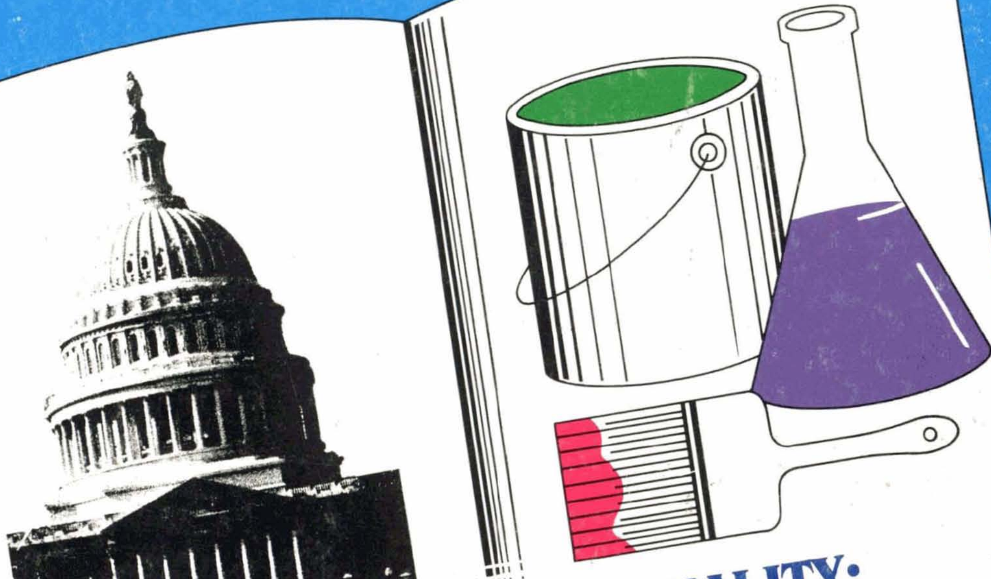
JCTAX 58 (741) 1-138 (1986)

jct JOURNAL OF COATINGS TECHNOLOGY

October 1986



COMPLIANCE AND QUALITY: RECOGNIZING THE OPPORTUNITIES

ANNUAL MEETING AND PAINT SHOW ISSUE

ATLANTA
NOV. 5, 6, 7, 1986

64th Annual Meeting & 51st Paint Industries' Show

FSCT 1986

Georgia World Congress Center


Creating a natural environment for quality.
ROHM AND HAAS

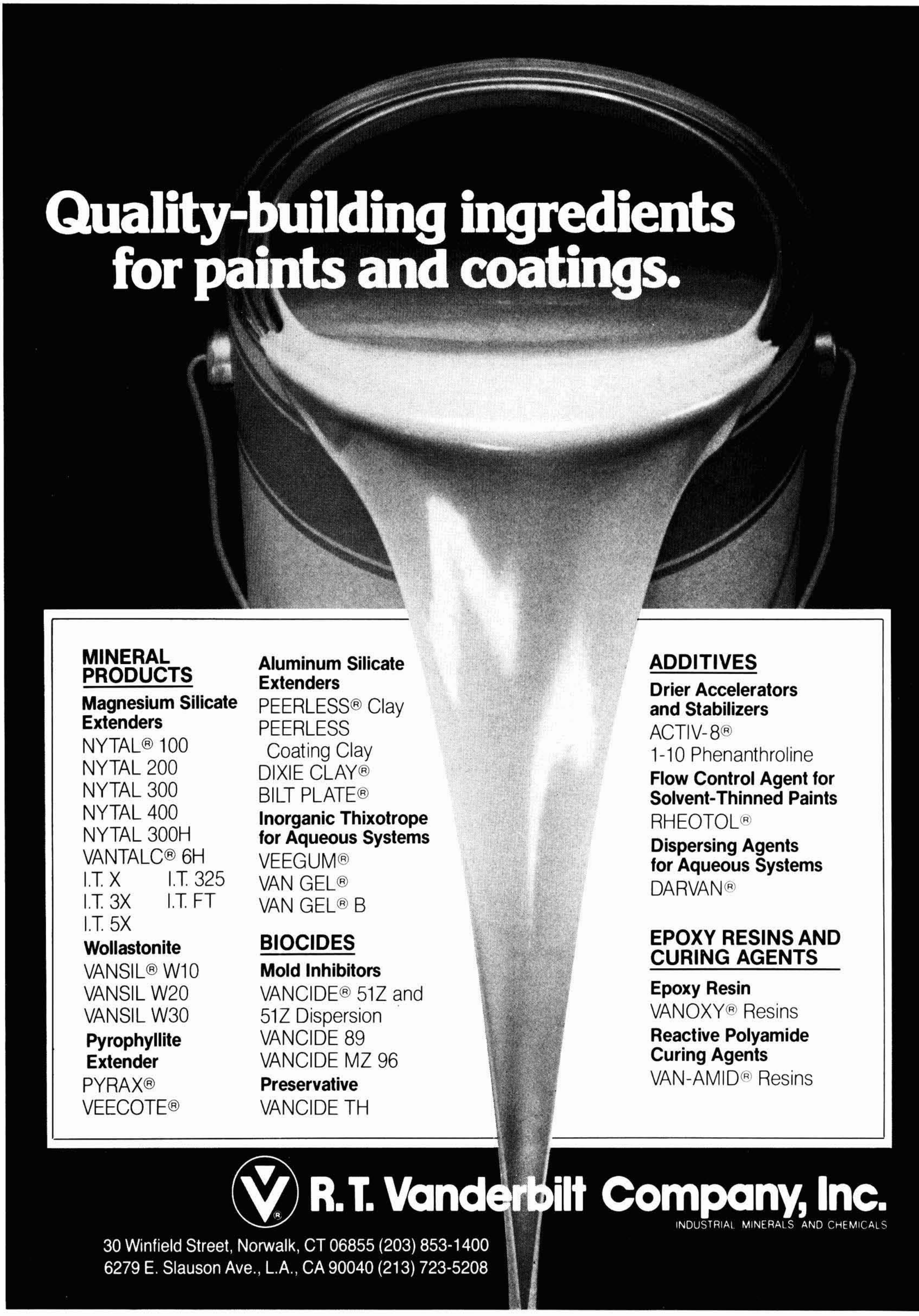
Quality is a product of its environment.

And when all the elements are working together, quality will thrive. And it will continue to flourish, improving with time.

At Rohm and Haas, we've been committed to quality for over 75 years. Now we've embarked on a major new corporate effort designed to make our products and services even better. We're out to earn your business by improving product consistency. And by adapting to your changing needs.

That kind of quality requires the commitment of every level of the company. Together, we are striving to attain it.

Because at Rohm and Haas, we're creating a natural environment for quality. One that will flourish with time.


Quality-building ingredients for paints and coatings.
MINERAL PRODUCTS
Magnesium Silicate Extenders
NYTAL® 100
NYTAL 200
NYTAL 300
NYTAL 400
NYTAL 300H
VANTALC® 6H
I.T. X
I.T. 325
I.T. 3X
I.T. FT
I.T. 5X
Wollastonite
VANSIL® W10
VANSIL W20
VANSIL W30
Pyrophyllite Extender
PYRAX®
VEECOTE®
Aluminum Silicate Extenders
PEERLESS® Clay
PEERLESS Coating Clay
DIXIE CLAY®
BILT PLATE®
Inorganic Thixotrope for Aqueous Systems
VEEGUM®
VAN GEL®
VAN GEL® B
BIOCIDES
Mold Inhibitors
VANCIDE® 51Z and 51Z Dispersion
VANCIDE 89
VANCIDE MZ 96
Preservative
VANCIDE TH
ADDITIVES
Drier Accelerators and Stabilizers
ACTIV-8®
1-10 Phenanthroline
Flow Control Agent for Solvent-Thinned Paints
RHEOTOL®
Dispersing Agents for Aqueous Systems
DARVAN®
EPOXY RESINS AND CURING AGENTS
Epoxy Resin
VANOXY® Resins
Reactive Polyamide Curing Agents
VAN-AMID® Resins
R.T. Vanderbilt Company, Inc.
INDUSTRIAL MINERALS AND CHEMICALS
30 Winfield Street, Norwalk, CT 06855 (203) 853-1400
6279 E. Slauson Ave., L.A., CA 90040 (213) 723-5208

OCTOBER 1986

jct JOURNAL OF COATINGS TECHNOLOGY

VOLUME 58 NUMBER 741

SOCIETY OF NATIONAL ASSOCIATION PUBLICATIONS

BPA

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

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

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

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 $20.00. Of this amount, $13.50 is allocated to a membership subscription to this publication. Membership in the Federation is obtained through prior affiliation with, and payment of dues to, one of its 26 Constituent Societies. Non-member subscription rates are:

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$27.00	$ 50.00	$ 37.00
2 Years	$51.00	$ 97.00	$ 71.00
3 Years	$73.00	$142.00	$103.00

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.

Staff

FRANK J. BORRELLE .... PUBLISHER
ROBERT F. ZIEGLER .... EDITOR
THOMAS J. MIRANDA .... TECHNICAL EDITOR
THOMAS A. KOCIS .... CONTRIBUTING EDITOR
PATRICIA D. VIOLA .... MANAGING EDITOR
VICTORIA L. GRAVES .... ASSISTANT EDITOR
KATHLEEN WIKIERA .... PUBLICATIONS ASSISTANT
LORRAINE LEDFORD ..... ADVERTISING SERVICES MANAGER

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

'Georgia on My Mind'

Georgia, and specifically Atlanta, seems to be on everyone's mind these days. And why not? The "New York of the South" will be the site of the Federation's 64th Annual Meeting and 51st Paint Industries' Show come November 5th, and members of the Southern Society Host Committee, headed by Jim Geiger, are preparing to offer a large dose of Southern hospitality to all attendees at the beautiful Georgia World Congress Center.

