper describes briefly one method for handling each of the two extremes of assessment. These are then illustrated by application to practical problems. No great originality is being claimed here but, because the analysis of subjective assessments has not been widely studied, it stands alone until other workers extend the field by applying these or other statistical methods. The objective is to stress the need for a rigorous approach to subjective assessments and to illustrate the information which can then be obtained. In fact, as three of the examples demonstrate, the careful use of subjective assessments can reveal differences not always appreciated when objective testing is the sole means of comparing paint performance.

COMPARISON OF TWO PAINT FILMS

Consider one assessor making a choice between two paints, A and B, as a trial. Each trial has three possible outcomes: the paint A is preferred, i.e., *for A*; or the paint B is preferred, i.e., *for B*; or no preference can be stated, i.e., *no difference*.

If n assessors make the comparison, i.e., n trials are carried out and the outcomes are summed, there will be a distribution across the three outcomes, x *for A*; y *no difference* and z *for B*; where $x + y + z = n$. In the absence of any consensus, or when the choices are being made at random, we have $x = y = z = n/3$. That is, the result of the n trials can be represented as a trinomial distribution in which each of the three outcomes has a probability of 1/3.

From the standard analysis of such a trinomial[1] we have:

$$\text{Expected frequency of any outcome} = n/3 \quad (1)$$

$$\text{Standard deviation} = \sqrt{n \cdot \frac{1}{3} \cdot (1 - 1/3)} = \frac{1}{3}\sqrt{2n} \quad (2)$$

Thus, there is a 95% probability that the frequency of an outcome will lie in the band;

$$\frac{n}{3} \pm t \cdot \frac{1}{3} \cdot \sqrt{2n} \quad (3)$$

where t is the appropriate students t value.

In order to be sure that a particular outcome is occurring more frequently than expected, it must appear at least $\frac{1}{3}[n + t_{(n-1),0.95} \cdot \sqrt{2}]$ times where $t_{(n-1),0.95}$ is students t value for 95% confidence at $(n - 1)$ degrees of freedom. Similarly, to be sure that a particular outcome is occurring less frequently than expected it must appear at most $\frac{1}{3}[n - t_{(n-1),0.95} \cdot \sqrt{2}]$ times. These values are presented for n up to 20 in *Table* 1.

When only four assessors are used it is impossible to arrive at any significant consensus, since even when all four make the same choice that event could occur by chance alone more than 5% of the time. When 10 assessors are used, the fact that a particular outcome is not chosen at all is only statistically significant and just possibly allows a consensus against that outcome. There follow two examples of the use of this simple comparison procedure and in both cases the need for careful design and control of the experimental conditions is stressed. Obviously, it is particularly important that there should be no means of identifying the paints and the substrates on which they are viewed, other than by some code which is unknown to the assessors.

Table 2—Summary of the Effect of Altering the Surface and Changing the Viewing Conditions

		Surface state and viewing condition					
		Unmodified		Cleaned		Coated	
Operator	Choice of Pigment	C	F	C	F	C	F
	A	2	8	2	4	6	4
1	No Diff.	1	0	1	1	1	0
	B	7	2	7	5	3	6
	A	2	5	2	5	2	3
2	No Diff.	7	1	3	2	4	3
	B	1	4	5	3	4	4
	A	2	8	6	8		
3	No Diff.	0	0	0	0		
	B	8	2	4	2		
	A			2	7	3	5
4	No Diff.			1	1	0	0
	B			7	2	7	5
	A	3	5	5	5	6	5
5	No Diff.	5	5	0	2	1	0
	B	2	0	5	3	3	5
	A	3	4			3	4
6	No Diff.	0	0			1	1
	B	7	6			6	5
	A	5	6	6	5		
7	No Diff.	2	0	0	2		
	B	3	4	4	3		
	A					4	4
8	No Diff.					3	3
	B					3	3

C = Constrained; F = Free.

Table 3—Subjective Assessments of Hiding Power and Paint Film Color—Gloss Paints Based on Pigments C and D

Assessment	Comparison	Constrained Viewing			Free Viewing		
		For C	No Diff.	For D	For C	No Diff.	For D
Hiding Power[a]	15% C-v-15% D (20.4) (20.9)	2	1	8	2	1	8
	15% C-v-14% D (20.4) (19.1)	0	0	11	3	3	5
	15% C-v-13% D (20.4) (18.5)	7	0	4	3	2	6
Color[b]	15% C-v-15% D (93.6/3.3) (93.9/3.1)	0	1	10	4	1	6
	15% C-v-14% D (93.6/3.3) (93.7/3.2)	2	0	9	6	0	5
	15% C-v-13% D (93.6/3.3) (93.6/3.3)	3	0	8	8	1	2

(a) Hiding Power—Number in brackets is objective hiding power.
(b) Color—Numbers in brackets are L value and b value.

Semigloss Latex Formulations

Two pigments intended for use in semigloss latex formulations had been compared by objective measurements such as color, hiding power and gloss and were indistinguishable. The assessments of some paint technologists refuted this but it was impossible to reach a consensus. There were grounds for believing that the formulation gave rise to some bloom and an experiment was designed to test the importance of this in influencing subjective assessments.

Using 10 variations of the standard formulation, 10 different paints were made from each pigment. The pigments could then be compared by making parallel drawdowns on white charts, the only difference between the two paints on any one chart being the pigment used in the paint. The assessor simply stated his preference for the right- or left-hand paint or no difference. Assessments were carried out after three stages of surface modification had been effected. Assessors made their first set of choices with the paints unmodified. For the second set of assessments the paint films were wiped with a soft damp tissue and then allowed to dry. A third stage of modification was achieved by coating the paint films with a one micron thick layer of clear hydroxyethylcellulose and again the charts were assessed. Although the assessors knew the surfaces were modified, they were unaware of the details.

Two sets of viewing conditions were used. In one, the assessor was constrained by being forced to stand in one place and view the charts without touching them. Natural daylight came from behind the assessor and the charts lay in a gray enclosure, open at the top and front, on a table in front of the assessor. In the other condition, the assessor was free to hold the card at any angle to the incoming light and to view it at any angle. There was an interval of at least one day between the sets of assessments; the cards were recoded for each of these assessments. The assessors were simply asked to say which of the two paints on the card they preferred on the basis of "appearance" with no instructions as to what that term constituted.

The results are presented in *Table* 2. Each assessor made 10 comparisons of the two pigments so any one outcome must occur at least seven times before preferences can be considered significantly different from random (see *Table* 1). Further, even when a particular outcome does not appear, it is just not possible to be 95% certain that the assessor has rejected it.

When the paints are assessed under constrained viewing in the initial unmodified condition four out of six operators, 1, 2, 3, 6, have significant preferences and 1, 3 and 6 agree with one another. Two of the three 1, 3 make significant reversals in their preferences when the viewing conditions are changed. When the cleaned paint films are assessed, there are fewer significant preferences, assessors 1 and 4, and only one reversal of preference with viewing condition, operator 4. Only operator 4 expresses a preference when the coated paints are examined and he moves away from that preference under free viewing conditions.

These results have been discussed elsewhere[2] and the conclusions need only be summarized here. These are that some of the skilled technicians can discriminate between the two pigments when the paint surfaces are unmodified, but they may be strongly influenced by the viewing conditions. As the surface modification reduced differences between the surfaces of the paints based on the two pigments, the tendency to prefer one pigment (or the other) was reduced. This has been explained in terms of energy reflected and scattered from the surface.[2] The important fact here is that an objective analysis of the subjective assessments has made available information about the impact on skilled observers of energy scattered and/or reflected by the surface of the paint film. This impact is much stronger than had been previously considered possible.

Table 4—Subjective Assessment of the 'Appearance'—Gloss Paints Based on Pigments C and D

	Constrained Viewing			Free Viewing		
Comparison	For C	No Diff.	For D	For C	No Diff.	For D
15% C-v-15% D	0	0	11	0	0	11
15% C-v-14% D	0	0	11	0	0	11
15% C-v-13% D	0	0	11	3	2	6

Alkyd Gloss Finishes

A similar problem was noticed when two grades of pigment were tested in an alkyd gloss formulation. Technologists reported that pigment D, at 13% PVC, was comparable with a standard, pigment C, at 15% PVC. Objective measurements did not support these observations and a detailed comparison was carried out.

Using pigment D, paints were prepared at 13%, 14%, and 15% PVC and these were compared with a 15% PVC paint made from the standard pigment C. Objective opacity assessments were obtained by making conventional scattering coefficient measurements and calculating the hiding power in square metres per liter of dry paint. The colors of standard thick paint films were obtained by reflectance measurements and quoted as L and b values. These objective measurements are presented in *Table* 3. Comparison charts containing two paints were prepared by making parallel drawdown, the standard paint and one of the three test paints, on both all white, and black and white charts.

Eleven skilled technologists were then asked to examine the drawdowns on the white charts and asked to state which paint they preferred on the basis of appearance; again no guidance was given on what constituted a desirable appearance. As before two viewing conditions were used, free and constrained, with the usual recoding and time lag between each. *Table* 4 presents the results of this assessment and, with 11 assessors taking part, it is necessary to have eight assessors concurring before a preference can be taken as significantly different from chance; if seven assessors concur on a choice this gives a strong indication of a real preference. Conversely, for any choice to be classed as not preferred there must be no assessor choosing it.

Under constrained viewing conditions pigment D is preferred even when used at 13% PVC. When viewed under free viewing conditions the comparison of D at 13% and C at 15% leads to a random distribution of outcomes; at 14% and 15% D is unambiguously preferred. Thus the technologists' comments are completely confirmed.

In an attempt to account for this unexpected result the assessors were asked once more to compare the drawdowns on white charts but this time to make a choice on the basis of paint film color ignoring hiding power and gloss.

Finally the assessors examined the drawdowns on black and white charts and were asked to state a preference on the base of hiding power, ignoring color and gloss. The outcomes, and the objective measurements, are presented in *Table* 3; the information is confused!

The color of pigment D is preferred at all PVC levels when constrained viewing conditions are used. While the objective assessments, also presented in *Table* 3, support this for 15% and 14% they do not support the subjective preference at 13%. Under free viewing conditions there is no clear preference when the 15% paints are compared, which is a clear statement that the two pigments are not the same when pigment D at 14% is compared with C at 15% and a preference for C when it is compared with D at 13%. This is a clear reversal of preference with a change of viewing conditions. Similarly, the hiding power preferences under both sets of viewing conditions are not completely supported by the objective assessments.

Thus, the use of subjective assessments in conjunction with carefully planned experiments has indicated that a poor relationship exists between objective and subjective assessments of both hiding power and color. Further, there is no consistent simple link between either the objective or subjective assessments of hiding power and color and the clear dominance of pigment D when assessors are asked for preferences based on unspecified appearance.

Table 5—Paired Comparisons on Eight Paints—A to H Inclusive

Order of Presentation and Assessors Preference

(1) A B	(8) C D	(15) E F	(22) G H
(2) D F	(9) F H	(16) C G	(23) B D
(3) A E	(10) A C	(17) A F	(24) C E
(4) C H	(11) E G	(18) B C	(25) B G
(5) D E	(12) A H	(19) F G	(26) C F
(6) B E	(13) D G	(20) E H	(27) D H
(7) B F	(14) B H	(21) A D	(28) A G

Scores and Rank

Paint	Score	Rank
A	1	7
B	3	5½
C	5	2½
D	7	1
E	5	2½
F	4	4
G	3	5½
H	0	8

Usefulness of Subjective Assessments

Explanation of the anomalies revealed by these experiments will be presented in a future paper. The objective of this paper is to demonstrate that careful use of the skills of trained observers constitutes a powerful research tool. Even the simple case of comparing two paints demonstrates that changes in viewing conditions change the preference of some observers. Secondly, it also demonstrates that surface differences may have a significant effect compared with the amount of energy which actually interacts with the surface. Thirdly, we could not account for a strong subjective preference based on an unspecified "appearance" by either subjective or objective assessments of hiding power and color. That is, the

objective use of subjective comparisons of paint films suggests an incomplete understanding of what affects those comparisons.

COMPARISON OF MORE THAN TWO PAINT FILMS

Consider the problem of an assessor trying to place a series of paint films in some order of merit. Once the series contains more than five films, it is possible that the continuous cross referencing which is involved in making the assessment affects the constancy of the criteria being used. (Indeed, when foods are being compared for taste it becomes impossible to compare a series). A second problem is that the ordering produced by the assessor may have no rational basis, and, therefore, has no significance. These two problems can be overcome by adopting the technique known as paired comparison ranking.[3,4]

Assume a series of n paints are to be placed in order of merit according to some subjective criteria. The paired comparison method assesses each of the n paints with the others in the series so that $n(n-1)/2$ comparisons involving two paints are carried out. In each of these the assessor states which of the two is preferred so that the comparison has only two outcomes. While it is possible to analyze the data when a third outcome of *no difference* is allowed, there are advantages in forcing a two outcome decision at this stage.

If the paints are presented in some order, A being compared with the rest, then B with all those except A, etc., it is possible that an unconscious ranking will be developed and replace individual judgements of each pair. To avoid this the comparisons are carried out in a predetermined random order and the assessors' decision recorded by crossing out the paint not preferred. The score for each paint is then simply the number of times it is preferred, the highest score being assigned rank 1 and the lowest rank n. Equal scores are assigned shared or joint ranks. An example of this is presented in *Table 5*.

It is possible that the assessor is either inconsistent or indecisive about some of the paints; this will be evident as a lack of discrimination in the final scores and hence the final ranking. Such a lack is exhibited by the data presented in *Table 5* and inspection reveals one such inconsistency has occurred when B, E, and G are considered as a trio:

B was preferred relative to E
E was preferred relative to G
But G was preferred relative to B

These preferences form an inconsistent or circular triad and the greater the number of circular triads the less significant is the ordering produced by the assessor. A full analysis of paired comparison can be found in references (3) and (4). The following text summarizes the main points. The number of circular triads, d, is given by:

$$d = \frac{n(n^2-1)}{24} - \frac{1}{2} \sum_{i=1}^{n} \left(S_i - \frac{(n-1)}{2} \right) \qquad (4)$$

where S_i is the score of the i'th paint. Applying this to the data in *Table 5* gives d = 3 and when n = 8 a d value of up to 7 can be tolerated before the assessors ranking must be considered possibly arising from chance. For n = 7 the critical d value is 4 and for n = 6 a d value of 1 is just tolerated. Approximated values are presented in *Table 6*.

Table 6—Number of Circular Triads Which Must Not Be Exceeded If the Ranking Is to Be Considered as Significant

No. of Paints	Max. d Value
5	—
6	1?
7	4
8	8
10	22
12	40

When m assessors have arrived at a ranking there is a choice of methods whereby the individual ranks can be combined into a joint rank. It is pointless to include in a joint rank any assessments which are unreliable, i.e., they have d values which are too high. Even the assessors who are consistent within themselves may not form a significant consensus. The easiest method is to base the overall rank on the rank total, t_i, which is:

$$t_i = \sum_{j=1}^{m} r_{ij} \qquad (5)$$

where r_{ij} is the rank the j'th assessor assigned to the i'th paint. If the assessors were showing no consensus the expected rank total would be:

$$t_E = m(n+1)/2 \text{ for all i values}$$

and from these two a coefficient of concordance, W, can be calculated.

$$W = \frac{12 \sum_{i=1}^{n} (t_i - t_E)^2}{m^2 n (n^2-1)} \qquad (6)$$

This is a measure of the extent to which the m individual assessors agree with each other; it ranges from zero when there is no agreement at all to unity when the assessors are in complete agreement, that is, it is analogous to a correlation coefficient. The significance of any actual

Table 7—Minimum Value of $\sum_{i=1}^{n} (t_i - t_E)^2$ Which Must Be Reached Before the Concordance Between m Assessors Comparing n Paints Can Be Considered Significant

	n				
m	6	7	8	10	12
4	155	235	338	620	1024
6	233	352	508	929	1537
8	311	470	677	1239	2049
10	389	588	846	1549	2561
12	583	882	1269	2324	3841

Table 8—Data from the Paired Comparison Ranking of Six Gloss Paints

Assessor	Paints G4	G3	G6	G1	G2	G5	No. of Circular Triads
1	1	2	3	4	5	6	0
2	1	2	3	5	5	5	1
3	1	2	3	4	6	5	0
4	1	2	3	4	6	5	0
5	1	2	3	4	5	6	0
6	1	2	3	5	5	5	1
Rank Total	6	12	18	26	32	32	
Overall Rank	1	2	3	4	5½	5½	

Rank 1 = highest gloss; Rank 6 = lowest gloss
Expected rank total if there is no consensus = 21
Σ (Rank total $-21)^2 = 582$
Coefficient of concordance = 0.924

value can be tested by the 'F' test and details are presented in reference (1).

Obviously, the value of $\sum_{i=1}^{n} (t_i - t_E)^2$ is of major importance and *Table* 7 presents a guide to the value which must be exceeded before the assessors can be considered to have a significant level of agreement. Assuming concordance is established, the final rank order is based on t_i. The paint having the lowest t_i is assigned rank 1 and that with the highest rank n; paints with equal rank totals are assigned joint ranks.

While this brief exposition has been written in terms of comparing paint films, the method can be applied to any set of subjective comparisons. Two of the following illustrations deal with comparisons of paints and the third deals with a market research study of the relative importance of the properties of TiO_2 pigments.

Factors Affecting Gloss

It is recognized that subjective statements about gloss are influenced by more than the quantity of energy reflected in a specular manner. As part of an investigation into these other factors a pilot study was conducted into the role played by the spectral selectivity of the surface.

Six white paints were prepared using formulations, milling methods, and drying conditions which were known to change the spectral selectivity of the surface of the paint film. These paints were then used to prepare films on a plate glass substrate so that six glossy paint films were available. Six skilled paint technicians then carried out a paired comparison ranking to put the paints in an order of merit for gloss. These assessors were given no information about the paints, which were simply coded G1 to G6. The resulting rankings, the number of circular triads and the rank totals are presented in *Table* 8. The six assessors are in complete agreement about paints G4, G3, and G6; G1 is assigned either fourth rank or equal fifth. However, two of the assessors rank G5 above G2 and two reverse this; the remaining two rank G5 and G2 equal fifth with G1. These assessors, No. 2 and No. 6, have one circular triad indicating some confusion or difficulty in connection with paints G1, G2, and G5. A ranking of six paints containing one circular triad can only just be accepted as significant but in this case the circular triad is associated with paints about which the other assessors were not unanimous. That is, there is clearly a problem with paints G2 and G5 and possibly G1.

If there is no consensus, the expected rank total is 21 and the sum of the squared deviations from this is much larger than the minimum required for significance, and the coefficient of concordance is 0.924 which is massively significant. A significant overall ranking is obtained and some explanation must be sought for the assessors' problems with paints G2 and G5.

Conventional 45° gloss measurements were carried out using the three tristimulus color filters to give gloss in red, green, and blue light. These are presented in *Table* 9 which also contains a measurement of spectral selectivity—the gloss undertone. This is analogous to the conventional undertone used in describing white pigments and is defined as:

$$\text{Gloss Undertone (G.U.)} = \frac{\text{Red gloss} - \text{Blue gloss}}{\text{Green gloss}} \times 100$$

Obviously the nearer the G.U. is to zero the lower the spectral selectivity and vice versa when any image reflected by the surface is more likely to be colored relative to the object. *Figure* 1 presents the average gloss, the gloss undertone and the subjective gloss plotted in two dimensions.

Paint G4, with an average of 76.7%, is unambiguously ranked as having the highest gloss. Paint G3 has marginally lower gloss than G6 yet is unambiguously ranked higher; paint G1 with a gloss of 64.3% is unambiguously placed two ranks lower than G3 which has a gloss of 65.7%. However, the ranking of these three paints, covering a range of only 2.9% in average gloss, follows the gloss undertone, i.e., higher undertone coincides with lower rank. It seems likely that the assessors are using gloss undertone, that is spectral selectivity, in making their judgements. If this is so, then the problems with G2 and G5 may be explained. Paint G2 has the higher gloss but also has the higher undertone and an assessor who dislikes a slightly red image will rank G2 lower than G5. Conversely, an assessor who is not sensitive to image color will rank G5 lower than G2. This does not account for those assessors who rank G1, G2, and G5 as being the same. Finally, a different set of assessors could produce a different ranking because they have different strengths of preference for image color and image brightness.

Table 9—Ranking of Surfaces with Different Spectral Selectivities

Paint and Subjective Rank	"EEL" Gloss Values % Blue	Green	Red	Average Gloss %	Gloss Undertone
G4—1	73	75	82	76.7	12.0
G3—2	64	65	68	65.7	6.2
G6—3	64	65.5	72	67.2	12.2
G1—4	60	63	70	64.3	15.9
G2—5.5	57	60	68	61.7	18.3
G5—5.5	51	53	58	54.0	13.2

Again our purpose is not to present detailed explanations of the findings but to illustrate the potential value of subjective assessments. In this instance, a combination of objective measurements and an analysis of subjective assessments of gloss suggest that marginal changes in the color of the specular beam can strongly influence the preferences of some observers.

Hegman Gauge Readings

While the Hegman gauge is a simple and inexpensive method of assessing dispersion it is not a precise instrument. This lack of precision is associated with the problem of representing information about the dispersion present on the gauge as numbers. During research into this problem it became apparent that experienced operators would agree in a qualitative manner about the "state of dispersion" indicated by the gauge, but that the prevailing method of representing that state as a number was not completely satisfactory. A new procedure was devised whereby three readings taken from the gauge were combined into a single number.

To test the validity of the new procedure a series of 10 paints was prepared to provide dispersions ranging from very poor to very good. Gauges were drawn down from these paints and photographed for use in a paired comparison ranking. The assessors were asked to state which photograph represented the paint having the better state of dispersion. No criteria were suggested and assessors with considerable experience in gauge reading were asked to avoid basing their assessment on some conventional reading procedure. To verify that this was happening two further groups of assessors were used: one consisting of people, knowledgeable of Hegman gauges, but who rarely used one, and the second consisting of people unfamiliar with Hegman gauges who were instructed that any defect on the paint channel was unsatisfactory, and were told how to judge the "size" of a defect. The individual rankings, the number of circular triads and the rank totals are presented in *Tables* 10a, b, and c; the data are presented in descending order of dispersion. As usual the assessors were given no information about the paints.

The maximum number of circular triads, produced by assessor 14, is well within the permitted maximum so this, and hence each of the assessments, is statistically significant. However, while eight of the 10 experienced assessors and three of the five semiexperienced assessors were consistent only one of the five inexperienced assessors was consistent. That is, the degree of consistency fell as the degree of experience with Hegman gauges fell, as was expected. The ranking produced by each of the three sets of operators is virtually identical and, as seen in the following table of sums of the squared deviations from mean rank total and coefficients of concordance (W), are massively significant.

	10 Experienced Assessors	5 Semi-Experienced Assessors	5 Inexperienced Assessors
$(t_i - t_E)^2$	7656	1962.5	1813
W	0.93	0.95	0.88

So, the three sets of observers are producing a consensus about the state of dispersion indicated by the appearance of the Hegman gauge. Further, this consensus is independent of the level of experience possessed by the assessors. Therefore the three sets of assessments can be pooled to produce a grand rank total from all 20 assessors and thus an overall rank. *Table* 11 presents this grand rank total, the overall rank and both the original and the new objective numerical values assigned to the 10 photographs.

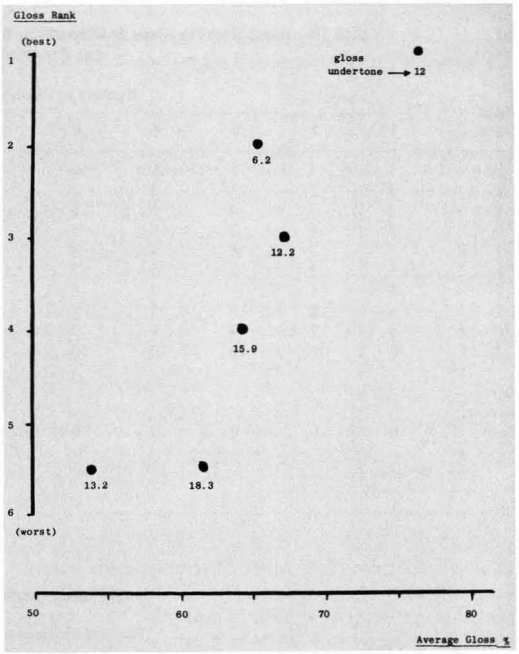

Figure 1—Gloss rank against average gloss and gloss undertone

Clearly, the new and original numerical methods of representing the appearance of the Hegman gauge are successful in that both correlate excellently with subjective assessments. When standard correlation coefficients are used to quantify the degree of correlation the new method is marginally better (*Table* 11); the negative sign occurs because the best dispersion was assigned rank 1 and the numerical presentation gives the good dispersions the higher numbers. Thus, there is a marginal advantage in using the new numerical assessment in that it agrees slightly more closely with the subjective assessments of both expert and nonexpert assessors.

One feature of *Table* 11 is worth further comment and that is the slightly better correlation coefficients obtained by using the rank totals rather than the overall ranks based on them. This simply reflects the fact that rank totals which are close together are a result of assessors finding difficulty in judging the state of dispersion on the two photographs. Some assessors prefer one and some the other. That is, the actual rank totals can be used as a measure of the strength of preference and this is illustrated in photographs N, E, and K ranked 1, 2, and 3. Despite this clear ranking, the rank totals clearly

Table 10—Assessing the State of Dispersion Represented By Photographs of a Hegman Gauge
(a) Experienced Assessors

Paint Code	Ranking by Assessors 1-10										Rank Total	Overall Rank
	1	2	3	4	5	6	7	8	9	10		
N	1	1	1	1	1	1	1	1	1	1	10	1
E	3	2	3	3	3	3	2	2	2	2	25	2
K	2	3	4	2	2	2	3	4	3	3	28	3
G	4	4	2	5	5	4	7	3	6	5	45	4
J	7	7	6	4	4	7	5	7	4	5	56	5½
H	5	5	5	6	7	6	6	5	6	5	56	5½
F	6	6	7	7	6	5	4	6	6	7	60	7
D	8	8	8	8	8	8	8	8	8	8	80	8
C	9	9	9	9	9	9	9	9	9	9	90	9
A	10	10	10	10	10	10	10	10	10	10	100	10
No. of Circular Triads	0	0	0	0	0	0	0	0	1	1		

(b) Semi-experienced assessors

Paint Code	Ranking by Assessors 11-15					Rank Total	Overall Rank
	11	12	13	14	15		
N	1	1	1	1	1	5	1
E	3	2	3	2	2	12	2
K	2	4	2	3	3	14	3
G	4	3	5	6	4½	22½	4
J	5	6	4	4	6½	25½	5
H	6	5	6	6	4½	27½	6
F	7	7	7	6	6½	33½	7
D	8	8	8	8	8	40	8
C	9	9	9	9	9	45	9
A	10	10	10	10	10	50	10
No. of Circular Triads	0	0	0	4	2		

(c) Assessors with no experience

Paint Code	Ranking by Assessors 16-20					Rank Total	Overall Rank
	16	17	18	19	20		
N	1	1	1	1	1	5	1
E	3	2	2½	5½	2	15	2½
K	2	3	4½	2½	3	15	2½
G	7	4	2½	5½	5	24	4
J	5	6	6	2½	5	24½	5
H	6	6	4½	4	5	25½	6
F	4	6	7	7	7	31	7
D	9	8	8	8	9	42	8
C	8	9	9	9	8	43	9
A	10	10	10	10	10	50	10
No. of Circular Triads	0	1	2	3	1		

indicate that photograph K is only marginally worse than E which is itself clearly worse than N.

The technique described has been used in practical application for resolving the difficulties associated with relating the titanium dioxide manufacturers' quality control procedures to the paint manufacturers' assessment of pigment dispersion in the finished paint. The former endeavors to assign precise numerical values to states of dispersion in order to maximize information on quality trends; the latter in many instances adopts a pass/fail criteria based on subjective assessments.

PAIRED COMPARISONS AS A MARKET RESEARCH AID

While it is accepted that the main purpose of TiO_2 pigments is to provide opacity, obviously there are other paint properties which are pigment dependent. Interaction between a given grade of pigment and a particular formulation can mean that two different paints using that grade will not have the same balance of properties. However, it is often difficult to decide on the relative importance of paint properties partly because they are interdependent and because the relative importance changes. It is essential that the pigment manufacturer is aware of the relative importance placed on different properties by the paint maker.

A paired comparison ranking is the obvious way of establishing the relative importance of paint film properties once a controlled and reasonably common set of criteria are guaranteed. Eventually, the following was established as a satisfactory procedure.

For any paint system a set of relevant properties was compiled by independent discussion with paint technologists who were not participating in the property assessment exercise. These properties were paired off in random manner (*Table* 5) ready for comparison. Each assessor was told to consider a series of pairs of paint properties which were equally deficient and when considering any pair to assume that all other properties were perfect.

Further, he was to assume that the TiO_2 manufacturer could afford to improve only one of the two. The assessment he was asked to make was to state which one of the pair should benefit from the finance available for improvement. These background assumptions and the method of making the selection, which emphasized that the TiO_2 manufacturer was going to invest money to help the ultimate consumer of the paint, increased the likelihood of the outcome being a result of an objective use of the assessors' knowledge.

The procedure was first used to investigate the relative importance placed on paint properties by members of a Technical Marketing Group. This served a dual purpose of familiarizing them with the procedure and establishing the level of consensus within the Group. United Kingdom paint manufacturers were then involved in the investigation and a market consensus established for the following systems: alkyd decorative gloss, flat latex, semi-gloss latex, automotive finishes, general industrial, and exterior coil coatings. Results for the flat latex are presented to illustrate the information obtained.

Table 11—Objective and Subjective Assessments of the State of Dispersion Shown on the 10 Hegman Gauge Photographs

Photograph	Old Numerical Assessment	Subjective Assessments: Rank Total	Subjective Assessments: Overall Rank	New Numerical Assessment
N	7.0	20	1	10.0
E	5.5	52	2	7.7
K	5.0	57	3	7.4
G	6.5	91.5	4	5.9
J	4.5	106	5	6.6
H	6.5	109	6	5.8
F	5.0	124.5	7	6.8
D	2.5	162	8	3.6
C	4.0	188	9	3.7
A	2.0	200	10	2.9
Correlation Coefficients		-0.8	-0.78	-0.92
			-0.95	

Initial discussion with paint technologists produced the following list of important properties for flat latex systems: color, durability, ease of dispersion, mill base loading, opacity, sheen control, and viscosity stability. Five members of the Technical Marketing Group carried out the assessment and the results are presented in *Table* 12 in overall rank order. All assessors were internally consistent in their rankings and the consensus is highly significant with a sum of squared deviations of 608 and a coefficient of concordance of 0.87. Within that consensus there is one relatively low discrimination in that sheen control, with a rank total of 28, is close to mill base loading with a rank total of 26. If agreement between five assessors had been perfect the difference between successive ranks would have been 5.

Thirteen paint manufacturers took part and their rankings are presented in *Table* 13 (a) in the order obtained from the Technical Marketing Group. All 13 were internally consistent. This was a clear indication that there was no confusion in the assessment of the individual paint manufacturers. Although there is a reasonable agreement between the overall rank obtained

Table 12—Relative Importance of Paint Properties—Flat Latex Paint. Technical Marketing Group Rankings

Property	Assessor Number 1	2	3	4	5	Rank Total	Overall Rank
Opacity	1	1	1	2	1	6	1
Viscosity stability	2	2	2	1	3	10	2
Ease of dispersion	4	3	4	3	2	16	3
Color	5	4	3	4	4	20	4
Mill base loading	3	7	6	5	5	26	5
Sheen	6	5	5	6	6	28	6
Durability	7	6	7	7	7	34	7
No. of circular triads	0	0	0	0	0		

Rank 1 = most important; Rank 7 = least important.

Tables 13(a) and 13(b)—Relative Importance of Paint Properties—Flat/Latex Paint. Paint Manufacturers' Rankings

(a)

Property	Assessor Number												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Opacity	2	2	2	4	1	1	2	1	2	1	3	2	4
Viscosity stability	1	1	1	1	2	2	1	2	1	3	1	4	1
Ease of dispersion	4	4	4	3	4	4	6	4	3	2	2	1	2
Color	3	3	3	5	3	5	5	3	4	4	4	6	3
Mill base loading	6	7	6	4	7	3	4	5	7	6	7	3	6
Sheen	7	6	7	6	5	7	7	6	5	7	6	7	5
Durability	5	5	5	7	6	6	3	7	6	5	5	5	7
No. of circular triads	0	0	0	0	0	0	0	0	0	0	0	0	0

(b)

Property	No. 1–13		No. 1–9		No. 10–13	
	Rank Total	Overall Rank	Rank Total	Overall Rank	Rank Total	Overall Rank
Opacity	25	2	15	2	10	3
Visc. Stab.	21	1	12	1	9	2
Ease of Disp.	43	3	36	4	7	1
Color	51	4	34	3	17	4
M.B. Loading	71	5	49	5	22	5½
Sheen	81	7	56	7	25	7
Durability	72	6	50	6	22	5½

from the Technical Marketing Group and the ranking of the individual manufacturers, there are some notable disagreements. These are especially marked in the case of assessors 10, 11, 12, and 13, who assign a higher rank to ease of dispersion than either the Marketing Group or their fellow manufacturers. *Table* 13 (b) presents the rank totals and overall ranks for all 13 assessors and also divides the assessors into two groups and presents the data for these groups. The overall rankings of these subgroups are in accordance as seen by the sum of the squared deviations and the coefficients of concordance presented below.