Not to be outdone, Percy Pierce and his Program Committee have put together a slate of speakers which will keep all attuned to what's happening in today's industry with three days of presentations geared to the theme, "Compliance and Quality: Recognizing the Opportunities." The theme reflects the emerging technologies, such as water-based, high-solids, and powder coatings, which are helping the industry meet regulatory requirements.

The Keynote Address at Wednesday's Opening Session will be presented by the former Governor of Wisconsin, Lee Sherman Dreyfus, and one of America's most recognizable sports commentators, Haywood Hale Broun, will speak at Friday's Annual Awards Luncheon.

Highlighting the Annual Meeting is the Mattiello Lecture, given this year by the well-known and respected Dr. Zeno W. Wicks, Jr., Professor Emeritus of North Dakota State University's Polymer and Coatings Dept.

Running concurrently with the Annual Meeting will be the largest Paint Show ever held by the Federation. A record 57,850 sq. ft. of exhibit space will be occupied by 242 companies featuring the latest raw materials, manufacturing equipment, and services available to the coatings industry. As the Paint Show grows, so does its importance to the coatings manufacturer. The competitive edge in compliance, quality, and profit can be found on any aisle.

The complete technical program and details on the Paint Show are located on pages 25-66 in this special Convention Issue.

The Federation thanks all of the members who worked for the success of this meeting, and the exhibiting companies for their support and contributions to the success of the Paint Show and the Coatings Industry.

With apologies to Ray Charles, it is a clear bet that the ideas and developments which come out of the Atlanta Annual Meeting—and not an old, sweet song—will keep Georgia on your mind.

Robert F. Ziegler

Robert F. Ziegler,
Editor

WE HAVE EVERY SOLUTION VINYL IMAGINABLE TO STOP THE UNTHINKABLE.

If you think it doesn't matter which solution vinyl resin you use, maybe you'd better think again.

Because your reputation goes on with every single coat.

Our resins have the highest performance characteristics you'll find anywhere.

And all with one thing in common.

A reputation for reliability that goes back fifty years.

Meanwhile, we keep coming up with new UCAR Solution Vinyl Resins to meet demands of today's emerging coatings technologies.

We offer resins that resist corrosion yet make recoating a snap.

And resins for two-component coatings with longer pot life and faster dry time.

Whether you use our resins straight or mix them to upgrade performance of other resins, we know you'll be impressed.

But why not check into it yourself?

Just contact your local UCAR Coatings Resins Sales Representative. Or write to Dept. GGW, L-4489, 39 Old Ridgebury Road, Danbury, CT 06817.

You'll soon find that our variety of UCAR Solution Vinyl Resins will give you a lot to think about.

UNION CARBIDE

UCAR Coatings Resins

THE CUNO COATING.

The satisfaction of a new car. The glistening appearance of a quality paint finish; the fresh, clean scent of a new interior; an audio system that makes you feel like you're in a recording studio; all this is possible, in part, because of **CUNO.**

CUNO Industrial Filter Products is a world leader in filtration products for industrial uses. Our **BETAPURE™** cartridges make the sound of your audio cassette tapes crystal clear by eliminating distortion due to irregularities in the oxide coating. And that deep mirror-like paint finish on the hood is possible because every major manufacturer of paint and coatings in the automotive industry uses our **Micro-Klean®** filter cartridges—cartridges that remove the contaminants which can cause surface blemishes and defects. Throughout the car, from the carpet on the floor to the gasoline in the tank, **CUNO** Industrial Filter Products enhances virtually hundreds of components in today's quality automobiles.

CUNO is involved in coatings of a more personal nature, too. You can use lotions, ointments, and even contact lens solutions with confidence, knowing that **CUNO** Microfiltration Products has removed any contaminants. New filtration technologies for highly technical and quality oriented industries, including food, beverage and pharmaceutical manufacturers—that's what Microfiltration Products is all about.

In more than a million homes throughout the world, **Aqua-Pure®** filters mean clean, clear and fresh drinking water. **CUNO** Consumer Products manufacturers reverse

Abstracts of Papers in This Issue

STYRENE COPOLYMERS: THEIR ORIGIN AND DEVELOPMENT—R.B. Seymour

Journal of Coatings Technology, 58, No. 741, 71 (Oct. 1986)

Polystyrene is usually considered too brittle for use as a coating. However, it is useful as both a coating and a plastic when flexibilized by the addition of natural or synthetic elastomers. Copolymers with butadiene or isoprene and graft copolymers of styrene and acrylonitrile and butadiene are also used in coatings and for tough plastics. The terpolymer of styrene-maleic anhydride and acrylonitrile and blocks of styrene-maleic anhydride copolymers with elastomers are being used as coatings and as engineering plastics.

UNSOLVED PROBLEMS OF CORROSION PROTECTION BY ORGANIC COATINGS: A DISCUSSION—W. Funke, et al.

Journal of Coatings Technology, 58, No. 741, 79 (Oct. 1986)

Fifty critical questions and problems related to corrosion protection by organic coatings are summarized in the subject areas of metal surface structure and pretreatment of metal surfaces, corrosion mechanisms under coatings and mechanisms of coating failures by corrosion, adhesion of organic coatings on metals, permeability for corrosive agents, anticorrosive pigments and corrosion inhibitors, practical corrosion testing and electrochemical testing of organic coatings, and corrosion protection coating systems.

PAINT CALCULATIONS IN A FIVE OUNCE NUTSHELL—R.J. Petry

Journal of Coatings Technology, 58, No. 741, 93 (Oct. 1986)

A very powerful program has been developed for use with a Texas Instruments TI-66 Programmable Calculator. This program enables the paint technician to very quickly calculate important mathematical values for paint, such as VOC, lbs/gal, % N.V., PVC, etc.

JCT JANUARY 1987
Post-Convention Issue

On November 5-7, the Annual Meeting and Paint Industries' Show of the Federation of Societies for Coatings Technology will take place at the Georgia World Congress Center in Atlanta. Complete coverage of this event will be published in the January 1987 issue of the JOURNAL OF COATINGS TECHNOLOGY. Follow-up features will include awards, technical proceedings, exhibitor booth descriptions, and Convention and Annual Meeting News.

Lighten up a little... with Ircogel® 905 liquid rheology control

Its new lighter color lets you formulate in a broader spectrum of colors, even whites and light metallics.

Any thixotrope can give you control over runs and sags. But only the new IRCOGEL 905 can give you a combination of rheology control plus minimum package viscosity increase and gloss retention.

Use it in high solids, solvent-based pigmented coatings, including whites and light metallics.

Use it in urethane, alkyd, acrylic, epoxy or polyester/styrene coating systems. IRCOGEL 905 mixes quickly, easily, uniformly. There's no grinding, dissolving or need for high-shear, high-speed mixing. Accurate adjustments are easier to make.

In high solids systems, IRCOGEL 905 provides heat stable sag control with minimal increase in package viscosity, good pigment dispersion and no effect on gloss. The additive has long term storage stability with good anti-settling properties.

In moisture-cure urethane systems, you achieve improved inner-coat adhesion and high film build to permit one coat application without blistering.

For complete details and testing samples, please contact the nearest Ashland Chemical Company office listed on the opposite page.

The Lubrizol Corporation
Diversified Products Group
29400 Lakeland Boulevard
Wickliffe, OH 44092

IRCOGEL 905

Lubrizol®
DIVERSIFIED PRODUCTS GROUP

Let's discuss your formulations in Booth 309/311 at the Paint Industries' Show in Atlanta.

FSCT Schedules Regional Seminars on Statistical Process Control

A series of two-day regional seminars on the application of Statistical Process Control (SPC) to the coatings industry has been announced by the Federation.

To be held during March 1987 under the auspices of the Federation's Professional Development Committee, the seminars are designed to introduce Statistical Process Control methods to personnel working in coatings manufacturing and related areas (e.g., chemicals, pigments) which employ a batch process. Focus will be on: identifying appropriate product and machine variables to measure; plotting and interpreting SPC control charts; evaluating process capability; and implementing an SPC system.

Programming will emphasize the application of Dr. Edwards Deming's concepts which apply statistics to production samples to reduce variation and minimize waste; the format will be practical, rather than theoretical, and will offer a "hands-on" understanding to insure proper implementation.

The seminars will be held in the following areas: Chicago, March 2-3; Atlanta, March 9-10; Philadelphia, March 16-17; and Los Angeles, March 30-31.

Dr. Peter J. Hunt, President of Productivity Management Consultants, Madeira Beach, FL, will conduct the seminars. Dr. Hunt is Adjunct Professor of Management, College of Business, University of South Florida, and author of *Statistics for Managers: A Text for Decision Makers*, which is currently used by universities at both the undergraduate and MBA levels, as well as by private industry and the U. S. Navy.

For further information, contact Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 832, Philadelphia, PA 19107 (215) 545-1506.

"Special Purpose Coatings" Papers Available

Papers presented at the recent seminar on "Special Purpose Coatings," sponsored by the Federation of Societies for Coatings Technology in Pittsburgh, PA, May 13-14, are available in limited quantities.

The package includes all 13 presentations made at the seminar. Included are the following:

- "Traffic Markings—A General Commentary"—D. R. Miller, Redland-Prismo Corp., Canton, GA
- "Aerosol Paints and Coatings"—R. M. Hall, Rust-Oleum Corp., Evanston, IL
- "Performance and Cost-Effectiveness of High Solids Maintenance Coatings"—J. P. Wineburg, E. I. du Pont de Nemours & Co., Inc., Philadelphia, PA
- "Automotive Refinish Coatings"—R. Allinder, BASF Inmont, Whitehall, OH
- "Fire-Retardant Paints"—W. A. Rains, Albi Div. of Stan Chem, Inc., East Berlin, CT
- "Introduction to Elastomerics"—T. De Pippo, The Neogard Corp., Dallas, TX
- "Evaluating and Predicting Performance of Heavy-Duty Maintenance Coatings"—B. R. Appleman, Steel Structures Painting Council, Pittsburgh, PA
- "The Problems of Highway Bridge Maintenance"—D. Spagnoli, Pennsylvania Department of Transportation, Pittsburgh, PA
- "High Performance Corrosion-Resistant Coating Systems"—J. J. Bracco, Mobay Chemical Corp., Pittsburgh, PA
- "Conducting an Inspection of the Paint Job"—K. Trimber, KTA-Tator Associates, Pittsburgh, PA
- "Marine Coatings for Ships and Off-Shore Structures"—J. White, Devoe Marine Coatings Co., Div. of Grow Group, Inc., Louisville, KY
- "Coatings for Petroleum Refineries and Petrochemical Plants"—G. Repka, PPG Industries, Inc., Houston, TX
- "Special Purpose Coatings for Pulp and Paper Mills"—D. Jones, Southern Coatings and Chemicals Co., Sumter, SC.

Cost of the complete set of seminar papers is $75. To order, contact Ms. Meryl Cohen, FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107, (215) 545-1506.

1986–87
Constituent Society Officers
(to date)

BALTIMORE

President—C. Theodore Grumbine, Lenmar, Inc.
Vice-President—Edward Countryman, Bruning Paint Co.
Secretary—Helen Keegan, Valspar Corp.
Treasurer—Donald Hilliard, Union Chemicals
Society Representative—Joseph Giusto, Lenmar, Inc.

BIRMINGHAM

President—Graham W. Fowkes, Consultant
President-Elect—Gerald G. Gough, Holden Surface Coatings Ltd.
Secretary—David M. Heath, Holden Surface Coatings Ltd.
Treasurer—Stan V. Brettell, Llewellyn Ryland Ltd.
Society Representative—Raymond B. Tennant, Carrs Paints Ltd.

CHICAGO

President—Ronald Kleinlein, Sherwin-Williams Co.
Vice-President—Raymond Cziczo, Reliance Universal, Inc.
Secretary—Evans Angelos, Kraft Chemical Co.
Treasurer—Kevin Murray, DeSoto, Inc.
Society Representative—John T. Vandeberg, DeSoto, Inc.

CDIC

President—Joseph W. Stout, Hanna Chemical Coatings Co.
Vice-President—Andrew Nogueria, Fischer Coatings
Secretary—Carolyn Tully, Sun Chemical Co.
Treasurer—N. Jay Huber, Paint America Co.
Society Representative—Lloyd J. Reindl, Flanagan Associates, Inc.

CLEVELAND

President—Madelyn K. Harding, Sherwin-Williams Co.
Vice-President—Richard Eley, Glidden Coatings and Resins, Div. of SCM Corp.
Secretary—R. Edward Bish, Jamestown Paint and Varnish Co.
Treasurer—Ilona Nemes-Nemeth, Sherwin-Williams Co.
Society Representative—Fred G. Schwab, Coatings Research Group, Inc.

DALLAS

President—Ashwin V. Parikh, Coulter Electronics
Vice-President—Noel Harrison, Western Specialty Coatings Co.
Secretary—Bruce Alvin, DeSoto, Inc.
Treasurer—Steve Stephens, Ribelin Sales Co.
Society Representative—William Wentworth, Jones-Blair Co.

DETROIT

President—Richard Schreiber, United Paint & Chemical Corp.
Vice-President—Gabriel Gabriel, Mercury Paint Co.
Secretary—Joanna Cederna, BASF Inmont Corp.
Treasurer—Rosemary Brady, Akzo Coatings America, Inc.
Society Representative—Gary Van de Streek, Akzo Coatings America, Inc.

GOLDEN GATE

President—Patricia Shaw, Davlin Paint Co.
Vice-President—Timothy Donlin, Pacific Coast Chemicals
Secretary—Ernest Soldavini, Nuodex/Huls
Treasurer—David Filson, Clorox Corp.
Society Representative—Barry Adler, Royelle, Inc.

HOUSTON

President—James Judlin, Devoe & Raynolds Co.
Vice-President—James Harrell, Buckman Laboratories
Secretary—James E. Tusing, PPG Industries, Inc.
Treasurer—James Ignato, O'Brien Corp.
Society Representative—Donald R. Montgomery, O'Brien Corp.

KANSAS CITY

President—Steven Johnson, Cook Paint & Varnish Co.
Vice-President—Jerry Hefling, Loctite Corp.
Secretary—Roger Haines, Tnemec Co., Inc.
Treasurer—Nick Dispensa, Davis Paint Co.
Society Representative—Norman A. Hon, Cook Paint & Varnish Co.

LOS ANGELES

President—Henry Kirsch, Trans Western Chemicals, Inc.
Vice-President—Ray DiMaio, Koppers Co.
Secretary—Parker Pace, Behr Process Corp.
Treasurer—Melinda K. Rutledge, Allo Chemical Co.
Society Representative—Jan P. Van Zelm, Byk-Chemie USA

LOUISVILLE

President—Howard L. Ramsay, DuPont Co.
Vice-President—Kenneth Hyde, Reliance Universal, Inc.
Secretary—Louis Holzknecht, Devoe Marine Coatings
Treasurer—Larry Pitchford, Reynolds Metals Co.
Society Representative—James A. Hoeck, Reliance Universal, Inc.

PIGMENT heubach INNOVATIONS

WHITE ANTI-CORROSIVE PIGMENT

HEUCOPHOS® -ZBZ

The first primer pigment combining the price of ordinary zinc phosphate and the high performance of chromate pigments.

Excellent performance on untreated aluminum, cold rolled and galvanized steel for cars, trucks, buses, and heavy equipment.

HEUBACH INC.

HEUBACH AVENUE
NEWARK, NEW JERSEY 07114

FOR SAMPLES, TECHNICAL DATA, AND A 24 x 28" POSTER, PLEASE CALL:
1-800-HEUBACH

MEXICO

(To be announced at a later date.)

MONTREAL

President—Jean-Pierre Cote, Ashland Chemicals
Vice-President—E. Templeton, NL Chem Cananda, Inc.
Secretary—R. Ferris, Canbro, Inc.
Treasurer—Luc Pepin, Sico Inc.
Society Representative—Horace A. Philipp, Dept. of National Defense

NEW ENGLAND

President—Maureen M. Lein, Davidson Rubber Co.
Vice-President—Kevin Mulkern, Truesdale Co.
Secretary—Roger Woodhull, California Products Corp.
Treasurer—Gail Pollano, Polyvinyl Chemical Ind.
Society Representative—Daniel Toombs, D.N. Lukens, Inc.

NEW YORK

President—Kenneth J. DePaul, Whittaker, Clark & Daniels, Inc.
Vice-President—John W. Burlage, Pacific Anchor Chemical
Secretary—David Penichter, D.H. Litter Co.
Treasurer—Arthur A. Tracton, Consultant
Society Representative—Saul Spindel, D/L Laboratories, Inc.

NORTHWESTERN

President—Larry Brandenburger, Valspar Corp.
Vice-President—Joan B. Lamberg, Horton-Earl Co.
Secretary—Richard Karlstad, Ceramic Industrial Coatings
Treasurer—Mark W. Uglem, Hirschfield's Paint Mfg., Inc.
Society Representative—Richard Fricker, Valspar Corp.

PACIFIC NORTHWEST

President—Dennis Hatfield, J.F. Shelton Co.
Vice-President—Yvon Poitras, General Paint Corp.
Secretary—John Daller, McCloskey Corp.
Treasurer—Emil Iraola, Olympic Home Care Products Co.
Society Representative—Carlton R. Huntington, Chemical Distributors, Inc.

PHILADELPHIA

President—Donald F. Denny, E.W. Kaufmann Co.
Vice-President—Thomas L. Peta, C.J. Osborn Chemicals
Secretary—Lawrence J. Kelly, Peltz-Rowley Chemical Co.
Treasurer—Orville E. Brown, M.A. Bruder & Sons, Inc.
Society Representative—Carl W. Fuller, U.S. Oxides

PIEDMONT

President—Steve Lasine, McCullough & Benton, Inc.
Vice-President—Charles Howard, DeSoto, Inc.
Secretary—Barry York, Reliance Universal, Inc.
Treasurer—Forrest Flemming, Reliance Universal, Inc.
Society Representative—James N. Albright, Jr., Lilly Co.

PITTSBURGH

President—A.J. Isacco, II, Puritan Paint & Oil Co.
Vice-President—Mark Troutman, Bradley Paint Co.
Secretary—Richard G. Marci, Royston Laboratories
Treasurer—Edward Threlkeld, Ashland Chemical Co.
Society Representative—Raymond C. Uhlig, PPG Industries, Inc.