	All Assessors 1–13	Subgroup A 1–9	Subgroup B 10–13
Sum of squared deviations	3374	1786	320
Coefficient of concordance	0.713	0.788	0.714

That is, all 13 paint manufacturers have a sufficient degree of concordance to say that the ranking presented in *Table* 13 (b) is highly significant. There are differences between the two subgroups and between these groups and the Technical Marketing Group. A study of the rank totals indicates that the major difference is the importance of ease of dispersion.

While it is possible to discuss the results in some detail it is enough here to highlight the main conclusions. Most important is the fact that there is a good broad agreement between the paint manufacturers and the Technical Marketing Group indicating a common agreed body of knowledge. Within that agreement four manufacturers give greater importance to ease of dispersion. This clearly represents a difference between them and both the remaining manufacturers and the Marketing Group. The survey reported here was carried out recently and there is evidence that these manufacturers were responding to the energy price changes which were making an impact on production processes. All of the paint manufacturers who participated found the exercise valuable and each one was given the overall market ranking for each formulation and their own ranking.

SUMMARY

The purpose of this paper is to illustrate the range of information which can be obtained by using subjective assessments in an objective manner. However, the illustrations have themselves demonstrated the extreme sensitivity of observers:

(1) Very small changes in the spectral energy distribution leaving the surface of a paint film can have a significant effect on the judgements of trained technicians. It is not always easy to relate these changes to conventional objective measurements.

(2) Once the possibility of these effects is accepted it becomes essential to use subjective assessments rather than rely on objective measurements. In doing so it is essential to design the circumstances of the assessment so that all assessors have controlled viewing conditions and no means of discriminating between the objects being assessed other than the assessed differences.

(3) It is essential to ask each assessor the same question and it may be necessary to construct a fairly elaborate explanatory text to ensure that the assessors are concentrating on the differences being studied. This is especially true when essentially different parameters are under investigation as in the case of paint film properties.

(4) There are statistical methods available which are more powerful and more exact but they often require a high level of statistical expertise. The two methods outlined and illustrated here are simple and robust and can be used by anyone with a technical background. They allow working paint technicians to make objective use of subjective data.

ACKNOWLEDGMENTS

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Ceramic Coatings

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The nature of glasses and their physical and chemical properties of importance when used as ceramic coatings are described. There are important constraints arising from the use of a brittle coating material on a substantially rigid backing. Organic and inorganic coatings are roughly compared on various counts. Crystallization from a glass coating during cooling is used for opacification and for decorative effects in glazes and porcelain enamels.

Ceramic glazes, porcelain enamels, and glass colors are all quite different families of compositions because they have to "fit" and adhere to different substrates within temperature limits dictated by the properties of these substrates.

Emphasis is placed on modern products and possible avenues for future development.

INTRODUCTION

Porcelain (ceramic) enamels and organic coatings are the products of distinctly different technologies, yet they are often found in use side by side on separate components of manufactured objects, such as many household appliances. It was felt that organic coatings technologists would find some interest in a review of the background and present state of the art in this neighboring discipline.

For the purpose of this review, a ceramic coating will be defined as a thin layer of glass fused onto and adherent to the surface of clayware, metal, or glass and formed from finely-divided materials by heating at temperatures within the capabilities of the substrate. This definition excludes some interesting types of coating, for example flame-sprayed refractory oxides and compositions that are heated, but not fused. The nature of the substrate and its refractoriness largely determine what sort of glass compositions can be used as coatings and, as will be seen later, the choice becomes more restricted as the temperature is lowered. The main groups of ceramic coatings considered here are shown in *Table* I.

Many definitions of the term glass have been given, depending on the viewpoints of the various authors. A very general one is used here; namely, that a glass is an inorganic product of fusion which has cooled to a rigid condition without major crystallization.

One of the characteristics displayed by glass-forming melts is their high viscosity compared with those of ionic melts and molten metals. This is due to the partially covalent character of the bonds between the ions, which leads to partially directional bonding and a tendency to form extended 3-dimensional networks. For example, the silicon-oxygen and the boron-oxygen bonds both possess about 50% covalent, 50% ionic character. Silicates and borosilicates constitute almost all of the glass of commerce. It should be noted here that there is a distinct similarity between the viscosity-molecular weight relationship of the polymer chemist and the extended network/high viscosity concept of the glass technologist.

Given a liquid of high viscosity just above its liquidus temperature, it is quite possible to cool it fast enough for it to reach a condition of truly enormous viscosity without the occurrence of nucleation and of crystal growth. These processes depend upon ionic motion, and their speeds are inversely proportional to viscosity (i.e., high viscosity, slow ionic movement). Once in a high-viscosity state, higher than 10^{15} poise, the rate of crystallization becomes extremely small, so that to all intents and purposes the glass becomes stable indefinitely.

Silica itself forms a good glass; it is very refractory and viscous and necessarily commands a high price because of the technical difficulties involved in its manufacture. It is the best available glass-forming oxide because of its tendency to form extended networks due to its tetrahedral, covalent bonding. For inexpensive, bulk glass production, it is necessary to reduce the required melting temperature to something technologically feasible. This is done by adding "fluxes" such as alkali and alkaline earth oxides. It might be noted here

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Table 1—Main Types of Ceramic Coatings

Substrate	Coating Name
Traditional Clayware	Glaze
Metal (Steel)	Porcelain Enamel
Glass	Glass Enamel

that a "flux" to a glass technologist might be very roughly equated to a "molecular weight control agent" in polymer chemistry. These function by breaking the strong Si-O-Si bonds:

$$\equiv \text{Si-O-Si} \equiv + \text{Na}_2\text{O} \rightarrow 2 \equiv \text{Si-O}^- \text{ Na}^+$$
$$\equiv \text{Si-O-Si} \equiv + \text{CaO} \rightarrow \equiv \text{Si-O}^- \text{ Ca}^{2+} \text{ }^-\text{O-Si} \equiv$$

In this way, some of the network bonding is destroyed with a consequent loss of rigidity. In the melt, ionic motion is enhanced; alkali ions can hop from singly-bonded oxygen to singly-bonded oxygen quite easily; alkaline earths move with rather more difficulty, while the network can also move by bond interchange now that there is a population of broken bonds. The viscosity therefore decreases. Common bottle and window glass is a good compromise between meltability, chemical durability, and freedom from crystallization. Its idealized composition is 73% SiO_2, 15% Na_2O, 10% CaO and 2% Al_2O_3.

To set the scene in round numbers, [1] window glass is melted at temperatures around 1500° C-1550° C, at which its viscosity will be in the range of 100-1000 poise. It will be worked or formed at about 900° C-1000° C, with a viscosity in the region of 10^4-10^5 poise, and it will be annealed (or stress relieved) at temperatures near 500° C-550° C and will have a viscosity of 10^{13}-10^{15} poise. At 10^{13} poise, stresses are relieved in a few minutes while at 10^{15} poise it takes a few hours to do so. On further cooling, the viscosity continually increases, and at room temperature it may be calculated to be well over 10^{20} poise. Such a material acts as a true solid. When heated to about 550° C (about 10^{13} poise), it starts to behave as a high-viscosity liquid. This temperature range in which the viscosity is about 10^{13} poise is quite important technically; it is called the transformation range and is designated Tg. It varies with glass composition, of course. Thermoplastics show essentially the same type of transformation range, albeit at much lower temperatures.

One can, with some justification, look upon a glass-forming melt as a solution of various metal oxides, each one dissolved in a solvent composed of the other oxides present. For special purposes this solution can be made saturated at the melting temperature with one oxide, and if this liquid is then cooled slowly, this oxide, or a compound containing it, will recrystallize. This technique, where the opacifier is allowed to crystallize, is used in the ceramic industry to make opaque glazes and porcelain enamels. It can also be made to yield beautiful large crystals within a glaze by adopting a very careful, slow cooling cycle. This is not done commercially, but is done regularly by studio potters.

THE ANTIQUITY OF CERAMIC COATINGS

The first glazed pottery objects (beads) were found in Egypt and have been dated beyond 5000 B.C. Glazed vases and statuettes were being made in the same country by 2000 B.C. The use of glazes was known in India and Mesopotamia by 3000 B.C. From these early beginnings the secrets of glazing spread to Crete and then to Greece. The Assyrians and Babylonians were adept at the art by 600-700 B.C. The knowledge spread to Northern Africa (the Moors) and from there to Europe. The earliest glazes were all impure alkali silicates. The use of lead oxide as a flux and glaze constituent was discovered over 2000 years ago and this led to glazes of great brilliance and lower firing temperature. It is reasonably certain that these early lead-containing glazes were made by sprinkling powdered galena (PbS) onto the surface of the unfired clay pots and then firing them. The lead sulfide would be oxidized to lead oxide and, with silica and alumina from the clay, would form a lead aluminosilicate glass. This type of glaze was not very durable and, consequently, lead poisoning was quite common in the Roman Empire.

Enameling of metals is also of great antiquity. The Egyptians made jewelry several hundred years B.C., using blue and white enamel glasses on gold. Miniature paintings in fused enamels on precious metal were brought to a fine art in the 1600's in France. As the background knowledge of metal enameling was developed, the technique was applied to baser metals in the progression gold-silver-copper-iron. Porcelain enamel was first successfully applied to sheet iron in Austria and Germany in the 1850's. The iron was at first quite impure but, as metallurgy became better understood, purer iron came onto the market and it became easier to enamel. The industry expanded rapidly and by 1925 the output of enameled products reached $675 million per year. The industry is now mature and shows no sign of declining.

Glass decoration is of relatively recent origin. Application of colored enamels to glass was developed about 1500 in Italy. Angelo Broviero of Murano is generally considered to be the originator. Nowadays the products are widespread; tumblers, beverage containers, glass tableware, and ovenware are all available in decorated form.

IMPORTANT PHYSICAL PROPERTIES OF CERAMIC COATINGS

Ceramic coatings and paints are sometimes found to be competing for the same job. An example is the appliance market, where organics are used when the coating does not have to withstand elevated temperatures; prolonged, hot, detergent contact; or much household, abrasive, powder cleaning.

Ceramic coatings differ from paints in several important aspects. They have limitations because they have to be fused onto the substrate at a temperature that the latter can withstand, and they are brittle solids. While paints do not suffer from these two limitations, they do have other drawbacks as well as some advantages. For

example, painted metals are commonly postformed, an unthinkable practice with porcelain enamels. *Table* 2 shows some differences between the two types of coating in rough, comparative terms.

The matching (or mismatching) of coefficients of thermal expansions of coating and substrate is of primary importance in the use of ceramic coatings. Glasses are well known to be weak in tension and very strong in compression. To make practical use of this effect, the coating must be placed under compression at all times. To break such a coating, the compression force would have to be overcome before a tensile condition could be arrived at which would then cause it to fail. *Figure* 1 shows typical thermal expansion graphs for a ceramic body (actually bone china) and a suitable glaze. The substrate essentially expands linearly along the line A (this is not universally true behavior, as many pottery body types show bumps in their expansion curves, but this does not affect the present discussion), while the glaze follows the curve B. This curve may be explained as follows: At low temperatures, the glaze behaves as a normal solid; when it reaches the transformation range, it starts to act as a high-viscosity liquid and expands as a liquid; and finally, at the temperature marked Mg, it is too fluid to push out the dilatometer rod any farther and, in fact, it starts to deform under the slight spring tension of the dilatometer rod. This point is called the "dilatometric softening point," and corresponds to a viscosity of about 10^{11} poise.

Let us consider what happens when the glazed ware cools after glaze fusion. The body contracts along the line A, while nothing significant happens to the glaze until we get into the transformation range, where it starts to behave as a solid, i.e., stresses can be built up more quickly than they can be relieved by viscous flow. Because the body is much thicker and stronger than the glaze, its expansion/contraction behavior will dominate the behavior of the composite. The body will contract more than the glaze during cool-down from the transformation range to ambient, and the glaze will be forced into compression to make it contract the extra amount designated Δ in *Figure* 1. There is an optimum range of Δ. If it is negative, the glaze will be placed in tension and will typically fracture during the cooling cycle or shortly after being put into service; this malady is called "crazing" and used to be a big problem. On the other hand, if Δ is too large, the compression becomes too great and something has to give, and the usual failure mode is for flakes of glaze to fly off the ware, particularly on rounded edges, a process that is called "peeling" or "shivering". The correct range of Δ is about 0.02–0.10%, and little trouble should be experienced if the mismatch is kept within this range. Although this discussion has used a ceramic body/glaze combination as an example, exactly similar considerations apply to porcelain enamels and glass enamels, except that the metal substrate will bend, since it is flexible. This amount of bend or "warp," if measured under carefully controlled conditions, can be used as a practical measure of enamel compression.

For a coating to fuse, flow out, and free itself of most of the bubbles and imperfections with which it starts out on initial fusion, it has to be heated to such a temperature that its viscosity is in the region of 1000 poise. This is particularly important for ceramic glazes, because these are usually compounded from various raw materials such as feldspar, quartz, clay, limestone, and, possibly, a pre-melted glass. These materials have to decompose, react, melt together, and homogenize during the heating cycle, so a low viscosity is desirable. The other two types of coating are composed almost completely of pre-melted, pulverized glass (known as "frit" in the trade) plus a little suspending agent such as clay and, possibly, some opacifier. Here all reactions have been carried out previously and all the frit has to do is melt, flow together, and lose some of the entrapped air from the surface. The time-at-temperature for the latter two coatings can be measured in minutes, while a traditional glaze may require several hours at, or near, peak temperature, coupled with a slow cool-down.

Table 2—Some Differences Between Ceramic Coatings and Paints

Property	Paints	Ceramic Coatings
Fusion Necessary	No*	Yes
Brittle	No	Yes
Thermal Expansion Important	No	Yes
Abrasion Resistance	Low	Good
Chemical Resistance	Low/Good	Good
Temperature Resistance	Low	Good
Resistance to Staining	Low/Good	Good
Solvent Emission Problems	Yes	Some (glass enamel media)
Energy Requirements	Low	Moderate
Cost	Moderate	Low

* Except for powder coatings.

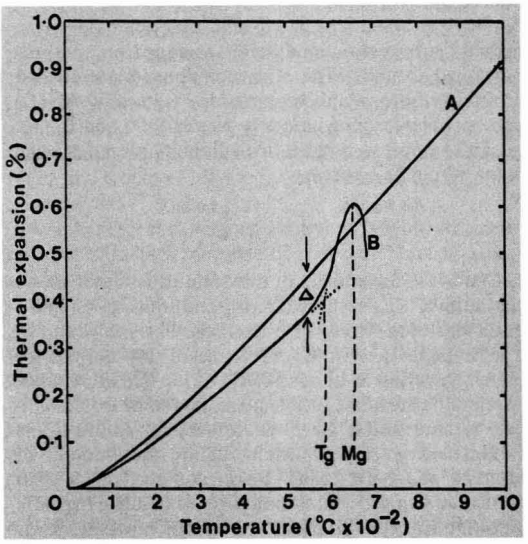

Figure 1—Thermal expansions of bone china (A) and a matching glaze (B). The mismatch (Δ) near the transformation point determines the glaze compression after cooling

Table 3—Commercial Glaze-Body Combinations

Body Type	Bisque Fire (°C)	Glaze Type(s)	Firing Temperature (°C)	Approximate Linear Expansion Coefficient
Hard Porcelain	1000	Clear. Lead free. No frit	1350–1400	$50 \times 10^{-7}/°C$
Bone China	1235	Clear. Low lead or lead free. High frit content	1050–1100	$100 \times 10^{-7}/°C$
Hotel Ware	1250	Clear. Low lead. High frit content	1200	$60 \times 10^{-7}/°C$
Sanitary Ware	—	Opacified. Lead free. Little frit	1270	$60 \times 10^{-7}/°C$
Stoneware	1000	Various. Lead free. No frit	1250	$65 \times 10^{-7}/°C$
Semi-Vitreous Ware	1250	Clear. Low lead or lead free. High frit content	1150	$70 \times 10^{-7}/°C$
Wall Tile	—	Opacified. Lead free. High frit content	1100–1150	$70–80 \times 10^{-7}/°C$
Floor Tile	1180	Opacified. Increasing proportion glazed. Textured nonslip abrasion-resistant glazes needed	1000–1100	$60–70 \times 10^{-7}/°C$

GLAZES

Ceramic bodies are quite refractory and will withstand high temperatures (e.g., 1000°C–1400°C) for several hours without distortion. Within this temperature range it is quite possible to provide a multiplicity of coating compositions with a multiplicity of surface textures, degrees of opacity, and colors. *Table* 3 gives a listing of various types of ceramic products and the types of glaze used to coat each, with firing temperatures and approximate values of the thermal expansion coefficient. Sanitary ware and wall tile are subjected to only one firing, body and glaze maturing simultaneously. It is fairly certain that there will be a continuing trend toward single-firing for the other products because of fuel and time savings.