ROCKY MOUNTAIN

President—Craig Hansen, George C. Brandt, Inc.
Vice-President—Marcy S. Baugh, Consultant
Secretary—Jeffrey B. Johnson, Sashco, Inc.
Treasurer—Paul Silva, Kwal Paints Inc.
Society Representative—James Peterson, Peterson Paint Co.

ST. LOUIS

President—Al E. Zanardi, Thermal Science, Inc.
Vice-President—James N. McDerby, F.R. Hall & Co.
Secretary—Robert Wagnon, Mozel Chemical Products Co.
Treasurer—Howard Jerome, Consultant
Society Representative—John Folkerts, Futura Coatings, Inc.

SOUTHERN

President—Ronald R. Brown, Unocal Chemicals Div.
Vice-President—C. Lewis Davis, Vi-Chem, Inc.
Secretary—R. Scott McKenzie, Southern Coatings and Chemical Co.
Treasurer—Kenneth W. Espeut, Carter Coatings Corp.
Society Representative—Berger G. Justen, Justen & Associates

TORONTO

President—Gordon Major, Consultant
Vice-President—Phil Read, Sico, Inc.
Secretary—Larry Ham, Stochem, Inc.
Treasurer—Hans Wittman, BASF Canada
Society Representative—Kurt Weitz, Indusmin Ltd.

WESTERN NEW YORK

President—Michael L. DePietro, Spencer Kellogg Products
Vice-President—Jean L. Luck, Pratt & Lambert, Inc.
Secretary—Marko K. Markoff, Consultant
Treasurer—Gerald F. Ivancie, Pratt & Lambert, Inc.
Society Representative—Thomas E. Hill, Pratt & Lambert, Inc.


What was once hard to handle, now just goes with the flow.
New Acrysol® RM-825 makes thickening easy.
Latex paint thickeners have never been easy to work with, particularly the dry cellulosic kind. But all of that is about to change.
Because now there's new Acrysol RM-825 rheology modifier from Rohm and Haas.
A smooth, lower viscosity liquid, Acrysol RM-825 is both easier to handle and easier to incorporate.
And that easy-going manner carries right over into performance by providing superior flow and leveling, increased film build and excellent spatter resistance.
It's the easiest way to improve the performance of all your latex paints.
To learn more about this smooth operator, contact your Rohm and Haas technical representative. Or write to Marketing Services, Independence Mall West, Philadelphia, PA 19105.
Acrysol is a registered trademark of Rohm and Haas Company. ©1986 Rohm and Haas Company
ROHM AND HAAS
PHILADELPHIA, PA. 19105

Cost
Availability
Safety
Effectiveness

VISIT US AT THE PAINT SHOW, BOOTH 955.

The CASE for ARCOSOLV® solvents keeps getting stronger

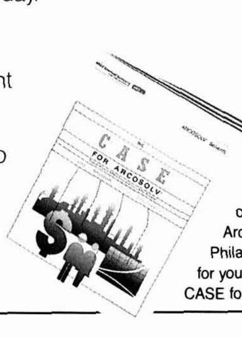
When you need the cost and performance of E-series solvents, but want the safety of P-series, it's an open and shut case—you want Arcosolv solvents from ARCO Chemical Company. Why? Because we produce only P-series solvents. So, we have to make them right—and in the quantities you need, available where you need them. That's why we introduced Arcosolv P-series ethers in 1981, PM acetate in 1983, DPM acetate in 1984, and new PTB ether in 1985. Also, we have increased terminal locations, and increased our production capacity.

It's a CASE of putting what you need where you need it . . .

Arcosolv P-series ether and acetate production has expanded to more than 125 million pounds per year. It's available from strategically located terminals across the country, and from our network of highly-trained distributors, ready to put the case for Arcosolv solvents to work for you. Today.

. . . with the effectiveness you want.

With solvency power for a wide variety of substances, excellent coupling and coalescing ability, and a good range of evaporation rates, Arcosolv solvents are the straightforward formulation choice for everything from automotive coatings to specialty paints, industrial cleaners to electronic chemicals. In many cases Arcosolv solvents have directly replaced E-series. And if you need reformulation assistance, we're ready to help.



Call Toll-Free 1-800-354-1500, or write to ARCO Chemical Company, Arcosolv Solvents, 1500 Market Street, Philadelphia, PA 19101, for your free copy of "The CASE for Arcosolv Solvents."

ARCO Chemical Company
Division of AtlanticRichfieldCompany

ARCO

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

64th Annual Meeting & 51st Paint Industries' Show

FSCT 1986

Program

Georgia World Congress Center • Atlanta, Georgia
November 5, 6, 7, 1986

Program

"Compliance and Quality: Recognizing the Opportunities"

WEDNESDAY, NOVEMBER 5

OPENING SESSION (9:30)

AUDITORIUM

Sixty-Fourth Annual Meeting of the Federation of Societies for Coatings Technology opened by President William Mirick

Invocation and In Memoriam

Welcome: Ronald R. Brown, President of Southern Society for Coatings Technology
James E. Geiger, Chairman of the Host Committee
Percy E. Pierce, Chairman of the Program Committee
John C. Ballard, Chairman of the Paint Industries' Show Committee

Introduction of Distinguished Guests

E.W. FASIG KEYNOTE ADDRESS (10:00-11:00)

AUDITORIUM

THE AMERICAN MISSION—Lee Sherman Dreyfus, President, Lee Sherman Dreyfus, Inc., and former Governor of the State of Wisconsin

WATER-BASED COATINGS SYMPOSIUM (2:00-4:00)

ROOM 205

CONTROL OF FOAMING IN WATER-BORNE COATINGS—Pamela Kuschnir, Richard R. Eley, and F. Louis Floyd, Glidden Coatings & Resins, D. P. Joyce Research Center, Strongsville, OH (A Roon Awards competition paper)

U. S. NAVY REQUIREMENTS IN THE NEXT CENTURY AND THEIR IMPACT ON COATINGS TECHNOLOGY—A PRELIMINARY STUDY OF VINYLIDENE CHLORIDE (VDC) CONTAINING LATICES AS POTENTIAL COATINGS CANDIDATES—Alexander A. Chasan, U. S. Navy, David Taylor Naval Ship R&D Center, Bethesda, MD

TITANIUM CHELATES—A NOVEL APPROACH TO RHEOLOGICAL CONTROL IN LATEX PAINTS—John E. Hall, Technical Service Dept., Tioxide Canada Inc., Sorel, Quebec, Canada

DEVELOPMENT OF A NOVEL PAINT FILM FUNGICIDE WITH AN EXTRAORDINARILY SAFE TOXICITY PROFILE—Paul Woodcock and Terry Young, ICI Americas, Inc., Chemicals Div., Wilmington, DE

SCIENTIFIC SYMPOSIUM (2:00-5:00)

ROOM 202

RECENT ADVANCES IN GROUP TRANSFER POLYMERIZATION AND THEIR APPLICATION IN COATINGS—Harry J. Spinelli and John A. Simms, Finishes and Fabricated Products Dept., Research and Development Div., E. I. du Pont de Nemours & Co., Inc., Experimental Station, Wilmington, DE

FRACTAL-BASED DESCRIPTION OF THE ROUGHNESS OF BLASTED STEEL PANELS—Jonathan W. Martin and Dale P. Bentz, Center for Building Technology, National Bureau of Standards, Gaithersburg, MD

MOISTURE AND TEMPERATURE INDUCED STRESSES (HYGROTHERMAL STRESSES) IN ORGANIC COATINGS—Dan Y. Perera, Head of Research Dept., Coatings Research Institute, Limelette, Belgium (Presented on behalf of FATIPEC: Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe)

ON THE REFLECTION/ABSORPTION FOURIER TRANSFORM INFRARED SPECTROSCOPY OF COATINGS ON STEEL—Tinh Nguyen, Research Scientist, Building Materials Div., National Bureau of Standards, Gaithersburg, MD

BINDERS FOR HIGHER-SOLIDS COATINGS—SYNTHESIS AND PROPERTIES OF MODEL ALKYD RESINS—Steven L. Kangas and Frank N. Jones, Polymers & Coatings Dept., North Dakota State University, Fargo, ND (A Roon Awards competition paper)

THURSDAY, NOVEMBER 6

POWDER COATINGS SYMPOSIUM (9:00-11:30)

ROOM 202

POWDER COATING: AN OVERVIEW—Champ Bowden, Technical Manager, Glidden Coatings & Resins, Charlotte, NC, and Donald S. Tyler, Executive Vice-President, Volstatic, Inc., Florence, KY (Presented on behalf of The Powder Coating Institute)

POWDER COATINGS—A HISTORICAL PERSPECTIVE—Douglas S. Richart, Development Manager—Powder Coatings, Morton Powder Coatings, Reading, PA

NEW OPTIONS FOR POWDER COATINGS—Barbara Clinch, Technical Section Manager, H. B. Fuller Co., Industrial Coatings Div., Vadnais Heights, MN

EVALUATION OF METHODS FOR MEASURING VISCOSITY OF POWDER COATING RESINS—D. W. Maners, Shell Chemical Co., Deer Park, TX

RESINS AND CURING AGENTS FOR THERMOSETTING POWDER COATINGS—Lorraine Kapilow, Senior Chemist, CIBA-GEIGY Corp., Resins Dept., Ardsley, NY

MANUFACTURING COMMITTEE SEMINAR ON PRODUCTIVE ALTERNATIVES FOR IMPROVING MATERIALS CONTROL (8:30-12:00)

ROOM 205

In a materials-intensive industry such as coatings manufacture, it is imperative to accurately monitor and control materials flow. A panel of speakers will review some concepts which address the problem of accurate and productive handling of raw materials and finished product. Each will be addressed in theory by an equipment supplier and in practice by a current user.

SEMI-BULK HANDLING OF POWDERS

Av Handleman, President, Semi-Bulk Systems, St. Louis, MO

Michael Drew, Process Engineer, E. I. du Pont de Nemours & Co., Inc., Moberly, MO

LOAD CELLS

Mike Sargent, Toroid Corp., Huntsville, AL

(Second speaker to be announced)

MASS METERING

Speaker from Micro Motion Inc., Boulder, CO

(Second speaker to be announced)

FILLING BY WEIGHT

William Cegles, National Marketing & Sales Manager, Serac, Inc., Addison, IL

Richard M. Hille, Manufacturing Manager, General Paint & Chemical Co., Cary, IL

BAR CODING

Richard Dickover, Caere Corp., Richmond, VA

William Whiting, Rust-Oleum Corp., Evanston, IL

COLOR SYMPOSIUM (2:00-4:00)

ROOM 205

PEARLESCENT PIGMENTS: EFFECTS OF PARTICLE SIZE DISTRIBUTION ON COLOR—Harold A. Miller, The Mearl Corp., Research and Development Laboratories, Ossining, NY

COLOR INSTRUMENTATION AND THE AUTOMOTIVE INDUSTRY—Sidney A. Paradee, Color Instrumentation Supervisor, Ford Motor Co., Mt. Clemens, MI

COLOR MATCHING COMPUTERS—Edward M. Krzes, Pratt & Lambert, Inc., Buffalo, NY

OBJECTIVE COLOR-DIFFERENCE EVALUATION—AN UPDATE—Rolf G. Kuehni, Manager, Technical Marketing, Textile Dyes Dept., Mobay Corp., Rock Hill, SC

SOLVENT-BASED COATINGS SYMPOSIUM (2:00-4:30)

ROOM 202

PROPYLENE GLYCOL METHYL ETHER ACETATE AS A SOLVENT FOR SOLUTION ACRYLIC POLYMERIZATION—Nancy J. Morris, Chemicals & Metals Dept., Dow Chemical U.S.A., Research Center, Walnut Creek, CA

Registration Hours

Tuesday, November 4 . . . . 8:00 am - 5:00 pm

Wednesday, November 5 . . . . 8:00 am - 5:30 pm

Thursday, November 6 . . . . 8:00 am - 5:30 pm

Friday, November 7 . . . . 8:00 am - 3:00 pm

TEST FACILITIES FOR EXPOSURE ASSESSMENT OF VOLATILE ORGANIC SOLVENTS—Larry J. Culver, Senior Technical Representative, and Saundra L. Hillman, Technical Representative, Chemicals Laboratory, Technical Service & Development Div., Eastman Chemical Products, Inc., Kingsport, TN (A Roon Awards competition paper)

CYCLE VARIATIONS IN A FLUORESCENT CONDENSATION TEST APPARATUS AND GLOSS RETENTION ON CONSUMER ALKYD ENAMELS—Golden Gate Society for Coatings Technology

URETHANE ACRYLIC INTERPENETRATING POLYMER NETWORKS (IPNs) FOR COATING APPLICATIONS—Detroit Society for Coatings Technology

EPOXY HARDENER COMPATIBILITY FOR EPOXY RESINS IN COMPLIANCE SOLVENT FORMULATIONS—James A. Mertens, Technical Development Coordinator, Inorganic Chemicals Dept., Chlorinated Solvents Section, Dow Chemical U.S.A., Midland, MI

FRIDAY, NOVEMBER 7

PIGMENTS AND DISPERSION
(9:00-10:30)
ROOM 205

PEARLESCENT PIGMENTS—A NEW APPROACH TOWARDS SURFACE COATINGS TECHNOLOGY—Pekka Vapaaoksa, Product Manager, Kemira Oy, Vuorikemia Plant, Pori, Finland (Presented on behalf of SLF: Federation of Scandinavian Paint and Varnish Technologists)

MONITORING PIGMENT DISPERSION USING THE FREE VOLUME MICROPROBE—B. Mayo, R. Sharpe, and J. Pfau, Polymer Science and Technology Section, Battelle Columbus Laboratories, Columbus, OH (A Roon Awards competition paper)

ULTRASONIC DISPERSION OF PIGMENTS IN WATER-BASED PAINTS—James Stoffer, John Gordon, and Maher Fahim, Department of Chemistry, College of Arts and Sciences, University of Missouri–Rolla, Rolla, MO

APPROACHES TO QUALITY
(9:00-10:30)
ROOM 202

MANAGEMENT REPORTS CAN IMPACT QUALITY—Frank B. Bredimus, Quality Manager, Chemicals and Pigments Dept., E. I. du Pont de Nemours & Co., Inc., Wilmington, DE

QUALITY ASSURANCE—D. W. N. Clayton, Quality Assurance Manager, Crown Decorative Products Ltd., Paint Div., Darwin, Lancashire, England (Presented on behalf of OCCA: Oil and Colour Chemists' Association)

OVEN VS. SHELF STABILITY OF LATEX PAINTS—Chicago Society for Coatings Technology

ANNUAL BUSINESS MEETING
(9:30-10:30)
ROOM 218

Annual Business Meeting of the Federation
Installation of Officers, 1986-87

MATTIELLO MEMORIAL LECTURE
(10:30-11:30)
AUDITORIUM

FREE VOLUME AND THE COATINGS FORMULATOR—Dr. Zeno W. Wicks, Jr., Professor Emeritus, Polymers and Coatings Dept., North Dakota State University, Fargo, ND

AWARDS LUNCHEON
(11:45)
BALLROOM

Presentation of these awards: George Baugh Heckel...Paint Show...Roon Foundation...American Paint & Coatings Journal/A. F. Voss...Armin J. Bruning...Southern Society Alfred L. Hendry...Materials Marketing Associates...Program Committee...Ernest T. Trigg

Featured Speaker: Heywood Hale Broun, Sports Broadcaster and Commentator for CBS News

Paint Show Hours

Wednesday, November 5 .... 11:30 am - 5:30 pm

Thursday, November 6 .... 9:00 am - 5:30 pm

Friday, November 7 .... 9:00 am - 3:00 pm

OTHER INFORMATION ABOUT THE ANNUAL MEETING AND PAINT SHOW

PROGRAM THEME

The theme of the program sessions this year is "Compliance and Quality: Recognizing the Opportunities." It focuses upon emerging technologies which are helping the coatings industry meet regulatory requirements. Increased awareness and understanding of potential physiological and toxicological effects of coatings and their raw materials have spurred development of these technologies, which are also responding to increased expectations of quality products, processes, methods, and attitudes. As the selection of papers indicates, the speakers come from throughout the world of coatings science.

SPOUSES PROGRAM

The spouses program will open on Wednesday afternoon with a "Peach of an Afternoon" social in the Marriott Marquis Ballroom. Many suppliers have contributed giveaways and door prizes. Continental breakfast will be served on Thursday and Friday mornings also in the Marriott Marquis. On Thursday the spouses will tour the lovely Buckhead area, the Governor's Mansion, and visit the High Museum. Luncheon will be served at Anthony's, housed in an authentic antebellum mansion built in 1797.

PROGRAM COMMITTEE

The Chairman of this year's Annual Meeting Program Committee is Dr. Percy E. Pierce, of PPG Industries, Inc., Allison Park, PA. Seven other members of the Federation working with him are: William A. Wentworth, Vice-Chairman, of Jones-Blair Co., Dallas; Granville D. Edwards, of Shell Development Co., Houston; Loren W. Hill, of Monsanto Polymer Products Co., Springfield, MA; Thomas Hill, of Pratt & Lambert, Inc., Buffalo; George R. Pilcher, of Hanna Chemical Coatings Co., Columbus, OH; Ralph Stanziola, Color Consultant, from Bridgewater, NJ; and Robert Thomas, of PPG Industries, Inc., Barberton, OH.

HOST COMMITTEE

The Southern Society of the Federation will serve as official host for the 1986 Annual Meeting and Paint Show. Heading the Host Committee is James E. Geiger, of Sun Coatings, Inc., Largo, FL. The subcommittee chairmen are: Spouses—Mrs. James E. (Lynne) Geiger; Program Operations—Thad T. Broome, of Precision Paint Corp., Atlanta; Registration Area—Ronald R. Brown, of Unocal Chemicals Div., Charlotte, NC; Federation Exhibit—Dan M. Dixon, of Engelhard Kaolin Co., Gordon, GA; and Information Services—Berger C. Justen, of Justen & Associates, Tampa, FL.

HOTELS

Eight hotels in downtown Atlanta have reserved blocks of rooms for the Federation. The headquarters hotel is the Marriott Marquis. The others are: Atlanta Hilton, Hyatt Regency, Westin Peachtree, Atlanta Marriott, Holiday Inn, Omni International, and Ritz-Carlton.

FEDERATION BOARD MEETING

The Board of Directors of the Federation will meet on Tuesday, November 4, at 9:00 a.m. in the Marriott Marquis Hotel. Luncheon is included.

FEDERATION AWARDS LUNCHEON

The Awards Luncheon will be held on the final day, Friday, in the Ballroom of the World Congress Center.