When discussing or comparing glaze compositions, three systems are possible. Weight percentage of the various oxides can be used, as can molar percentage of the oxides. However, the most popular system is the so-called Seger formula (originated by the famous German ceramist of that name). This uses the molar formula, but with a twist. The mono and divalent oxides (the network breakers or modifiers) are added up and proportioned to unity. The other components are divided arbitrarily into amphoteric oxides (typically Al_2O_3) and network forming oxides (typically SiO_2 and B_2O_3). As an example, a typical, low-solubility glaze for bone china would be written:

$$\left.\begin{matrix}0.4\ Na_2O\\0.3\ CaO\\0.3\ PbO\end{matrix}\right\}\ 0.4\ Al_2O_3\ \left\{\begin{matrix}3.0\ SiO_2\\0.4\ B_2O_3\end{matrix}\right.$$

One of the advantages of this formula is that it shows the ratio of fluxes:silica directly and, thus, gives one a good idea of the fusion characteristics likely to be shown by the glaze. A ratio of 1:3 is reasonably normal for glazes maturing at about 1050°C–1100°C. More silica would indicate a less fusible glaze, less silica would indicate a more fusible glaze. Of course, the nature of the fluxes used is also important, as are the amounts of alumina and boric oxide. Boric oxide is both a glass former and a flux, while alumina tends to make the glaze resistant to crystallization; too much, however, tends to retard proper melting. This quoted composition can be arrived at in many different ways. Technologically, the best way to make it is to use lead bisilicate frit ($PbO \cdot 2\ SiO_2 \cdot 0.1\ Al_2O_3$) to introduce the required lead oxide content (plus some of the silica and alumina, of course); use, say, 5% of kaolinite as a suspending agent for the glaze (this introduces some SiO_2 and Al_2O_3), and use the remaining oxides in the required proportions to permit melting together to form another, lead-free, frit. The required weights of the three components are then milled together in water to form a creamy suspension. When this is fused the resultant glass will have the desired composition. The advantage of this frit approach is that it renders insoluble the otherwise soluble oxides Na_2O and B_2O_3 and drastically reduces the solubility of the lead oxide by the incorporation in lead bisilicate.

In the bad old days, such a glaze would probably have been made up from white lead (basic lead carbonate), feldspar, clay, whiting, and borax—a very poisonous mixture which would not be tolerated today. Alternatively, one could start with lead bisilicate and add appropriate amounts of feldspar, clay, whiting, and borax, with possibly some quartz.

A wide variety of frits is available. All frit makers will probably have at least 100 assorted compositions on their books and, with their aid, practically any desired composition can be built up with only minor raw material additions for final adjustments. *Table* 4 shows just a few representative frits out of the many available.

Comparing present-day glazes with those in use only 15–20 years ago, a distinct trend is apparent away from the use of titania as an opacifier and toward the cleaner and cheaper zircon. Almost all opacified glazes today use zircon, and a wide variety of frits are available containing quite large quantities of dissolved zirconia. When milled, applied to the substrate, and fired, much of the zirconia crystallizes during cooling as the compound $ZrSiO_4$, zircon. Such glazes can be formulated to have glossy, satin, or matte surface textures and can be colored in various pastel shades. The glazes can be splattered on top of one another to give quite exotic effects, on wall tile for example. New, pleasing effects and textures are in constant demand, but once introduced onto the market they are quickly duplicated. Sanitary ware is invariably finished with a satin finish glaze in pale pastel shades or plain white. Most high-quality tableware is glazed with clear glazes, but everyday tableware is often finished with an opacified, sometimes tinted, glaze. Floor tiles, until recently, were not glazed, but an increasing

Table 4—Some Commercial Glaze Frits-Seger Formulae

Na_2O	K_2O	CaO	BaO	ZnO	PbO	Al_2O_3	SiO_2	B_2O_3	ZrO_2	TiO_2
0.333	—	—	—	—	0.667	—	1.98	0.666	—	—
0.212	0.045	0.393	—	—	0.350	0.065	2.14	0.707	—	—
0.483	0.198	0.319	—	—	—	0.286	1.97	0.308	—	—
0.346	—	0.188	—	0.465	—	—	1.62	0.988	—	—
0.159	0.152	0.212	—	—	0.477	—	2.62	0.318	—	0.442
0.022	0.071	0.302	0.252	—	0.353	0.098	1.23	0.455	—	—
0.152	0.012	0.326	0.107	0.403	—	0.018	1.36	0.295	0.172	—

proportion is being so finished. Textured, nonslip effects are important, and the glazes commonly contain substantial amounts of zircon to combat frictional wear.

PORCELAIN ENAMEL

Porcelain enamels are limited to firing temperatures of up to 825° C and have to match a substrate with the high thermal expansion of about 140×10^{-7}/° C. Steel becomes soft and deformable within this temperature range and, consequently, heavier-gauge steel is usually used for enameling than painting to combat the warpage tendency. The temperature trend has been downward for many years and at the present time commonly-used enamels are fired between 750° C–800° C, producing coatings which are highly chemically resistant. This downward trend will continue, but it is probable that some chemical durability may have to be sacrificed to get as low as 725° C, the probable minimum temperature that will be used commercially in the foreseeable future.

The white, cover coat that is so familiar on appliances is really a very closely related family of glasses. Each manufacturer has a large number of proprietary formulations tailored to meet the requirements of a particular furnace, firing schedule, grade of steel, metal pretreatment, desired degree of chemical durability, desired warp, and so on. *Table* 5 shows the approximate ranges of composition of white, cover coats. The system is a mixed alkali borosilicate glass with about 40% silica, 18% boric oxide, and a total of about 15–18% alkali oxides with upward of 20% titania. The thermal expansion is largely controlled by the alkali content, while the mixing of lithia, soda, and potash helps the durability (a phenomenon known as the "mixed alkali effect"). During melting of the glass at about 1200° C, all the titania dissolves giving a clear frit product. When remelted at the lower temperatures used for enameling, about two-thirds of the titania crystallizes out of solution in the form of anatase crystals with a length of about 0.2 μ, which is just about the best size for efficient opacification. The minor constituents P_2O_5 and fluorine aid the crystallization and help to retard the anatase → rutile transformation. Anatase is bluish-white, while rutile is cream and, thus, undesirable.

The metal substrate has to be properly prepared before enameling can be successfully carried out. The purer the metal the better it is. Zero carbon steel is the ideal material, but is more expensive and is becoming difficult to obtain. Cheap, cold-rolled steel is inconsistent in its behavior. The metal is prepared by an acid etch (to produce micro-roughness) followed by a thin nickel flash (~ 0.1 g/ft^2). The nickel apparently helps to control oxidation of the steel during heat-up prior to enamel fusion.

Over the years, many types of specialty enamels have been developed. For example, there are high-temperature enamels designed to adhere to stainless steel and superalloys. These are fused at up to 950° C and can be used in jet engine combustion cans to stop oxidation. Another, more major, recent development has been the emergence of the so-called "continuous cleaning" enamels for ovens. In this application the enamel is designed to be quite porous and contains major proportions of catalytically active oxides of multi-valent metals such as iron, manganese, and copper. Splashes of soil (e.g., fat) are absorbed and spread out by capillary action on the large internal surface area of the enamel, where oxidation to CO_2 and H_2O is accelerated by contact with the catalytically-active oxides. There are some problems with this type of enamel, and it cannot, as yet, be regarded as fully developed. Because of its necessarily porous nature, it is not as hard and durable as a conventional enamel, while excellent adhesion to the substrate is hard to obtain. Cooking temperatures are really quite low and catalyst activity is, thus, not as high as would be preferred. In the relatively near future a combination catalytic/pyrolytic oven will probably be introduced. A pyrolytic oven needs to be heated occasionally to about 1000° F to burn off the soil, but a continuous cleaning coating needs only about 700° F to clean completely in a short time. The combination would use less energy in the cleaning cycle, would not have to be cleaned as often, and would be inherently safer because of the lower temperature.

Another recent development has been the introduction of dry electrostatic spraying of porcelain enamels as an alternative to the traditional wet application methods. Organic coatings have used this process for quite some time, but porcelain enamels have had serious problems which have only recently been overcome. Because of its high alkali content, the resistivity of the enamel powder would be too low for satisfactory adherence without special protective coatings on the frit particles while the resistivity is also humidity-sensitive. Now that viable enamels are available, a start has been made on the conversion of appliance plants to the new application method. It offers considerable cost savings, frees factory space, offers recycling of overspray so almost 100% of the enamel bought is ultimately used, and can also yield a more uniformly sprayed, smoother, finished coating.

Table 5—Typical Porcelain Enamel Cover-Coat Compositions

SiO_2	38–45	
B_2O_3	12–19	
Li_2O	0.5– 1.5	Total Usually 15%–18%
Na_2O	7–10	
K_2O	5– 9	
P_2O_5	0.8– 2.5	
TiO_2	15–20	
ZrO_2	0– 3	
F_2	1.5– 5	
Other Oxides	0– 3	(e.g., MgO, ZnO)

Table 6—Range of Glass Enamel Compositions

PbO	50–87
SiO_2	12–36
Na_2O	0– 5
K_2O	0– 5
B_2O_3	0–15
CdO	0– 4
TiO_2	0– 4
Al_2O_3	0– 6
Li_2O	0– 2
ZrO_2	0– 6

GLASS ENAMELS

The substrate is usually soda-lime glass in the form of bottles and tumblers. This glass starts to soften at about 600°C, which sets an upper limit to the temperature that can be used to fuse the enamel. Enamels have been formulated that will soften and gloss-out at 550°–600°C and also "match" the expansion of the glass with a reasonable compression. The glass substrate has an expansion coefficient of about 90×10^{-7}/°C, while industrially-available enamels have values in the range $75–85 \times 10^{-7}$/°C. At the present time, the only family of enamels that will do all the things required of them contain substantial proportions of lead oxide. *Table* 6 shows the ranges of composition of typical glass enamels. They are essentially lead silicates or lead borosilicates with various minor additions which are, nevertheless, very important. Resistance to detergents and food acids is gained by careful proportioning of these minor constituents, particularly titania and zirconia. It should be emphatically stated that present-day enamels are perfectly safe with regard to lead release, and in any case they are invariably applied to the outside of the article and, thus, should not come into contact with the mouth or the food or drink contained within the article. Opacifiers and colors are added separately during milling.

However, lead-containing glass enamels have been stigmatized as being potentially dangerous as, for example, in the celebrated McDonald's case in Massachusetts.[2] It is, therefore, very likely that lead-free glass enamels will make their appearance within a few years. The developmental difficulty is to achieve the three important properties, fusion temperature, expansion, and durability, simultaneously. At the moment, we can get two out of three; we have formulations that have correct fusion and expansion, but abysmally bad durability, and other formulations that have correct expansion and really good durability, but require temperatures 50°C higher than the glass can withstand. However, suitable compositions will emerge in time.

FUTURE TRENDS

To close this review it will be appropriate to view some possible future lines of development in addition to those mentioned previously.

With regard to ceramic glazes, it is fairly certain that there will be a powerful trend to reformulate existing glaze compositions to make them suitable for very rapid firing and/or single-firing. Some types of glaze used today do contain major proportions of frit, and this type of glaze will increase in popularity because it requires a minimum of heating at the melting temperature to flow out and become homogeneous. Frit is necessarily more expensive than the raw materials previously used, but fuel economies and increased throughput of ware through existing furnaces should counterbalance this disadvantage. In Europe, some tableware is being fired completely (cold to cold) in half an hour, so the time at peak temperature can only be a few minutes at most. The glaze has to mature straight away (and so, of course, will the body, which probably will have to be reformulated, too).

Porcelain enamels will advance as indicated previously. Continued work on continuous cleaning coatings will improve adhesion and catalytic activity. However, a great deal of work remains to be done on electrostatic dry spray. Another avenue of research will be to perfect formulations that will adhere well to cold-rolled steel with only minimal metal preparation.

Glass enamels are quite satisfactory as they are, but work is continually in progress to reduce firing temperatures a few more degrees without giving up the desirable properties. The introduction of lead-free enamels will probably come first for nondurable applications and, as expertise is gained in formulating, they will gradually take over the beverage and tumbler market.

It should have become apparent that far from being an old-fashioned, stolid, mature subject, ceramic coatings right now are in a state of rapid change. The next ten years will be an exciting and challenging time for those concerned with the progress of the industry.

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Effective Treatment of Paint Waste

Jules A. Feledy and Edward M. Antonucci
Drew Chemical Corporation*

In January 1980, the EPA issued revised effluent guidelines and standards for the Paint Industry. In order to meet these requirements, handling procedures are presented including suggested equipment needs. Various treatment methods are used in the industry. The types of methods include the use of inorganic salts, anionic flocculants, and cationic flocculants. Actual testing procedures are presented with supporting case histories and cost analyses. Each method results in certain trade-offs of the following properties, i.e., degree of solidification, clarity of supernatant, settling rates and resultant heavy metal content.

During the last five years the term paint washup water and paint waste has received a lot of discussion in both the industry, as well as in individual accounts. The treatment of paint waste has been an ongoing project at many paint companies for the last 5 to 10 years. This treatment can range from just monitoring and reducing the level of paint washup water all the way to sophisticated treatment centers. The following summarizes the current state of the art in terms of treating paint waste, as well as highlighting why we must treat this waste, and what the current regulations are regarding both effluent and sludge.

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Presented at the 15th Bienniel Western Coatings Societies Symposium in Anaheim, CA. March 6, 1981.

Why Do We Treat Waste?

Companies first started to treat waste due to local government regulations and increased charges to dispose of the effluent and waste. Sewerage costs often vary depending on the occurrence and concentration of selected pollutants and pollutant parameters. The cost of disposing paint waste in drums can vary anywhere from $30 to $100 a drum depending on the location, whether the material is hazardous or not, etc.

The government regulations that concern paint waste treatment are twofold: those regarding effluent and those which would regulate disposal of solid waste. A significant legislation was proposed in January 1980. This proposed EPA document (EPA-440/1-79/049-b) deals with effluent limitations, guidelines, and standards for the paint industry. In this proposal, the EPA is suggesting option 4 which is "EPA recommends that waste water effluent limitations attainable through the application of the best available technology economically achievable (BAT) rest on reduction of water use, recycling of rinse water back into products and/or contract hauling to *completely eliminate* the discharge of pollutants from all paint manufacturing facilities". Similarly "EPA recommends that standard performance for new sources and pre-treatment standards for new and existing sources require *complete elimination* of pollutant discharges from paint manufacturing facilities".[1] Hence, this is where the term "zero discharge" is obtained and the EPA requires compliance by July 1, 1984.[2] It should be emphasized that this is just a proposal by the EPA and has not yet been approved.

As we know, EPA is a federal agency, however, certain state and local municipalities already have enacted certain effluent limitations. These limitations will remain in effect until the EPA has approved their effluent limitations to this industry. The state/local regulations will remain in effect if they are at least as stringent as the federal guidelines. In general, most state legislation is concerned with the reduction of certain known pollutants such as heavy metals. Also, color is important. Certain local areas, such as the city of Chicago, have very stringent BOD/COD levels which must be met. In general, however, if a paint plant is treating their water with some kind of a chemical treatment program, their effluent can often be approved for discharge into local state water systems. There are exceptions, however.

Table 1—Products

Type	Charge	M.W.	Typical Use Levels %	Comments
Cationic	—	—	0.1-.35	—
Cationic	Medium	100,000	0.05-0.1	Most consistent performer - yields good supernatant clarity.
Cationic	High	5-7 MM	—	Fast forming floc - poorer supernatant clarity.
Cationic	—	<50,000	0.1-.3	Fast forming floc - excellent clarity.
Anionic	High	20 MM	.001-.003	Liquid, good clarity.
Anionic	High	20 MM	.001-.003	Powder, good clarity.