Presentations will be made to the recipients of: George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation); the Flynn Paint Show Awards; Roon Foundation Awards; Armin J. Bruning Award; MMA Awards; Society Speaker Awards; Southern Society Alfred Hendry Memorial Awards; and Trigg Awards.

H.H. Broun

The featured speaker will be Heywood Hale Broun, well-known sports broadcaster and commentator for CBS-TV.

Mr. Broun, who has covered over 600 events as diverse as the Super Bowl, the Olympics, World Series, a marble tournament, and golf on a frozen lake, began his career as a sports writer and later moved on into acting. He has performed in 14 Broadway plays and was a familiar figure in the early days of television. However, with his trademark—the plaid sports coat—he endeared himself to television audiences as the wittily eloquent essayist at major horse racing events.

A special door prize will be awarded at the close of the lunch this year: a pair of first-class tickets on Delta Airlines, valid for travel within one year on Delta's domestic services (excluding Hawaii).

REGISTRATION FEES

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

There is a special registration fee of $25 each for retired members and their spouses. This applies to advance registration only.

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

FLY DELTA TO ATLANTA AND SAVE

Delta Airlines, in cooperation with the Federation, is offering a special discount fare which affords passengers a 40% minimum savings off Delta's round trip, undiscounted day coach fares for those who travel to Atlanta on Delta's domestic system. Phone 1-800-241-6760 for reservations and immediately reference the Federation's file number: U0235.

SHUTTLE BUS SERVICE

Shuttle bus service between the cooperating hotels and the World Congress Center will be furnished with the courtesy of the Federation, Union Carbide Corp., and Akzo Chemie America/Interstab Chemicals, Inc.

NPCA MEETS IN ATLANTA SAME WEEK

The National Paint and Coatings Association will hold its annual meeting on November 3-5, 1986, at the Atlanta Hilton Hotel. Persons wearing NPCA badges (who sign up at a special registration desk) will be admitted to the Paint Show on Wednesday only, with the compliments of the Federation.


NOW, THE WOLF
IS AT YOUR DOOR.
Wolfkur® reactive curing agents expanding NL's resins capabilities.
After 20 years of leadership in the European market, the Wolf is now at your door. WOLFKUR. Manufactured domestically by NL Chemicals to help you produce tough cross-linked coatings that provide outstanding protection and adhesion. WOLFKUR. Expanding the resin capabilities of NL. WOLFKUR. Highly reactive but with low toxicity and low viscosity. NL offers a wide range of WOLFKUR reactive polyamide and amidoamine curing agents. For more information clip the coupon or call (609) 443-2500.
NL Chemicals
NL Chemicals, Inc., Box 700, Hightstown, NJ 08520. Tel: (609) 433-2500, Telex: 642240
NL Chem Canada, Inc., 4 Place Ville-Marie, Suite 500, Montreal, P.Q., Canada H3B 4M5. Tel: 514-397-3501
Please send me ☐ Brochure ☐ Sample of WOLFKUR
☐ Have a salesman call.
Name
Title
Company
Address
City
State
Zip
Tel.
ADEMARK OF NL VICTOR WOLF, LTD.

ABSTRACTS OF PAPERS

CONTROL OF FOAMING IN WATER-BORNE COATINGS

Pamela Kuschnir, Richard R. Eley, and F. Louis Floyd, Glidden Coatings & Resins

Although great strides have been made in the technology of film properties of water-borne coatings in the past decade, their tendency to foam during manufacture and application remains a chronic problem.

The present work shows that the foaming behavior of water-borne systems is strongly dependent on the location on a phase diagram, with a region of minimum foaming being identified. Although foaming is a surface phenomenon, bulk viscosity is shown to be the strongest single factor controlling foaming. All other factors are secondary in nature, with defoamers acting only on these secondary factors. The use of conventional defoamers for foam control has little effect unless the system is first formulated to the proper composition region.

U. S. NAVY REQUIREMENTS IN THE NEXT CENTURY AND THEIR IMPACT ON COATINGS TECHNOLOGY—A PRELIMINARY STUDY OF VINYLIDENE CHLORIDE (VDC) CONTAINING LATICES AS POTENTIAL COATINGS CANDIDATES

Alexander A. Chasan, U. S. Navy

Increased emphasis is placed on coating materials, and thus the coatings technology, as a result of changes in mission orientation for U. S. Navy fleet.

One trend is the consideration of a change to water-based products without detracting from performance characteristics.

Areas of concern are initially those of the interior, stressing safety. Habitability areas have traditionally been painted with materials that will not propagate flames and are self-extinguishing.

Initial research limited itself to surfaces in these areas, but large-scale tests now encompass galleys, and general quarters as well. Since fleet unit service is required in all parts of the world, significant problems that might be encountered under varying atmospheric conditions must be anticipated.

Basic work was accomplished using emulsions of polyvinylidene chloride, and comparison testing such formulated, water-based products, against current in-use solvent bound materials is routinely performed.

TITANIUM CHELATES—A NOVEL APPROACH TO RHEOLOGICAL CONTROL IN LATEX PAINTS

John E. Hall, Tioxide Canada Inc.

Titanium chelates, organic complexes of titanium, impart certain unique properties when incorporated in latex paints. Physical crosslinking, probably through hydrogen bonding, occurs between latex particles and the titanium chelate in its hydrolyzed form. As this type of interaction is reversible, a thixotropic structure results. The degree and type of interaction is dependent on the stabilizer system present in the latex.

Titanium chelates can be used to induce varying degrees of thixotropy, ranging from lightly structured paints with a creamy consistency, to partially gelled "non-drip" systems. Titanium chelates can also be used to increase the sag resistance of latex paints containing associative thickeners, without compromising roller spatter resistance, flow and levelling, or high shear viscosity. The optimization of titanium chelate/associative thickener/surfactant combinations is illustrated using a simplex statistical design method.

DEVELOPMENT OF A NOVEL PAINT FILM FUNGICIDE WITH AN EXTRAORDINARILY SAFE TOXICITY PROFILE

Paul Woodcock and Terry Young, ICI Americas, Inc.

The protection and esthetic enhancement of a variety of substrates, especially wood, is the primary objective of the coatings industry. Such coatings are themselves subject to attacks launched by environmental microbes. These attacks interfere with the performance characteristic of these coatings.

An industry has been built around the need to protect the dried film from microbial attack. The agents developed to provide this protection have been called film fungicides. There are a number of such products now on the market. Each of these have some undesirable properties or lack some desirable one from the perspective of the paint formulator.

This paper presents data delineating the developmental history and performance characteristics of a novel film fungicide which has formulating, antifungal, and toxicological characteristics which have been sought for many years.

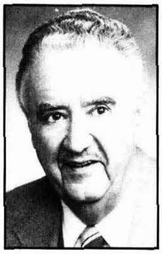
The new Densil A film fungicide is compared with selected film fungicides now in use from the functional and from the physiological perspectives. The relative effect the selected fungicides have on a wide variety of deteriogenic fungi in laboratory and exterior exposure studies is considered.

Relative toxicological factors are addressed including safety in handling and use.

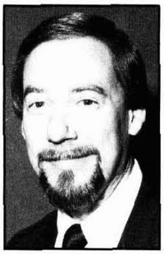
RECENT ADVANCES IN GROUP TRANSFER POLYMERIZATION AND THEIR APPLICATIONS IN COATINGS

Harry J. Spinelli and John A. Simms, E. I. du Pont de Nemours & Co., Inc.

Group Transfer Polymerization (GTP) is a new type of addition polymerization that was discovered by Du Pont and is useful for the polymerization of acrylate and methacrylate monomers. It involves the repeated catalyzed addition of monomer to a trialkylsilyl-containing polymer and followed by transfer of the silyl group to the incoming monomer. GTP gives living polymers and can be carried out over a wide temperature range. Because of this livingness, GTP provides control over the architecture of the polymer.

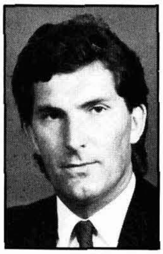


L. Dreyfus



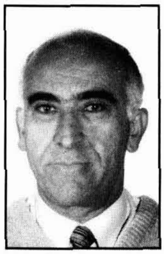
F. Floyd

A. Chasan

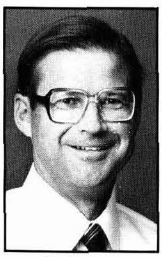


J. Hall

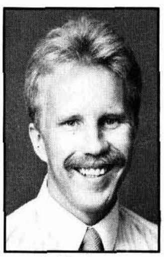
H. Spinelli



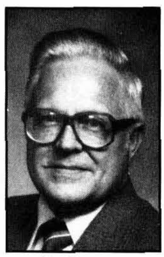
D. Perera



F. Jones



S. Kangas



D. Maners

This control over polymer design allows one to synthesize resins with many different structures. Some unique polymers that have been made include resins with narrow dispersities, block polymers, star polymers, and terminally functional resins. These structured polymers, when used in coatings, impart significant improvements in both application and appearance. Some of these advantages include increases in application solids, superior pigment dispersions, better application control, an excellent hardness/flexibility balance, and ease of manufacture.

FRACTAL-BASED DESCRIPTION OF THE ROUGHNESS OF BLASTED STEEL PANELS

Jonathan W. Martin and Dale P. Bentz, National Bureau of Standards

A standard series of blasted steel panels were imaged with a thermographic camera. Compared to a visual camera, the thermographic camera was found to better delineate the peak-to-valley heights of the crater-like structures, minimize imaging problems due to light reflectance, and eliminate most of the imaging problems associated with surface discoloration. Fractal dimensions were calculated for each of the study panels. The fractal dimensions of this standard series of blasted steel panels correlate very well with their perceived roughness. This correlation occurs because the roughness of a blasted panel dictates both the roughness of its thermographic image and its fractal dimension.