The EPA also has listed regulations for disposal of solid waste which is generated in a paint plant. Paint washup water was declared as a hazardous material in the May 19, 1980 *Federal Register.* However, the NPCA has recently succeeded in having this guideline amended. In the January 5, 1981 issue of the *American Paint & Coatings Journal,* it was noted the NPCA was successful in obtaining a suspension of EPA listings of paint-making waste as hazardous. The EPA has agreed to suspend for the January 16 effective date all four listings of paint manufacturing wastes as hazardous under RCRA. This ruling suggests that unless EPA generates better data and support for specific hazardous waste listing, "paint manufacturers and users need only to test their waste streams against the four general criteria of corrosivity, reactivity, ignitability, and extraction procedure toxicity".[3] Hence, paint manufacturers will still have to test their waste streams for these four general criteria. However, in general, many latex washup water streams will pass these criteria and may be classified as non-hazardous. This in itself, is a major achievement for the industry, since disposal costs for nonhazardous vs hazardous material is significant.* However, it is still very expensive, hence, the goal of the paint industry is to reduce volume of washup water and paint waste.

How Does A Paint Manufacturer Meet The Current Regulations?

In general, paint washup water will meet the current regulations providing the paint plant is not using high levels of products containing heavy metals, such as mercury, etc. However, it is important that a plant segment its wastes so that solvent washup water is never blended with latex or water reducible washup water. If this is met the chances of having waste classified as nonhazardous is excellent.

Another way to meet this regulation is to limit the amount of solid waste generation to less than 1,000 kilograms per month. Many small and medium size paint companies meet this requirement. In all cases efforts should be made to reduce the amount of waste water generated. Water can be conserved in several ways, namely by using washup water in the next batch of paint, using high pressure nozzles, and using the pig system for cleaning filling lines, transfer lines, etc.

Many paint companies today are re-using washup water from white bases or white paint. However, many paint companies do not like to mix washup water from one production batch with another production batch. Obviously good reasons exist for not wanting to mix wash water, however, there are ways to treat this wash water.

CHEMICAL TREATMENT OF LATEX WASHUP WATER: The only successful chemical treatment is through the use of polyelectrolytes. A polyelectrolyte is an organic polymer containing a sufficient amount of charged functional groups or neutral functional groups capable of hydrogen bonding with water to impart water solubility to the polymer and to allow it to behave as an electrolyte in solution.

Table 2—Test Procedure To Determine Optimum Flocculant System

1. Add 1,000 ml of well mixed sample to each beaker in the jar tester.
2. Record planned products, dosages, mixing speed and time, and pH on test sheet.
3. Adjust pH if necessary. Alum, ferric chloride, hydrochloric acid (HCL), etc. Optimum pH is typically 6.5-7.2.
4. Measure and add cationic polymeric flocculant to each waste paint wash water sample. Dosage levels vary from 0.05-0.3% (500-3000 ppm). The cationic polymer may be added neat or as a 1% or 10% solution. The dilutions are easier to disperse and often result in lower usage levels of the actual flocculant; however, many accounts do not want to be bothered by this added step.
5. Mix flocculant at high speed (100 rpm or high speed) for 1-5 minutes, reduce to low speed (20-40 rpm). Once pinflocs are formed, continue agitating to allow flocculation.

6a. If *no* anionic polymer flocculant is to be added, shut off agitation and allow floc particles to settle out. This may take 30 minutes–24 hours depending on system or plant requirements.

6b. 1. If an anionic polymer flocculant is to be added, a pH adjustment may be necessary. Ammonia or other suitable base may be used to raise pH to 8.5-8.7.
   2. Add 0.001-0.003% (10-30 ppm) of an anionic polymeric flocculant. This low concentration may be more easily and accurately added by using a 0.1 or 1% solution. Mix at high speed for 1-2 minutes. Mixing speed is then reduced to slow speed for several minutes.
   3. Shut off agitation and allow floc particles to settle out.

7. Record floc size (e.g. large-5; small-1); settling time and final color of supernatant (turbidity - 0 - worst or opaque and 10 - best or clear).
8. Repeat above to determine most optimum system.

Note: 1) pH adjustment is made prior to polymer additions.
2) If both a cationic and anionic flocculant are required, determine the optimum dose of cationic flocculant before exploring anionic flocculant doses. Pinfloc formation should be observed for correct cationic flocculant treatment prior to anionic flocculant addition.
3) Always allow for adequate mixing before adding the next chemical to the jar.

*This temporary suspension is now being reviewed by EPA. New background data is being generated for FO-17, FO-18, KO-79, KO-81, and KO-82. The new background data will dictate what type of paint residues the EPA will want to monitor. When completed, this interim final report will be made available to the industry.

In paint waste treatment, both cationic and anionic polyelectrolytes are used. In the remainder of this discussion, the term polymer will be used in place of polyelectrolytes since water soluble polymers are the type of material which are effective in this application. These polymers are flocculants which remove suspended solids via either coagulation or flocculation.

In order to remove suspended solids from liquid, two requirements must be satisfied: (1) the surface charge of the particles must be neutralized to overcome the inter-particle repulsion force and (2) the particles must be bound together to form larger particles which tend to settle rapidly. Polymers are capable of satisfying these requirements.

It is important to remember that coagulation and flocculation is a four step process. If one step is incomplete, the following steps will be unsuccessful. The first step is charge destabilization of the particle and surface charge neutralization. Coagulants contain charges opposite to that of the suspended solids. In most waste treatment, particularly paint, the type of coagulants which must be used are cationic since the suspended solids contain anionic charges. Once the surface charge is neutralized the particles can readily collide with each other. Then, hydrogen bonding forces allow the particle to form slightly larger solids called microflocs or pinflocs. Microfloc formation is the second step in this four step process. The water surrounding the newly formed microflocs should be clear. If it is not, coagulation has not been carried to completion, in other words not all of the particles have been neutralized. At this point the addition of more coagulant is needed. To achieve good coagulation thorough mixing is required. Over-mixing does not affect coagulation. Insufficient mixing would leave this step incomplete.

Flocculation can occur after microfloc formation. Flocculation is a two step process. The first step is aglomeration in which microflocs are attached together forming larger particles called flocs. To propagate floc growth high molecular weight polymers are added. They are able to bridge and mechanically and chemically bind microflocs together. Unlike coagulation, flocculation with polymers must be accomplished in a gentle slow mixing area. Rapid or violent agitation will break the flocs as they are formed reducing particle size and thereby increasing settling time. This completes the third step of the four step process. The fourth step involved is physical entrapment. As flocs begin to settle they capture smaller unattached microflocs further improving solids removal. This process,

Table 3—Treatment Results

Sample		Treatment		Costs	
Number	Description	Product	Dosage Level	1000 gl.	Evaluation
I	Solids-15% pH - 3.9 mainly vinyl/ acrylic	a. cationic polymer anionic polymer	3,000 ppm 50 ppm		small floc, slow settling, turbidity - 12 NTU
		b. cationic polymer anionic polymer	3,000 ppm 50 ppm		fast settling floc, turbidity - 50 NTU
II	Solids-2% pH - 9.3 contained 3% solvent	a. cationic polymer anionic polymer	3,000 ppm 40 ppm		medium floc, fast settling, turbidity - 30 NTU
III	Solids-5.3% pH - 7.1 mainly vinyl/ acrylic	a. alum anionic polymer	5,000 ppm 40 ppm	4.40	hazy supernatant, turbidity - 50 NTU
		b. cationic polymer anionic polymer	1,000 ppm 60 ppm	14.06	fast settling floc, crystal clear supernatant, turbidity - 12 NTU
IV	Solids-5.1% pH - 7.5 mainly vinyl/ acrylic	a. cationic polymer b. anionic polymer	1,500 ppm 30 ppm	22.20	fast settling resulting in 15% sludge and 85% clear supernatant
V	Solids-10%	a. cationic polymer b. anionic polymer	1,600 ppm 50 ppm	21.51	large floc, moderate settling, good clarity

coagulation and flocculation, only applies to suspended solids. Dissolved contaminants cannot be coagulated with polymers. They must first be chemically converted by pH changes, resulting in insoluble particles.

Other factors affect the performance of a flocculant in a paint waste system. Four areas are of particular importance, namely the amount of hydrophilic substance, the presence of stable emulsions (oil in water emulsions), pH, and temperature.

Certain acidic salts such as alum or ferric chloride are effective in not only reducing pH but acting as a coagulant. Many organic flocculants fail to remove color because they do not alter pH of the treated water. It should be remembered that if color is the major problem reducing the pH to 5 to 6 may help the clarity.

A stable oil in water emulsion also is difficult to floc. As we all know, emulsions are stabilized by surface charges. These charges help to keep the material emulsified in the water phase thus preventing coalescing. Again, inorganic coagulants such as ferric chloride or alum, as well as organic flocculants will break this emulsion, not only neutralizing the charges but by lowering the pH. pH is particularly important in removing certain inorganic materials such as heavy metals. Certain heavy metals have a tendency to coagulate at specific pH's. Examples are zinc-pH 9 and chromium ion-8.5.

Temperature is another factor which affects coagulation and flocculation. As mentioned earlier, polymers must uncoil to obtain optimum performance. In cold water the time required for uncoiling is increased and provision should be made for this by using either warmer makeup water or allowing for additional mixing time. Also, in winter months, some applications may require higher polymer doses than in summer months.

ORGANIC FLOCCULANTS: The principal type of polymer used in paint waste treatment is a cationic material. An anionic polymer may then be added later resulting in larger flocs and increased settling rates. Polymers are identified by two characteristics: charge and molecular weight. *Table* 1 lists some products which are offered to the industry. The degree of charge is basically the number of charge sights along the chain of a polymer. The degree of charge in a polymer is important as it determines the reactivity of the polymer. However, an increase in charge density has an inverse effect on the ability of the polymer to uncoil by virtue of internal charge repulsion. Hence, a highly charged material will take longer to uncoil and will need more agitation.

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Molecular weight is another important property of polymers. Molecular weight is important because the larger polymer molecule, the more effectively it can become entangled with suspended solids. All other properties being equal, the polymer with the highest molecular weight will have the strongest flocculating power and produce the densest flocs. Different polymer forms require different time to completely uncoil. In general, liquid cationic polymers take 10 to 20 minutes, whereas anionic materials may take 10 to 30 minutes to uncoil. In summary, flocculants used in paint waste treatment work in two ways: they neutralize charges and form bridges which pull down suspended solids.

How Do You Select The Correct Polymer For Your System?

In general, lab testing is required. The preferred method is the use of a jar tester. A jar tester consists of a six stirrer piece of equipment designed so that you can evaluate the same waste material using different chemical treatments and visually observe which one is forming the densest sludge. If a jar tester is not available, other types of agitation may be used. The suggested procedure is shown in *Table* 2.

Table 3 lists some results from evaluations in various paint companies across the country.

Suggested Equipment

The preferred system would consist of a two tank treatment system. The first tank would be used to collect the daily waste material. It is highly suggested that waste be treated on a weekly or bi-weekly basis. The first tank should be of sufficient size to contain that volume of waste water. Once ready to treat, a representative sample of the waste should be taken to the lab to determine the actual dosage level. After sufficient experimentation, a general dosage level can be arrived at. Material is then added and mixed for approximately 15 minutes or until pinfloc formation results. At this point, this material can be pumped into the second tank. While pumping into the second tank, the second polymer, an anionic material, can be added via an in-line dispersator. Sufficient mixing will occur in this in-line dispersator so that no agitator is needed in the second tank. Separation time varies from several hours to several days, depending on time requirements for the individual plant, as well as waste mixture. In general, many paint companies prefer to treat Friday afternoons and allow the material to set over the weekend for best separation. The water can then be discharged as effluent, re-used as washup water or even re-used in actual paint. There is some question on the two latter suggestions because of microbial growth. Hence, if you are going to re-use your material either as paint washup water or as re-use in paint, a biocide should be added. If the sludge is not re-used, the material can then be discharged as bulk solid waste or be filled into drums and be shipped out as dry solid waste. In either case, you will have to make it land fillable. If you are using a one tank system the same procedure can be followed except that all the material is added directly into this tank. The optimum system would be: a conical tank, variable speed agitator, draw off pipes at various levels for the supernatant, and at least a 4″ gate for removal of sludge.

RE-USE OF SLUDGE: A patent, "Recovery and re-use of paint solids from waste water" was issued to Drew Chemical Corp. (T. P. Brennan) on June 20, 1978. The abstract from this patent is as follows: "latex based paint waste water containing dispersed paint solids is clarified by flocculating the paint solids with a cationic flocculant. The separated paint sludge is brought to maximum pH and treated with an anionic dispersing agent whereby the sludge can be used in the formulation for the latex based paint." This procedure is being used now by several manufacturers. This material is being used as block filler, certain contractor paints, caulk and sealants, etc. If your sludge can be classified as non-hazardous this material may be sold as a raw material.

Summary

In conclusion, the treatment of paint waste is an important part of paint production. Government regulations dictated most of the effort, however, many companies are finding that it is a cost effective way to re-use water as well as to re-use raw materials. The cost of treatment systems is very negligible. The cost of installing the recommended equipment can be high, however, utilization of existing equipment often reduces the cost of installation to a very minimum. In essence, paint waste treatment is an important part of the production process and selecting the proper and the correct polymer system will enable the producer to have clearer supernatant which may be re-used and a sludge material which is denser, easier to discard, and has potential capabilities for re-use.

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Society Meetings

Birmingham — April 2

Peter Harland, of Croda Polymers International Ltd., spoke on "MARKETING FOR SURVIVAL IN THE 1980's."

Mr. Harland indicated that there were a number of factors causing the continued shrinking of the industrial paint market including the growing volume of imported paint and painted products; increasing use of such technological advances as one-coat systems and high-solids products; less waste-causing application techniques; and a reduced need for protective finishes because of the increased use of plastics.

To counter this recession, he said, U.K. manufacturers need to adopt a more aggressive marketing technique and choose the best products for development. Mr. Harland considered the three most important growth areas to be powders, water-borne paint and high-solids coatings.

He said that powder coatings usage would double during the next five years and that epoxy powder will be replaced by polyester. Mr. Harland contended that U.K. sales of water-bornes are lagging behind those of Germany and the U.S. because U.K. customers are more reluctant to change from the traditional. However, high-solids coatings are becoming more acceptable.

Q. In all this talk of 'growth areas' and 'Marketing for Survival', is there no future for conventional paintmakers?

A. Yes. Those with progressive ideas and who promote them well, they will survive.

Q. The cost of water-thinnable paints is not lower than conventional paints. How can they best be marketed?

A. The 'in the can' price seems to be important to most customers. The overall costs must be presented to them.

Q. Would government legislation help water-based paints?

A. Yes, this will happen, as in U.S.A.

Q. What about the energy costs in getting rid of water?

A. Yes, that is a point. But the cost of afterburners, to remove other solvents, might be more costly.

Q. What is the salesman's ploy for selling high solids?

A. Lower prices.

Q. How much of the U.K. industrial paint market is taken up by direct paint imports?

A. Approximately £40 million per annum.

BRIAN ADDENBROOKE, *Secretary*

Cleveland — April 21

Society officers for the coming year were elected. They are: President—Carl J. Knauss, Kent State University; President-Elect—Girish C. Dubey, Cambridge Coatings; Secretary—Donald C. Denison, Jr., Hilton-Davis; Treasurer—Harry A. Scott, Glidden Coatings & Resins; Fred G. Schwab, Coatings Research Group, will continue as Society Representative.

Dr. J. Edward Glass, of North Dakota State University, spoke on "ENZYMATIC RESISTANT HYDROXY ETHYL CELLULOSE."

Dr. Glass indicated a high viscosity and yield stress at low shear rate is needed for storage; during application a moderate viscosity to retain enough material on the applicator and a material of 1–3 poise at high shear rates of greater than 10,000 sec^{-1} is necessary to get good one-coat hiding. After application viscosity must be adjusted to inhibit sagging but a low viscosity is used to achieve leveling. He indicated that a complex viscosity exists where the elastic characteristics of the material are important in the final stage of leveling. This emphasizes the need for selective thickeners.

Cellulose of which cellose ethers are made have been used for two decades to achieve these rheological characteristics in trade sale paint. Cellulose is an abundant polymer and has a fair amount of segmental rigidity and good shear stability in giving good reproducible viscosity. Cellulose is not too sensitive to salts and can achieve minimum roller spatter with the correct molecular weight.