MOISTURE AND TEMPERATURE INDUCED STRESSES (HYGROTHERMAL STRESSES) IN ORGANIC COATINGS

Dan Y. Perera, Coatings Research Institute

Hygroscopic and thermal (hygrothermal, $S^{H,T}$) stresses were calculated (1) by determining their components as a function of temperature and relative humidity and (2) directly by using an apparatus (Stressmeter) developed during this study.

The results obtained show that a stress coating principally arises below the glass transition temperature (Tg) of the coating. The level of the stress $S^{H,T}$ can be considerable and is dependent on the type of coating, the nature of the substrate, and any variation in temperature and/or in relative humidity to which the coating is submitted. The highest $S^{H,T}$-values (tensile stress) are reached at low temperatures and relative humidities.

The determination of the hygrothermal stress dependency on temperature and relative humidity enables one to evaluate the Tg at different relative humidities. The interdependence between the hygrothermal stress and that developed during film formation (i.e., internal stress) can explain certain phenomena (e.g., effect of coating history) met in practice.

This study provides additional knowledge on stresses which have a negative influence on adhesion and cohesion in organic coatings.

ON THE REFLECTION/ABSORPTION FOURIER TRANSFORM INFRARED SPECTROSCOPY OF COATINGS ON STEEL

Tinh Nguyen, National Bureau of Standards

Reflection/Absorption infrared spectroscopy, which produces spectrum after reflecting from the metal surface, is currently a powerful technique for studies of thin and thick coatings on metals. The experimental procedures involved in FTIR-RA is complicated, however. Band shape and intensity obtained by this technique is quite different from those obtained by the conventional transmission, and a complex function of numerous variables. This paper presents spectral characteristics of several coatings on cold-rolled steel obtained by FTIR-RA, and examines several parameters that influence on band shape of an epoxy coating on steel. The application of this technique as a quantitative tool for studying films on metal is also discussed.

BINDERS FOR HIGHER-SOLIDS COATINGS—SYNTHESIS AND PROPERTIES OF MODEL ALKYD RESINS

Steven L. Kangas and Frank N. Jones, North Dakota State University

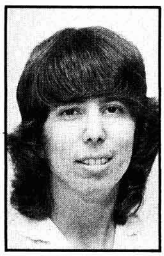
Model alkyd resins were synthesized by esterifying phthalic anhydride, triols, and a fatty acid with dicyclohexylcarbodiimide (DCC) at 25°C in pyridine with catalytic amounts of p-TSA. Reference alkyds were prepared by conventional esterification of the same formulations at 220°C. The products were characterized

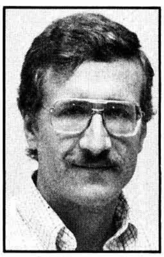
by infrared (IR) spectroscopy and by size exclusion chromatography (SEC). Model alkyds generally have lower $\bar{M}_n$ and $\bar{M}_w/\bar{M}_n$ than their conventional counterparts. The results indicate that the multi-temperature process is irreversible and is essentially free of side reactions. Thus it appears useful for reproducibly synthesizing model alkyd resins of predictable structure.

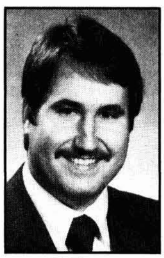
Substituting trimethylolpropane (TMP) for glycerol significantly reduces $\bar{M}_n$ and $\bar{M}_w/\bar{M}_n$ of alkyds prepared by a conventional process. Longer processing times are required. The results suggest that the -OH groups of TMP are less reactive than those of glycerol. This substitution is expected to reduce resin viscosity.

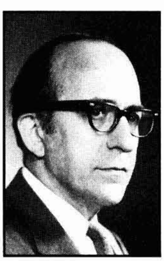
Properties of the model and conventional alkyd resins prepared as described were then studied. Solution viscosities of model alkyds were lower than those of comparable alkyds prepared by a conventional, high-temperature process. Air-dry coatings formulated from model alkyds dry faster than those based on conventional alkyds, but they have, on balance, inferior film physical properties. T_gs of films prepared from model alkyds show a greater dependence on $\bar{M}_n$ than their conventional counterparts. The observed property differences are attributable to the different molecular weights and molecular weight distributions of model and conventional alkyds.

Substitution of TMP for glycerol in conventional alkyds was shown to reduce $\bar{M}_w/\bar{M}_n$. As expected, this substitution reduces viscosity. However, it results in inferior impact resistance.

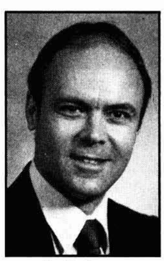

L. Kapilow

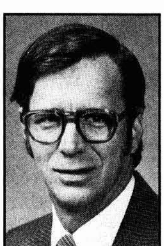

R. Sammel

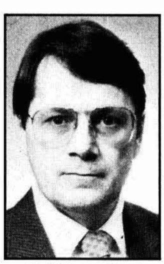

R. Drew


H. Miller


S. Hillman


L. Culver


J. Mertens


P. Vapaaoksa

It is probably not feasible to make high quality, higher-solids, air dry coatings simply by manipulating the molecular weights of soluble alkyd resins. Only modest increases (roughly 2 to 10%) of application solids appear possible, and measures that increase solids harm properties.

POWDER COATINGS—A HISTORICAL PERSPECTIVE

Douglas S. Richart, Morton Powder Coatings

Powder coating is a relatively new process which is now generally accepted as one of the alternate technologies for applying decorative and protective coatings. Powder coating had its origin in Germany in 1952 with the discovery of the fluidized bed coating process. Commercial acceptance was rather limited and it was not until the early 1960's, when the first electrostatic powder spray guns were developed, that powder coating technology and commercial acceptance started to accelerate. By the early 1970's, industry was wildly optimistic about the growth of powder coatings and estimates of the current and future markets for powder coatings were greatly exaggerated.

Stable, one-component, epoxy resin-based powders were developed for fluidized bed coating in the early 1960's. They were modified for application by the electrostatic spray process and are widely used today. Solid polyester resins with improved exterior durability were developed by both European and U.S. suppliers. Powder coatings based on polyester resins were first sold commercially in 1973 and now comprise almost half of the decorative market for powder coatings.

The market for powder coatings is growing at 10-15% per year and gradually increasing its share of the industrial finishing market. While market statistics vary widely depending on the source, the strong growth trend is still apparent.

NEW OPTIONS FOR POWDER COATINGS

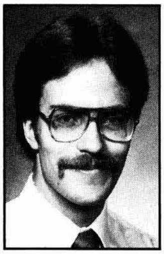
Barbara Clinch, H.B. Fuller Co.

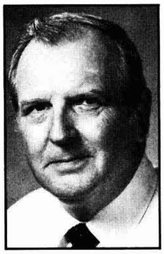
Thermosetting powder coatings have shown steady growth for the past 10 years. With this growth came many new powder coating polymers from which to choose. Various options involving thermosetting polyesters are examined. Lower cost general purpose polyesters, low hydroxyl polyesters, standard polyesters, high hydroxyl polyesters, and carboxyl polyesters are discussed and compared with epoxies, and hybrids. Options in curing agents/crosslinkers for the polyesters described are investigated. Exterior durability of the powder coating systems is compared and discussed. Relative differences in powder coatings cost are reviewed.

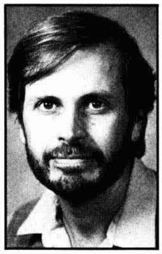
EVALUATION OF METHODS FOR MEASURING VISCOSITY OF POWDER COATING RESINS

D. W. Maners, Shell Chemical Company

The advantages and disadvantages of four common methods for determining viscosity of powder coating resins are discussed. The popular and rapid ICI cone and plate viscometer, while useful in process control, has not proved sufficiently reproducible for specification testing. Solution viscosity measurement is a good general method for even high molecular weight resins, but it does not always give the formulator the needed information. Melt viscosity measurement with Ubbelohde or Cannon-Fenske viscometers is preferred by some formulators, but is somewhat hazardous and

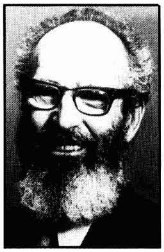

B. Mayo


R. Sharpe


J. Pfau


F. Bredimus


D. Clayton


Z. Wicks

difficult to apply. The Brookfield Thermosel provides a safe and easy alternate means to melt viscosity, but high molecular weight resins must be stabilized to prevent foaming over. No certain method is recommended. A selection must be based on the characteristics of the method and the needs to be met.

RESINS AND CURING AGENTS FOR THERMOSETTING POWDER COATINGS

Lorraine Kapilow, CIBA-GEIGY Corp.

Thermosetting powder coatings comprise a large segment of the current powder coatings market. These coatings range from mainly functional protective coatings to completely decorative applications. To achieve the desired balance between performance, appearance, and economics, selection of the proper resin and curing agent system is critical. By choosing the correct binder system, the properties of a coating can be tailored to meet a given set of requirements. Performance characteristics including flexibility, hardness, chemical resistance, corrosion resistance, and weatherability can be obtained as well as appearance properties.

The chemical and physical properties of epoxy and polyester resins and their respective curing agents are discussed, with emphasis on the selection of these resins for several end use applications.