Dr. Glass feels that cellulose ethers will maintain a good percentage of the market because of their universality.

Cellulose ethers differ also. Methyl cellulose has some disadvantage due to color acceptance compared to hydroxy ethyl cellulose. However, hydroxy ethyl cellulose is less surface active; therefore, it affects the foaming during preparation of the coating. This is one reason why Dow Chemical made hydroxy ethyl methyl cellulose to circumvent this deficiency. Methyl cellulose has greater enzymatic stability than the original hydroxy ethyl cellulose.

There was interest in obtaining greater enzymatic stability in hydroxy ethyl cellulose with the advent of the hydroxy ethyl methyl cellulose. The primary problem is the chain effect. If you add methyl chloride to cellulose it simply adds; if you add ethylene oxide it creates another hydroxyl group making it more reactive than the hydroxyls on the cellulose molecule.

Dr. Glass discussed the methods of defining substituent reactivity, the influence of caustic and the amount of water used in manufacture and use of these techniques to make the ethylene oxide go on the molecule where you want it in order to inhibit enzyme activity.

Cellulose is unique in that it has many hydroxyl groups with intermolecular bonding leading to high crystallinity. Cotton has 70% crystallinity meaning it is not reactive; wood has 50% crystallinity of low molecular weight. About 20 units are together in cotton; six are in wood. If you react with high caustic it goes into the crystalline areas and breaks the hydrogen bonding. Upon the addition of ethylene oxide you make all the hydroxyl groups available for reaction; however, if you react it you still have 5–10% crystallinity.

If substitution with ethylene oxide can be made at the two position, the enzyme is not likely to attack the molecule; but if it substitutes at the six position the enzyme may attack. You must use enough caustic to break up the crystallinity and then lower the amount. By control of the variable caustic concentration and time of adding as well as the amount of water added to the system, one can control the rate and position of the addition of the ethylene oxide to the cellulose. It is very sensitive to the amount of water added, he said.

Q. What function is the water playing in the control?

A. It must interact with the caustic synergistically in order to get the last degree of crystallinity removed. Caustic is not good enough by itself without the correct amount of water.

CARL KNAUSS, *Secretary*

Houston — April 8

William D. Meadows, of Cyprus Industrial Minerals Co., spoke on "CHLORITE—A NEW EXTENDER PIGMENT FOR THE COATINGS INDUSTRY."

The following Society officers were elected for the year 1981-82: President—A. Duane Fields, Valspar Corp.; Vice-President—K.D. Jacobson, Cron Chemical Corp.; Secretary—George Schwartz, Cook Paint & Varnish Co.; and Treasurer—Don Montgomery, O'Brien Corp. Willy C.P. Busch, of PPG Industries, Inc., will remain as Society Representative.

K.D. JACOBSON, *Secretary*

Los Angeles — May 13

The traditional "Past-President's Night" was opened with the introduction of the Society's only surviving charter member, Mentis Carrero, who joined the Society May 24, 1925.

Past-Presidents attending were: William A. Gerhardt, Jr. (1940-41); John Warner (1945-46); Dan Heisler (1955-56); Frank Martin (1957-58); Al Hershey (1961-62); Walter Barber (1963-64); Trev Whittington (1969-70); Duke Cromwell (1970-71); Robert McNeill (1974-75); Gerald L. West (1976-77); Robert Koperek (1977-78); Fred Croad (1978-79); and Albert Seneker (1979-80).

Winners of the Society's Scholarship Awards were announed. They were: Mark Stancl, who attends USC, and Carl Seneker, who is a polymer chemistry student at NDSU.

Fred Croad (left), LASCT Past-President and Awards Committee Chairman (1980-81), awards Mentis Carrere, Charter Member, with a 25 year pin

Joe Cordero, of Act Container, was presented with a 50-year pin commemorating his many years of service to the Society. Twenty-five year pins were presented to Fred Croad, Hyam Braitberg, James Briglio, Mentis Carrero (he has been a member longer but for some time was not active in the Society), Al Cota, Conrad Fimbres, Burton Fink, Milton Golden, William Haar, Robert McKinnie, Daniel Mui, and Bob Roberts. Members not present to receive their pins were: Alan Alexander, Susumu Enkoji, Harold Langland, John Misity, Louis Schuman, and Jim Thomas.

Outstanding Service Awards were presented to Ken O'Morrow, of Oil and Solvent Process Co., and William Ellis, of Chevron Research Co. Neither was able to attend to accept the awards but sent their thanks and appreciation.

The Society has purchased an audio-visual presentation, "Introduction to Resin Operations," which they presented to the City of Commerce Library.

William D. Meadows, of Cyprus Industrial Minerals Co., spoke on "TALC, AN OLD MINERAL WITH NEW USES."

Mr. Meadows explained that the planar surfaces of talc are hydrophobic and the crystal edges are hydrophilic. Therefore, both an anionic dispersant for the crystal edges and a wetting agent with a hydrophobic end for the planar surfaces are needed for a good talc dispersion.

The significant paint properties to which talc contributes were discussed in detail. These included: (1) High dry brightness; (2) Good wetting, including water systems; (3) Good suspension properties; (4) Good exterior durability; (5) Good moisture barrier properties; (6) Soft and non-abrasive; (7) Basic pH; (8) Talcs contribute to thixotropy; and (9) Good flatting efficiency.

Great emphasis was placed on a study to use ultra-fine talcs as replacements for calcined and delaminated clays. With the rising energy costs, calcined clays are getting more expensive.

In the future, Mr. Meadows visualizes new forms of talcs with special properties. Stearate treated talcs are already available which renders talc more hydrophobic. Because of the organophillic nature of talc, it will readily absorb many types of organic compounds. Sophisticated grinding and classification methods will provide talc blends with tailor made particle size ranges for specific applications.

L. LLOYD HAANSTRA, *Secretary*

Don Jordon (left), LASCT President, awards Joe Cordero with a 50 year pin

New York — April 14

A group discussion on "MEDIA DISPERSION EQUIPMENT" was featured.

John Rahter, of Paul O. Abbe Co., discussed an increase in ball mill sales and explained how the ball mill should be operated effectively and efficiently. Mr. Rahter stressed that the type and amount of media were very important to the output of the mill. Examples were cited where mills were run with a small amount of media and Mr. Rahter emphasized that all mills should be charged with 50% media.

A slide presentation on bead milling was given by Roy Nelson, of Epworth Manufacturing Co. Applications of batch bead mills for coatings were discussed including procedures, formulation, and investment costs. Mr. Nelson stated that the SW Mill is the simplest of the bead mill designs employing the fewest moving parts and the least operator skill for a successful operation. The mill has rapid dispersion time, fast clean up and quick turn around time, and simple maintenance. He explained that the payback on equipment should be considered and presented slides describing the economy of his equipment. Mr. Nelson discussed how to operate the SW Mill and the time lapse for proper dispersion of different pigments. He listed the advantages as: price, fast payback, no riggers required, simple operation, no premix, minimum maintenance and temperature control and disadvantages as: will not reduce pigment particle size, beaded pigments are not efficiently dispersed, allows air to be introduced into the batch, not being a pressure vessel and has limited vessel volume.

Leo Dombrowski, of Chicago Boiler Co., discussed the vertical media mill, with a slide presentation. He stated the different size and type of media and the high speed method of operation. He compared the different mills of the various companies and their pros and cons. The problems with most mills is the clean up of the pumps and hoses according to Mr. Dombrowski. He explained the disc shapes and uses. He said the product must be fluid so it can flow to be dispersed and premixed for it to work efficiently. He stressed that media selection is very important to make the mill operate to its utmost. A comparison of the different types of screens used in the various mills was discussed.

Jerry Chait, of Premier Mills Corp., discussed the horizontal media mill with a slide presentation. The mill was designed to eliminate most of the common problems derived in the coatings industry today according to Mr. Chait. The features of the horizontal mill are increased media loading, greater thru put rate, relieve maintenance problems, better stability, uniform particle size and superior life to the operating proponents. The mill has eliminated the basic problem of the vertical mill by reducing the media compaction, shell wear and disc life. Mr. Chait stated that you can increase productivity, lower energy cost and control temperatures better. He explained the ease of floatation because of its design. All different types of media could be used in these mills and maintenance was relatively simple and fast. There are models with two speeds and various type of screens. There are also mills that can be hooked up in series for very difficult grinding pigments.

Q. Is there any difference in efficiencies in the horizontal and vertical mill?

A. Yes. You get better thru put rate and better product quality and stability, uniformity and shelf life on the horizontal. You must take into consideration many facts into finding efficiencies of mills such as power, time and labor.

Q. Would all speakers comment on their machines in efficiencies in various batches between 50 and 100 gallons in a wide range of formulations?

A. J.R.—The ball mill is best on blacks.

R.N.—All factors like labor force, time to assemble and time to operate machine must be calculated in your estimate. Power consumption is also a factor. The SW is designed for such small batches because of less losses between the electric motor and product coming out the spout has the minimum of mechanical connections.

L.D.—Small batches are an inefficient way to run but we have a machine to fit all sizes. I would give the edge to the horizontal machine because there is less clean up material needed. You only need small amounts of solvents for the shell and the pumps.

J.C.—The change over in the horizontal mill is very fast.

R.N.—You also have to take into consideration that with the SW Mill you do not need a premix mill and tank.

TED YOUNG, *Secretary*

Pacific Northwest Society Officers for 1981–82. Seated left to right: President-Elect—Stephen Norton; President—Dick Stewart; Secretary—Robert Hogg. Standing: Administrative Secretary—Bill Shackelford; Past-President—Walter Clyde; and Past-President—Curt Bailey.

Piedmont — May 20

Jim Joudrey, of Columbian Chemicals Co., presented "CARBON BLACK, INVALUABLE SOOT."

A historical background on carbon black and modern day types were discussed. A slide presentation depicted the basic manufacture of carbon black, using the furnace process. Mr. Joudrey explained the chemistry of carbon black, emphasizing such characteristics as particle size, surface area, and structure.

The various testing methods utilized in determining quality of carbon black were explained. Mr. Joudrey discussed nitrogen testing, iodine absorption, DBP absorption, pH, volatile content, and ash content.

In discussing industrial carbon blacks, Mr. Joudrey noted three main types: low color, medium color, and high color. Examples of low color applications were chassis paint. Medium color is found in general maintenance coatings, while high color is used in automotive and appliance coatings.

Mr. Joudrey emphasized five areas to observe when selecting the proper black. These included blackness, physical form, vehicle compatibility, tinting tone, and opacity.

Slides detailed dispersion preparation in solvent and aqueous systems. Recommendations for appropriate dispersing aids were given.

In conclusion, Mr. Joudrey discussed types of dispersion equipment and recommended what type of carbon black is best when used with different types of equipment.

SARA ROBINSON, *Secretary*

Pittsburgh — May 4

Richard Max, of Synkote Paint Co., spoke on "COMPUTERS IN THE PAINT INDUSTRY."

Mr. Max described a computer as a special machine that operates on a plan. It is special because you design it, it is easy to modify, it is fast and accurate, it can complete various operations, but it can not execute more than one plan at a time.

The selection and implementation of a computer is very important, according to Mr. Max. A company must analyze its business needs and requirements and select a system to meet those needs. Case studies on paint companies that used a computer for certain functions and questions and answers were presented.

Mr. Max outlined a company's expectations in using a computer. Most importantly, were cost and time for development. A firm must also choose a computer for reliability, service, and data integrity. Mr. Max stressed the importance of future changes.

In conclusion, Mr. Max explained that a carefully chosen computer, operated properly, can assist greatly in a paint plant.

BILL CIBULA, *Secretary*

Rocky Mountain — May 11

Richard W. Harold, of Hunter Associates Laboratory, Inc., presented "APPLICATION OF APPEARANCE MEASUREMENT TO THE COATINGS INDUSTRY."

Mr. Harold explained how numbers can be affixed to what is observed. The first part that is seen is light. The visible spectrum is the part of the spectrum in between the Cosmic, Gamma and X-Rays at one end to television rays, radio waves and electric power at the other end. The second part is what occurs when white light hits an object. Mr. Harold explained how spectrum colors are reflected at an angle, giving an indication of how glossy the surface appears.

Various scales used to define color were shown. The techniques for their use in paint plants for batch corrections, research and development data for new products, checking incoming raw materials, and communication on color identity were discussed.

DONALD R. BAGGE, *Secretary*

St. Louis — May 19

Michael W. Malaga, of Gott, Inc., spoke on "DISPERSION EQUIPMENT."

A historical background of paint making was featured along with a discussion of how mills and dispersers were used and evolved in the paint industry.

Mr. Malaga explained the effective use of mills which can save time, energy, and money. Also, proper cleaning of the mills was stressed.

J.J. WROBEL, JR., *Secretary*

Elections

BALTIMORE

Active

BRESNAHAN, THOMAS J.—Bennette Paint Manufacturing Co., Hampton, VA.
BRIGGS, WILLIAM H.—Newport News Shipbuilding, Newport News, VA.
CARPER, ALAN BRUCE—Newport News Shipbuilding, Portsmouth, VA.
COVERSTONE, STEPHEN L.—Sampson Paint Manufacturing Co., Richmond, VA.
GHEEWALA, MAHESH J.—Bennette Paint Manufacturing Co., Hampton.
MILLS, CHARLES JR.—Bruning Paint Co., Baltimore, MD.
MOORE, SHARON A.—Jotun-Baltimore Copper Paint, Baltimore.
POMP, PAUL R.—Seaguard Corp., Portsmouth.
PORTER, FRED H.—Norfolk Naval Shipyard, Portsmouth.

Associate

HAJNOS, JOHN V.—Spencer Kellogg, Charlotte, NC.

DALLAS

Active

GARDNER, JIM—Trinity Coatings Co., Fort Worth, TX.
GREYWITT, ROBERT C. JR.—Jones-Blair Co., Dallas, TX.
OSTROWSKI, JOHN S.—Jones-Blair Co., Dallas.

GOLDEN GATE

Active

ADLER, BARRY—Royell Inc., Mountain View, CA.
KALFAYAN, ED J.—Technical Coatings Co., Santa Clara, CA.
MASI, GREG—Masco Paint Manufacturing, Sparks, NV.
MILLER, ROBERT T.—Frank W. Dunne, Oakland, CA.
MOGLER, DOUGLAS S.—D.J. Simpson Co., South San Francisco, CA.
O'SHEA, LOU ANN—Kelly-Moore Paint Co., San Carlos, CA.
RILEY, LEWIS H.—McClellan Air Force Base, McClellan Air Force Base, CA.
SMITH, ROBERT C.—Kelly-Moore Paint Co., San Carlos.
WOLFE, VICTOR L.—D.J. Simpson Co., South San Francisco.

Associate

HIPPS, JO—DuPont Co., Newark, CA.
PICKERING, KENDALL—California Resins Co., Inc., Vallejo, CA.

LOS ANGELES

Active

FODOR, JOSEPH J.—Day-Glo Color Corp., South El Monte, CA.
FRAZIER, ELEANOR A.—Day-Glo Color Corp., South El Monte.
KRANTZ, BERNARD—Star Color & Chemical, Los Angeles, CA.
ZYWOCIENSKI, JACK—Fineline Paint Corp., Sante Fe Springs, CA.

Associate

ADHIKARY, PAT—Bentley Chemical Corp., Beverly Hills, CA.
BERGER, IRVING—Witco Chemical Corp., Los Angeles, CA.
PARADISO, PHILLIP—Bentley Chemical Corp., Beverly Hills.
UDELL, RICHARD J.—Bentley Chemical Corp., Beverly Hills.
UDELL, RONALD G.—Bentley Chemical Corp., Beverly Hills.
VIENS, ANDREW—Union Chemicals Div., LaMirada, CA.

NEW YORK

Active

DOCTOR, HARRY SR.—Koppers Co., Inc., Newark, NJ.
ACCAMANDO, THOMAS J.—Lehman Bros. Corp., Jersey City, NJ.
MAGUIRE, DEBRA J.—Reichhold Chemicals, Inc., Tuxedo Park, NY.
MARINZULICH, GERALD E.—Drew Chemical Corp., Boonton, NJ.
STONEBACK, CRAIG J.—Engelhard Minerals & Chemicals Corp., Edison, NJ.

ST. LOUIS

Associate

DANIELS, JACK—Cargill, Inc., Carpentersville, IL.
KOHLMAN, ANNE—Mozel Chemical Prod. Co., St. Louis, MO.

WESTERN NEW YORK

Active

GILLESPIE, ROBERT—Spencer Kellogg, Buffalo, NY.
WAITE, ALVIN—Pratt & Lambert, Inc., Buffalo.
WOODS, ED—Spencer Kellogg, Buffalo.
PRICE, JAMES R.—Pratt & Lambert, Inc., Amherst, NY.

Associate

TROST, DOUGLAS C. JR.—Hercules Inc., Akron, OH.

Societies Hold 30th Annual Joint Meeting

About 85 couples attended the 30th annual joint meeting of the Kansas City and St. Louis Societies on June 6, at Lake of the Ozarks, MO. St. Louis served as host Society.

The technical program, "R&D: Key to Survival in the Eighties," featured the following presentations:

"High Solids Coatings"—R.K. Hong, Spencer Kellogg Div. of Textron, Inc.

"Amino Resins in High Solids Coatings"—George Bruner, American Cyanamid Co.

"Practical Methods of Pigment Evaluation"—Dan Dixon, Freeport Kaolin Co.

"Hydrophobic Aerosils in Industrial Primers"—Terry Bowerman, Degussa Pigments Div.

"Identifying 'Surprises' or Irregularities in Water-Borne and Higher Solids Coatings"—William Winters, Cargill Chemical Products Co.

Federation guests at the meeting were President-Elect and Mrs. Howard Jerome and Executive Vice-President and Mrs. Frank Borrelle.

At the closing dinner, Mr. Borrelle presented a Federation 50-year membership pin to G.O. "Steve" Stephenson, who was associated with the *American Paint Journal* for 42 years. He served as Editor of the *APJ* from 1930 until his retirement in 1972. He continues to serve the St. Louis coatings industry as Executive Secretary of the St. Louis Paint and Coatings Association.

Working under the direction of Chairman Floyd Thomas, Jr., Thomas & English, Inc., the Meetings Committee included John W. Kemper, Sterling Lacquer Mfg., Inc.; Robert J. Giery, Sinnett Industrial Paints; Joseph J. Wrobel, Jr., CIBA-Geigy Corp.; Howard Jerome, Spatz Paint Industries, Inc.; John Folkerts, Plas-Chem Coatings; and G.O. Stephenson, (retired) American Paint Journal Co.

"Coatings Tech Expo '82" To Be Held May 19–20

The New England Society for Coatings Technology has announced the 2nd Biennial "Coatings Tech Expo '82" to be held May 19–20, 1982, at the Sheraton Inn & Conference Center, Boxborough, MA.

Exhibitors participating are from the coatings, ink, plastics, rubber, adhesives, paper, and textiles industries. The exposition will provide a forum for the dissemination of information and the presentation of new products and services.

Seminars to benefit managers and manufacturers are scheduled in conjunction with technical sessions for the bench chemists during the two-day exhibition.

For additional information, contact Dame Associates, Inc., 51 Church St., Boston, MA 02116.

New Additions Increase 'Talks Available' to 53 Selections

The 1981-82 listing of "Talks Available for Constituent Societies" contains a total of 53 presentations which are available for the upcoming meeting season. Divided into seven subject headings, the booklet presents 14 new titles.

The booklet, compiled and distributed to the Societies by the Federation, includes for each presentation: (1) Title; (2) Name of speaker; (3) Company affiliation; (4) Geographic areas where talk is available; (5) Equipment needed; (6) Abstract; (7) Biographical sketch of the speaker; and, if applicable, (8) Where and when talk has previously been given.

The booklet is available from Federation headquarters.

The following presentations are listed:

Additives

"Microbiological Spoilage of Latex Emulsions: Causes and Prevention"—Merck & Co.

"Paint Rheology and Rheological Additives"—NL Chemicals/NL Industries, Inc.

"Driers for Water-Borne Coatings"—Tenneco Chemicals, Inc.

"Microbiological Problems Associated with Water Reducible Industrial Coatings"—Troy Chemical Corp.

Colors and Pigments

"Non-Lead, Non-Chromate Corrosion Inhibitor for Alkyd Paints"—Buckman Laboratories, Inc.

"Non-Lead, Non-Chromate Corrosion Inhibitor for Latex Paints"—Buckman Laboratories, Inc.

"Quality with Thermo-Optic Silicates as the Foundation"—Burgess Pigment Co.

"Colorant Formulation: Pigment Selection"—CIBA-GEIGY Corp.

"Development of Computer Selected Blends"—CIBA-GEIGY Corp.

"A New Mineral for Coatings"—Cyprus Industrial Minerals Co.

"An Update on Talc in Coatings"—Cyprus Industrial Minerals Co.

"Talc—That Crazy White Stuff"—Cyprus Industrial Minerals Co.

"Factors Governing Tinter Performance"—Daniel Products Co.

"Extenders, The Inorganic Backbone of Flats and Primers"—Minerals & Chemicals Div., Engelhard Corp.

"Organic Pigments: Past, Present, and Future"—Sun Chemical Corp.

"Polymeric Organic Dispersants for Pigments—Principles and Practices"—Swedlow, Inc.

"Wonderful World of Color"—Universal Color Dispersion

Production

"The 'Whys' and 'Wherefores' of Cartridge Filtration in the Coatings Industry"—AMF Cuno Division

"Carbon Black in Aqueous Coating Applications"—Columbian Chemicals Co.

"Dispersion of Carbon Black in Coating Systems"—Columbian Chemicals Co.

"Dispersion and Mixing"—Hockmeyer Equipment Corp.

"Slurry—The New Way"—Hockmeyer Equipment Corp.

"Particle Size Reduction Techniques"—Netzsch Corp.

"Pigment Dispersion and the C.P.V.C."—NL Chemicals/NL Industries, Inc.

"Powder Handling with the Air-Pallet® Semi-Bulk Container System"—Semi-Bulk Systems, Inc.

"Latex Paint Spoilage vs Plant Housekeeping"—Tenneco Chemicals, Inc.

"The Sandpiper"—The Warren Rupp Co.

Resins

"Film Surprises or Irregularities in Waterborne and Higher Solids Industrial Systems"—Cargill, Inc.

"Maintenance Paints with Chlorinated Rubber"—ICI Americas, Inc.

"Design Considerations for High Solids Reactive Coatings"—Monsanto Plastics & Resins Co.

"New Developments in the Formulation of Gloss Latex Paints"—Pacific Scott Bader Inc.

"Introduction to Formulating Latex Paints (Anatomy of a Latex Paint)"—Rohm and Haas Co.

"Aqueous Gloss Enamels"—Rohm and Haas Co.

"Formulating for High Solids Industrial Coatings"—Spencer Kellogg Div. of Textron, Inc.

"Innovative Resins for Trade Sales and Maintenance Coatings Meeting Current Environmental Regulations"—Spencer Kellogg Div. of Textron, Inc.

"Application of Water-Borne Industrial Finishes"—Spencer Kellogg Div. of Textron, Inc.

"Water-Borne Maintenance Coatings"—Spencer Kellogg Div. of Textron, Inc.

"Telechelic Polymers—Precursors to High Solids Coatings"—Swedlow, Inc.

Solvents

"Economic Recovery of Solvent Vapors"—DCI Corporation

"Recovery of Paint Wash Solvent—An Economic and Environmental Necessity"—DCI Corporation

"Solvent Recovery System Based on a Wiped Film Evaporator"—The Pfaudler Co., Div. of Sybron Corp.

"Computer Prediction of Evaporation of Aqueous Solvent Blends With Any Number of Cosolvents at Any Humidity"—Shell Development Company

"Computer Selection of Solvent Blends"—Shell Development Company

Testing

"Current Use and Trends Accelerated Weathering Tests in the United States"—Atlas Electric Devices Co.

"The Inside-Out Story of Exposure Tests"—Atlas Electric Devices Co.

"Exposure Evaluation: Part II-Bronzing—CIBA-GEIGY Corp.

"Exposure Evaluation: Quantification of Changes in Appearance of Pigmented Materials"—CIBA-GEIGY Corp.

"Precision Spectral Ultraviolet Measurements and Accelerated Weathering"—DSET Laboratories, Inc.

"A Visit to the Hightstown Exposure Station"—NL Chemicals/NL Industries, Inc.

"Know Your Enemy—The Weather- and How to Reproduce It in the Laboratory"—The Q-Panel Co.

"An Investigation of Abrasion Resistance"—Shamrock Chemicals Corp.

Environmental

"Effective Paint Waste Treatment"—Drew Chemical Corp.

"Environmental Update"—Sun Chemical Corp.

World Congress on Coatings To be Held in New York, Nov. 3–4

The first World Congress on Protective Coating Systems for Bridges and Structures will be held November 3-4 at the International Hotel, Kennedy Airport, New York. The conference is sponsored by the University of Missouri-Rolla in cooperation with the Institute for Bridge Integrity and Safety, the Federal Highway Administration, the Steel Structures Painting Council, and the New York City Department of Transportation.

Major emphasis of the program will be on new methods of surface preparation, different aspects of field problems, and the materials and techniques for improving corrosion protection.

Additional information can be obtained by contacting Norma R. Fleming, Conference Coordinator, Arts and Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401.

People


H.M. Werner


P.J. Fitzpatrick


K. McGuire


A.C. Zadroga

Harold M. Werner has retired from the Glidden Coatings and Resins Division of the SCM Corp.

In 1942, Mr. Werner began his career as a Resin Chemist at Glidden's Varnish Research Laboratory in Reading, PA. After 18 years of service, he was promoted from Section Head of Resins and Polyesters to Chief Chemist and then to Technical Director of Glidden's Eastern Region Laboratory. In 1965, Mr. Werner moved to Cleveland headquarters as Manager of Laboratory Administration and in 1972 became Manager of Quality Assurance.

Mr. Werner holds a B.S. Degree, with a major in Chemistry and minors in Mathematics and German, from Albright College, Reading.

Since 1945, Mr. Werner has been a member of the Philadelphia and Cleveland Societies for Coatings Technology. He has presented various papers at the Federation's Annual Meetings and Society seminars.

Mr. Werner has served in the American Society for Testing and Materials since the 1950's as alternate for the official corporate member, chairman on various committees and sub-committees, Secretary, Vice-Chairman-Administration and Research of Committee D-1 on Paint and Related Coatings and Materials, and as a member of the executive committee. In 1978, he was the first recipient of D-1's Henry A. Gardner Award for demonstrating outstanding competence in managing a unit of D-1.

Neville Chemical Co. has announced the promotion of **Martin P. Stumpf** to Midwestern District Sales Manager, Chicago, IL.

Mozel Chemical Corp. has announced the appointment of **William A. Truszkowski** to the newly created post of General Sales Manager and of **Anne Kohlman** to Technical Sales Representative. Mr. Truszkowski is a St. Louis Society member.

Ferro Corp. has announced the following appointments in its Coatings Division. **Edward J. Duda** has been named Technical Sales/Service Representative for Organic Powder Coatings. **James R. Gettys** was appointed Sales Manager for Metal Coatings and **John D. Million** was named Manager of Sales Operations.

Peter J. Fitzpatrick has been named Vice-President-Calcium Carbonates for Flintkote Stone Products Co. **Charles W. Bowman** was appointed General Manager for the Calcium Carbonates Department. Mr. Fitzpatrick and Mr. Bowman are Baltimore Society members.

Polychrome Corp. has announced the promotion of **William Enchelmeyer** to Technical Director of its Printing Ink Division, Cincinnati, OH.

NL Chemicals/NL Industries has announced the appointment of **Andrew R. Ellis** as Western Regional Sales Manager, headquartered in Los Angeles, CA.

Other appointments made included: **Daniel J. Heidel** as Sales Representative for the Los Angeles Southern District and **Jacqueline Eckert-Stokes** as Northern Sales Representative, Los Angeles.

Carboline Co. has named **J. David Porthouse** to the position of President and Chief Operating Officer.

Armstrong Containers, Inc. has announced the promotion of **Ted Rohde** to President and Chief Operating Officer. Mr. Rohde formerly held the position of Vice-President of Finance and Operations. **Jack Colties** was promoted to Vice-President of Operations.

David E. Kress joined the firm as Vice-President of Marketing and Sales. **Ray Meifert,** former Vice-President of Marketing and Sales will transfer to Atlanta as Vice-President and General Manager of Operations.

Also announced by the firm were the appointments of **Dennis Lewandowski** as Outside Sales Representative and **Tom Vana** as Assistant to the Vice-President, Marketing and Sales.

PPG Industries has made the following appointments in their Coatings and Resins Division, Research and Development Operations in Springdale, PA. **Kathleen McGuire** was named Technical Manager, Interior Consumer Products and **Albert C. Zadroga** was appointed Technical Manager, Color, Microbiology and Specialty Products. Ms. McGuire and Mr. Zadroga are members of the Pittsburgh Society.

Andrew A. Egloff has been appointed Director of Marketing of the Pigments Department for the Hilton-Davis Chemical Group, Cincinnati, OH.

James F. Lawrence was elected Division Vice-President of Cargill Chemical Products Division, Minneapolis, MN.

Donald E. Abbott was named Technical Service Manager of the Industrial Division of Coronado Paint Co., Edgewater, FL.

Ben Kaulback was named Operations Manager for Flecto Coatings Ltd., Richmond, B.C.

Tom Swart has joined Parker Paint Manufacturing Co., Inc. as a Research Chemist.

Donald L. Washabaugh was appointed Technical Director of Davis Paint Manufacturers, Inc.

Engelhard's Minerals & Chemicals Division has announced the appointment of **Frederick L. Hecklau** to the newly created position of Product Group Manager for the Pigments & Extenders Group.

William H. Ellis, of Chevron Research Co., El Segundo, CA, was the recipient of the Los Angeles Society's Outstanding Service Award for 1981. Mr. Ellis, a Past-President of the Society, served as General Chairman of the 1972 Western Coatings Societies Symposium and was instrumental in winning the MMA Award for the Society in 1978. He has presented papers at many Society and Federation meetings and was awarded a Roon Foundation Award at the 1971 Annual Meeting.

W.H. Ellis

Mr. Ellis has served a total of 10 years on the Federation Board of Directors as Society Representative and as a Member-at-Large. He is the current President of the Federation.

Dr. Herbert L. Fenburr, of Columbus, Ohio, was elected to Honorary Membership in the Federation during its Board of Directors meeting on May 15, 1981.

H.L. Fenburr

Dr. Fenburr, active in the Federation for more than 30 years, served as its President in 1967-68 and as a member of the Board of Directors from 1964-75. He also served as Chairman of the Finance, Investment, and Program Committees. He was President of the Paint Research Institute from 1970-73 and was a Trustee of PRI from 1969-76.

Dr. Fenburr received the Federation's George Baugh Heckel Award in 1976 for his many years of outstanding service to the Federation and the industry.

A Past-President of the C-D-I-C Society, Dr. Fenburr retired in 1976 from Hanna Chemical Coatings Co., Columbus, Ohio, after more than 38 years of service with the firm.

He received the Ph.D. Degree in Chemical Engineering from Ohio State University from which he was awarded the Distinguished Alumni Award in 1967. He was also the recipient of the Man of the Year Award from Temple Israel in 1959.

Dr. Fenburr is a member of the American Chemical Society, the American Institute of Chemists, the New York Academy of Science, and the National Society for Professional Engineers. He is a Registered Professional Engineer in the State of Ohio.

Dr. E.G. Perkins has been elected President of the American Oil Chemists' Society for 1981-82. Dr. Perkins is a professor of food chemistry and environmental toxicology at the University of Illinois, Champaign-Urbana, IL.

Other officers elected included: **Dr. Karl Zilch,** Vice-President; **Dr. Joyce L. Beare-Rogers,** Secretary; and **Dr. T.H. Smouse,** Treasurer. **Dr. Lincoln Metcalfe, Arnold Gavin,** and **Dr. David Min** were elected as members-at-large of the Governing Board.

Bob Wright has been appointed President of Proko Industries, Inc., Dallas, TX.

Obituary

Otto Karl Sieplein, Technical Executive of the Sherwin-Williams Co., Garland, TX, died in April. Mr. Sieplein was a member of the Dallas Society.

Roy E. Graves, a long-time member of the Detroit Society, recently died. Prior to his retirement, he had been employed by the Acme Quality Paint Division of Sherwin-Williams Co. Mr. Graves was also a Past-President of the Detroit Society and was an Honorary Member, as recognition of his many services.

Literature

Spectrocolorimeter

Automatically standardized, full scanning spectrocolorimeters with microprocessor computing power are described in recently released literature. For more information, contact Hunter Associates Laboratory, Inc., 11495 Sunset Hills Rd., Reston, VA 22090.

Nonmercurial Preservative

Information is now available on a new, nonmercurial preservative that controls micro-organisms in aqueous systems such as latex paints and resin emulsions. Additional information is available through the NP Div. of IMC, 666 Garland Pl., Des Plaines, IL 60016.

Matched Surface Chemistry

An important concept, developed for the convenience of LC column users called Matched Surface Chemistry in LC columns,, is featured in new literature. Packing material in columns of the same type are matched with respect to surface chemistry, irrespective of the internal diameters of the columns. For information, write the Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

Quarterly Bulletin

The Paint Research Association has introduced a new quarterly bulletin, "Hazards, Pollution & Legislation in the Coatings Field". Aimed at constantly updating developments on toxicity and pollution, this journal will be published each March, June, September, and December. For more information, contact Mrs. Caroline Veitch, Publications Coordinator, Paint Research Association, Waldegrave Rd., Teddington, Middlesex, TW11 8LD, England.

Inorganic Binder

A new eight-page booklet featuring an inorganic binder, developed primarily for single-package zinc-rich coatings, is available. The brochure describes the uses and advantages of this ready-to-use binder. For a copy of UCAR Silicate ESP, F-48233A, contact Union Carbide Corp., Coatings Materials Div., Dept. K3442, Danbury, CT 06817.

Flowmeter Catalog

A free catalog describing liquid and gas flowmeters offers comprehensive information describing theory of operation, applications, and types and sizes of mounting connections. Write to Ball Products, The Oilgear Co., 2308 S. 51st St., Milwaukee, WI 53219.

Laboratory Supplies

An illustrated, 124-page catalog describing laboratory equipment is now available. A copy can be obtained by writing to Interex Corp., 3 Strathmore Rd., Natick, MA 01760.

TFE Components

An eight-page, four color booklet describing the custom manufacturing of TFE components is now available. Production techniques covered in the bulletin include isostatic molding for producing thin-walled TFE tubing or parts with complex contours; automatic molding of high volume components; injection molding of melt processable fluoropolymers, nylon, and other plastics; and fully automated, tape-controlled machining. Bulletin 812 is available from Garlock, Inc., Valves and Industrial Plastics, 602 N. 10th St., Camden, NJ 08101.

Corrosion Inhibitors

Two new corrosion inhibitors are described in recently released brochures. These are amine mixtures which can be used for applications requiring reactive diluents, neutralizers and chemical intermediates. Details about ANCOR 300 and 301 can be obtained from Air Products and Chemicals, Inc., Performance Chemicals Div., P.O. Box 538, Allentown, PA 18105.

Surfactants

A new 56-page booklet including specifications and characteristics of groups of sorbitan, glycerol, alkyl, glycol, and phosphate esters, ethoxylated fatty acids, sorbitan esters, sorbitol, and sorbitol esters has recently been released. For more information, write Emery Industries, Inc., Dept. P, 1300 Carew Tower, Cincinnati, OH 45202.

Agitation Systems

A new line of turbine agitation systems are introduced in recently released literature. The systems include agitator, valves, feed and discharge nozzles, electrical controls, and mounting accessories. For more information, contact Hockmeyer Equipment Corp., P. O. Box 113, 610 Worthington Ave., Harrison, NJ 07029.

Filter System

A data sheet and detailed drawings are available for a new, four-bag pressure vessel filter system. Information on the RB-4B system can be obtained from American Felt & Filter Co., Attn.: Marketing Communications Dept., P.O. Box 1071, Newburgh, NY 12550.

Glossmeter

New literature introduces a simplified, precision glossmeter. This hand-held instrument is designed for both industrial and laboratory applications. For more information, contact Gardner Laboratory Div., Pacific Scientific Co., P.O. Box 5728, 5521 Landy Ln., Bethesda, MD 20014.

Thickness Gauge

New literature introduces a digital coating thickness gauge which is pocket size and completely automatic. With a self-balancing magnetic principle, it is insensitive to shock, vibrations, and temperature variations. For additional information, contact Mr. Frank Rueter, Vice-President Marketing, Zorelco Limited, P.O. Box 25468, Dept. C-19, Cleveland, OH 44125.

Acrylic Emulsion

An acrylic emulsion polymer is described in a comprehensive, technical publication. This 12-page booklet discusses starting point formulations, physical properties, test results, and film thickness recommendations. The Rhoplex MV-23 booklet can be obtained from Marketing Services, Rohm and Haas Co., Independence Mall West, Phila., PA 19105.

Mill

Information is now available on a new mill designed as a small batch production mill, a large laboratory machine, or a pilot project mill. The mill consists of a vertical, enclosed spindle housing with a patented dispersion head made entirely of stainless steel in the wetted areas of the head assembly. For literature on the Kady Mill, contact Mr. Robert Kritzer, Kinetic Dispersion Corp., 127 Pleasant Hill Rd., P.O. Box 869, Scarborough, ME 04074.

Urethane Dispersion

A single package, self-crosslinking aqueous urethane dispersion that can be formulated into high-performance protective finishes for metal, wood, and plastics is described in recent literature. To obtain more information, contact Witco Chemical Corp., Organics Div., 400 N. Michigan Ave., Chicago, IL 60611.

Appearance Measurement

A complete multi-purpose instrument for the measurement of appearance properties of paper, pulp, clay, and related materials is described in new literature. This equipment is a brightness tester, opacimeter, and colorimeter in one high speed digital readout instrument. For more information, contact Testing Machines, Inc., 400 Bayview Ave., Amityville, NY 11701.

LC Detectors

Two new high performance liquid chromatography detectors are described in recently released literature. The LC-25 refractive index detector features ease of setup and use, with short warmup time. The LC-10 fluorescence detector is a compact instrument offering the user variable filtered excitation sources and emission filters. To obtain literature, write Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

Epoxy Resin

A four-page brochure contains information on a new, experimental resin designed to provide improved thermal and chemical resistance in powder coatings. The pamphlet contains a chemical description, possible applications, and typical properties. The brochure on XU 259 can be obtained from Resins Dept., CIBA-GEIGY Corp., Ardsley, NY 10502.

Phenolic Resins

A new eight-page booklet on phenolic resins has been issued. The brochure lists the physical characteristics and describes the uses of 16 phenolic resins. Five baking resins and solutions; three oil-soluble, heat reactive resins; five nonheat-reactive resins; two aqueous dispersions; and a dispersion in Rule 66 type exempt solvent are included. To obtain copies of booklet F-48266, write Union Carbide Corp., Coatings Materials Div., Dept. K3442, Danbury, CT 06817.

Air Cleaner

A 24-page brochure on an electronic air cleaner for in-plant air cleaning of industrial process emissions is available. For a copy, write American Air Filter Co., P.O. Box 35260, Louisville, KY 40232.

Letters to the Editor

Reader Comments on "Improved Communication"

TO THE EDITOR:

In the February edition of The Journal of Coatings Technology, Joseph H. Boatwright of the Chicago Society wrote a letter asking for improved communications among the American paint industry.

I am employed in Indonesia for a major British Company and I would, via your magazine, draw a parallel regarding American raw material suppliers.

Given that South-East Asia is currently one of the few areas of the World not in recession, and that the "ICI" name should be familiar to most large American raw material suppliers, you might expect a keen interest and rapid reply to business enquiries.

No way! About 60% of trade enquiries to American raw material suppliers go unanswered, whether by letter or telex. Often when a reply is received, it is less than enthusiastic, and clearly drafted to avoid further interest on our part.

Given the current value of the U.S. Dollar, American exports can be very competitive. Presuming that this lack of interest in export enquiries extends beyond suppliers to the paints industry, American industry is losing a major opportunity to extend its business horizons and establish overseas trade links.

A.J. CRASKE
ICI Paints Indonesia
Jakarta, Indonesia

Coming Events

FEDERATION MEETINGS

(Oct. 28–30)—59th Annual Meeting and 46th Paint Industries' Show. Cobo Hall, Detroit, MI. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

1982

(Apr. 29–30)—Spring Meetings. Society Officers on 29th; Board of Directors on 30th. 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).

SPECIAL SOCIETY MEETINGS

(Sept. 23–24)—Montreal and Toronto Societies Joint Symposium on "Coatings Directions for the 80's."

(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. 22–24)—Southwestern Paint Convention. Shamrock Hilton Hotel, Houston, TX.

(May 6–8)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C.

(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

(Aug. 31–Sept. 4)—"Introduction to Paint Formulation" Short Course. University of Missouri-Rolla, Rolla, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Sept. 7–11)—"Advanced Paint Formulation" Short Course. University of Missouri-Rolla, Rolla, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, MO 55401).

(Sept. 13–16)—Canadian Paint Manufacturers Association Annual Meeting. Four Seasons Hotel, Vancouver, B.C. (Lydia Palazzi, Canadian Paint Manufacturers Assn., 515 St. Catherine St. W., Montreal, Que., Canada H3B 1B4).

(Sept. 14–16)—Second International Conference on "The Durability of Building Materials and Components." Gaithersburg, MD. (Dr. Geoffrey Frohnsdorff, B348, Bldg. 226, Center for Building Technology, National Bureau of Standards, Washington, D.C. 20234).

(Sept. 14–18)—Semi-Annual "Spray Finishing Technology Workshop." Bowling Green State University and DeVilbiss Co., World Headquarters, Toledo, OH. (Dr. Richard A. Kruppa, Professor, Manufacturing Technology, Bowling Green State University, Bowling Green OH 43403).

(Sept. 20–25)—4th Congress of the Association Internationale de la Couleur, "COLOR 81." International Congress Centre (ICC), Berlin (West), Germany. (Prof. Dr. Heinz Terstiege, (AIC COLOR 81), Bundesanstalt fur Materialprufung (BAM), Unter den Eichen 87, D-1000 Berlin 45, Federal Republic of Germany).

(Sept. 21–22)—"Techniques and Mechanics of Marketing Specialty Chemicals" Short Course. Hilton Plaza Inn, Kansas City, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri–Rolla, Rolla, MO 65401).

(Sept. 23–24)—"Managing for Innovation in Coatings" Short Course. Hilton Plaza Inn, Kansas City, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri–Rolla, Rolla, MO 65401).

(Sept. 28–29)—Golden Jubilee of Colour in the CIE. The Colour Group (Great Britain). Imperial College, London, England. (Ms. M.B. Halstead, Thorn Lighting Ltd., Great Cambridge Rd., Enfield, Middlesex EN1 1UL, England).

(Oct. 7–9)—"Fundamentals of Adhesion: Theory, Practice and Applications" Course. State University of New York, Institute In Science and Technology, New Paltz, NY. (Dr. Angelos V. Patsis, Director, Institute In Science and Technology, State University of New York, CSB 209, New Paltz, NY 12561).

(Oct. 13–15)—Association for Finishing Processes of the Society of Manufacturing Engineers. "Finishing '81" Conference and Exposition, "Economics, Compliance, and Energy." Cobo Hall, Detroit, MI. (William J. Yeates, Executive Director AFP/SME, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Oct. 13–16)—"Formula 81". RAI Exhibition Centre, Amsterdam, Holland.

(Oct. 19–23)—"Scanning Electron Microscopy and X-Ray Microanalysis: Theory and Practice in Materials Science" Course. State University of New York, Institute In Science and Technology, New Paltz, NY. (Dr. Angelos V. Patsis, State University of New York, New Paltz, NY).

(Oct. 25–27)—"Women in Coatings—Meeting the Challenges" Short Course. Detroit, MI (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Oct. 26–28)—National Paint and Coatings Association Annual Meeting. Detroit Plaza Hotel, Detroit, MI. (Karen Bradley-Welch, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Oct. 26–29)—"Scanning Electron Microscopy and X-Ray Microanalysis: Theory and Practicé in Biology and Medicine" Course. State University of New York, Institute In Science and Technology, New Paltz, NY.

(Nov. 2–4)—American Society for Testing and Materials Committee D-33 on Protective Coating and Lining Work for Power Generation Facilities Meeting. Monteleone Hotel, New Orleans, LA. (ASTM, 1916 Race St., Phila., PA 19103).

(Nov. 2–4)—"Water Soluble Polymers: Synthesis, Structure and Applications" Course. State University of New York, Institute In Science and Technology, New Paltz, NY.

(Nov. 3–4)—Decorating Plastic RETEC, 5th Annual Regional Technical Conference, Society of Plastic Engineers, Decorating Division. Louisville, KY. (Edward S. Stumpek, General Electric, One Plastics Ave., Pittsfield, MA 01201).

(Nov. 3–4)—First World Congress on Protective Coatings Systems for Bridges and Structures. International Hotel, Kennedy Airport, New York. (Norma R. Fleming, Conference Coordinator, University of Missouri-Rolla, Rolla, MO 65401).

(Nov. 4–5)—Fourth Resins & Pigments Exhibition. Hotel Principe & Savoia, Milan, Italy. (Mike Tarrant, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 4–6)—American Society for Testing and Materials Committee, Utilities Nuclear Coating Work Committee Meeting. Monteleone Hotel, New Orleans, LA. (ASTM, 1916 Race St., Phila., PA 19103).

(Nov. 10–12)—"Refresher for Painting Contractors, Maintenance Engineers and Inspectors" Short Course. Hilton Plaza Inn, Kansas City, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Nov. 17–19)—"Job Estimating Workshop for Painting Contractors." Granada Royale, Kansas City, MO (Norma Fleming, Coordinator, Arts & Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401).

(Dec. 9)—American Society for Testing and Materials Symposium on Selection and Use of Wear Tests for Coatings. Phoenix, AZ. (ASTM, 1916 Race St., Philadelphia, PA 19103.)

1982

(Feb. 7–10)—Inter-Society Color Council. Williamsburg Conference, Williamsburg, VA.

(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).

(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, 222 W. Adams St., Chicago, IL 60606).

(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).

1983

(July)—25th Annual Pacific Coatings Convention. Melbourne, Australia. (O.C.C.A.A., 1983 Pacific Coatings Convention, C/- Tioxide Australis Pty. Ltd., Private Bag 13, Ascot Vale, Victoria, 3032, Australia).

Advertisers Index

Testing showed an increase in coating adhesion of 30 to 50% for solvent-based epoxy coatings modified with Hycar® RLP, over unmodified coatings. You can formulate two ways. Add an amine-terminated polymer (ATBN) to the amine curing agent or add a carboxy-terminated polymer (CTBN) pre-react to the epoxy side.

The clear, solvent-based epoxy coatings, on sandblasted cold rolled carbon steel, were measured with an Elcometer Adhesion Tester. The tester also showed improvements in solvent-less coatings. In both systems, the modified coatings contained 5 to 15 parts of Hycar® RLP, and were 2-3 mils thick.

Initial tests indicate that at these RLP levels there is no sacrifice in the coatings' electrical properties and corrosion and chemical resistance.

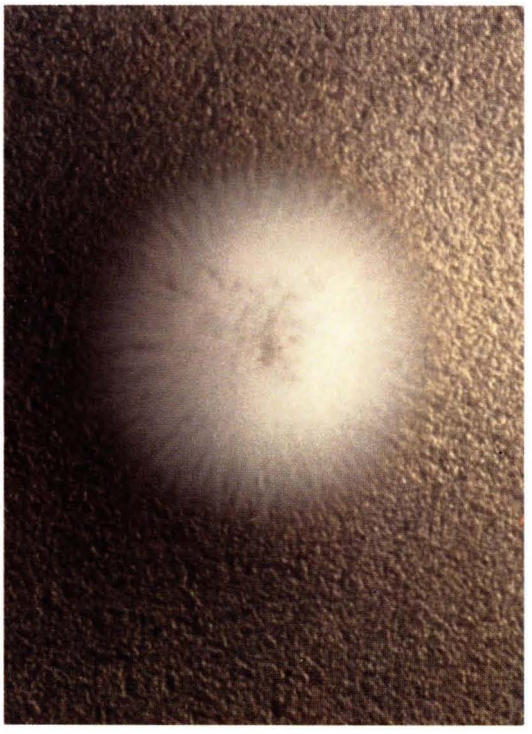
Impact resistance is also improved in solvent-less systems. Best of all, these advantages should result in a tougher, more durable coating.

Hycar® RLP are particularly recommended for use in high performance industrial and marine coatings.

For complete information and/or samples, contact The BFGoodrich Company, Chemical Group, Dept. JP-38, 6100 Oak Tree Boulevard, Cleveland, Ohio 44131.

BFGoodrich
Chemical Group

Two ways to increase epoxy coating adhesion and impact strength.



Coating with Hycar® RLP shows no damage after 10 lb. Gardner reverse impact test.

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For durable, high gloss product finishes in one coat... with less solvent waste, use Spencer Kellogg high solids resins.

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