HANDLING HAZARDOUS PIGMENTS WITH SEMI-BULK SYSTEMS, INC. AIR PALLETS®

R. Michael Drew, E. I. du Pont de Nemours & Co., Inc.

Semi-Bulk Systems, Inc. Air Pallets® have been used in handling hazardous lead chromate pigments at Du Pont's Moberly Plant since 1980. These pigment containers were selected because they remove pigment loaders from close contact with hazardous pigments. It was also felt that their use would reduce hazardous waste.

Air sampling during loading shows lower lead and chromate levels for these pallet batches than for batches loaded from 50-lb. bags. Additionally, hazardous waste disposal costs have been reduced by $30M annually.

PEARLESCENT PIGMENTS: EFFECTS OF PARTICLE SIZE DISTRIBUTION ON COLOR

Harold A. Miller, The Mearl Corp.

Pearlescent pigments, particularly titanium dioxide and ferric oxide coated mica types, are gaining use in several major coating areas. A color evaluation method has been developed. Due to the significant gonio-chromaticity of these pigments, variations in particle size distribution (PSD) can affect the color characteristics. Several different pigments were fractionated into various PSD groups. Each sample was examined by PSD measurement and by CIELAB color difference. The relationship between PSD variations and the color difference variations are explained.

COLOR INSTRUMENTATION AND THE AUTOMOTIVE INDUSTRY

Sidney A. Paradee, Ford Motor Co.

The complexity of colored materials used in the automotive industry has caused the industry to investigate better ways to satisfy an ever more quality-conscious customer. Instrumental methods have been shown to be useful tools in reducing the subjectivity in gaining initial color acceptance and on-going color approvals.

The Detroit Colour Council, in cooperation with the Society for Automotive Engineers, has issued a recommended practice (J 1545) for the use of instrumental methods to measure color. This practice provides a consistent engineering practice for the determination of specifying tolerances for the acceptance of current production materials and coordinating the initial acceptance of parts from multiple suppliers.

This discussion covers the intent of the recommended practice and offers suggestions on how the use of instrumental methods may be applied to reduce the emotional and subjective aspects of color acceptance.

COLOR MATCHING COMPUTERS

Edward M. Krzes, Pratt & Lambert, Inc.

One of the recent advances in the paint industry is the availability of computerized color matching equipment for the retail store. The concept of producing custom color matches is not new. Dealers have been creating them ever since paint was produced in more than one color. This computer equipment is an aid to their ability to sell custom color matches and not a substitute for it. Understanding how the equipment interacts with the other factors involved in producing a saleable product is important. It can mean the difference between obtaining good results and disappointing mismatches. Topics discussed include what these systems can be expected to accomplish and how variances in bases, colorants, and colorant dispensers affect results.

OBJECTIVE COLOR-DIFFERENCE EVALUATION—AN UPDATE

Rolf G. Kuehni, Mobay Corp.

Considerable, if slow, progress has been made in industrial objective color difference evaluation since the adoption of the CIELAB formula by the CIE in 1976.

This review discusses new visual data developed since then, as well as new analyses of data using various mathematical techniques. The results give an indication of the number of well-placed samples and the number of various observations necessary to produce reliable color-difference ellipsoids. Several new formulas have been proposed, formulas that either are modifications of the CIELAB formula or that have been constructed on the basis of new theoretical models of color difference perception. Among these formulas of particular interest for the industrial worker is the CMC color-difference formula.

A consensus is beginning to develop on the shape and arrangement of color difference ellipsoids in CIE x,y,Y color space, based on limited work by many investigators. Several aspects remain to be clarified, however, and a larger uniform study encompassing fifty or more color centers in that space, perhaps funded by an industrial organization, would be of great benefit in arriving at an improved, reliable color-difference formula.

PROPYLENE GLYCOL METHYL ETHER ACETATE AS A SOLVENT FOR SOLUTION ACRYLIC POLYMERIZATION

Nancy J. Morris, Dow Chemical U.S.A.

Propylene glycol methyl ether acetate (PMA) has found extensive use as a replacement for ethylene glycol ethyl ether acetate (EEA) in many industrial coating systems. PMA has proven, in most cases, to be an excellent performance alternative, offering lower toxicity than EEA.

Solution acrylic polymerization has been one area where PMA peformed as well as EEA. Acrylic resin cooked in PMA generally exhibit much different molecular weight distribution than those cooked in EEA. Viscosities of the resin solution in PMA are also significantly higher than those in EEA. One solution to this problem has been to run the polymerization under pressure. Acrylic polymers cooked in PMA under pressure are very similar to those prepared in EEA. Of course, not all resin producers are capable of running polymerization under pressure. Thus, this study was undertaken to examine reaction variables, other than pressure, that would allow resin producers to use PMA as a solvent for acrylic polymerization.

Polymers were prepared using a model system and the effects to solvent, co-solvent, initiator, and initiator level on the physical characteristics of the polymer were examined. These preliminary studies indicate that PMA can be used as a solvent for acrylic polymerization to achieve polymers similar to those previously prepared in EEA.

TEST FACILITIES FOR EXPOSURE ASSESSMENT OF VOLATILE ORGANIC SOLVENTS

Larry J. Culver and Saundra L. Hillman, Eastman Chemical Products, Inc.

The effects of exposure to volatile organic solvents is of great interest to the coatings industry, to government regulatory agencies, and to the general public. Many toxicological studies have been conducted or are in progress to determine the relative toxicity of solvents. However, more information is needed to determine the typical exposure levels generated by solvents contained in end-use products. Both toxicity and solvent exposure data should be considered when assessing any hazards associated with a solvent.

This paper describes both test facilities and methods designed to monitor exposure levels in simulated end-use (domestic, office) environments. Variables relevant to exposure testing can be classified into three major categories: product systems, environmental conditions, and application methods. Solvent exposure levels can be monitored during the product application periods and also during the decay periods to define the rate of dissipation from the enclosed area. The computer assisted analysis of the data collected from a sampling matrix of charcoal filled adsorption tubes provides: (1) the average solvent concentration(s) in the test area, (2) the average solvent concentration(s) in the worker's breathing zone, (3) solvent concentration decay rates, and (4) information on the presence of concentration gradients. Data generated from this test facility should be useful in establishing guidelines for handling volatile organic solvents in industrial and/or residential environments.

CYCLE VARIATIONS IN A FLUORESCENT CONDENSATION TEST APPARATUS AND GLOSS RETENTION ON CONSUMER ALKYD ENAMELS

Golden Gate Society for Coatings Technology

A device for accelerating the effects of ultraviolet radiation and condensation, the fluorescent condensation test apparatus has been used in the coatings industry for fifteen years. Few results have been published concerning the variations in gloss retention that occur with cycle changes for air-drying coatings. Current test methods suggest cycles and recommend that the cycle be agreed upon by customer and supplier. This study shows the effect upon gloss retention of four air-drying vehicles when test cycles are varied within recommended ranges. Results indicate temperature, especially during condensation cycles, is more important than cycle duration.

EPOXY HARDENER COMPATIBILITY FOR EPOXY RESINS IN COMPLIANCE SOLVENT FORMULATIONS

James A. Mertens, Dow Chemical U.S.A.

The need to develop high performance coatings that meet the stringent volatile organic compound limits has forced many formulators to consider the use of the compliance solvent option to provide products which meet these performance requirements.

Of primary interest are the reactive components of two-component epoxy systems using amines and polyamides as hardening agents. This has raised several questions about the compatibility of these products with the compliance solvents, specifically 1,1,1-trichloroethane. The reactivity of these hardeners with 1,1,1-trichloroethane has been studied and several formulation options have been developed.

This paper discusses the results of these studies and how they can be interpreted to be used in making acceptable coatings which will meet high performance requirements and help satisfy VOC regulations.

PEARLESCENT PIGMENTS—A NEW APPROACH TOWARDS SURFACE COATINGS TECHNOLOGY

Pekka Vapaaoksa, Kemira Oy

Applications of mica pigments coated by titanium dioxide are presented and the following topics discussed: Nature of titanium-coated mica, the properties of the pigment and its influence on

physiological and toxicological effects of coatings; Applications of powder coatings, stowing enamels and coil coatings, the influence of pearlescent pigments on development of binder systems, examples and test results; and Applications of inorganic binder systems and influences of pearl pigments on heat and flame resistance coatings.

MONITORING PIGMENT DISPERSION USING THE FREE VOLUME MICROPROBE

B. Mayo, R. Sharpe, and J. Pfau, Battelle Columbus Laboratories

Generally, the measurement of pigment dispersion in a millbase is subjective (e.g., the Hegman gauge). Quantitative techniques do exist (Coulter counter, microscopy, light scattering) but require dilution of the millbase, which affects particle size distribution and wetting.

The use of the Free Volume Microprobe (FVM) was investigated as a tool for monitoring pigment dispersion in a high-solids oligomer. This is a new and comparatively inexpensive technique which is extremely sensitive to electron density and free volume changes. The measurement is nondestructive, requires no sample preparation, and can be used for in-situ measurements.

The FVM is very sensitive to pigment dispersion in high solids systems. It can detect oligomer and unwetted pigment in a millbase and follow wetting of the pigment.

MANAGEMENT REPORTS CAN IMPACT QUALITY

Frank B. Bredimus, E. I. du Pont de Nemours & Co., Inc.

The ability to satisfy customer quality and service requirements is emerging as an important measure of business success.

Improved results can be obtained through the use of proper reporting systems. It is necessary to design and administer reporting systems properly to insure that they support and reinforce an organization's objectives.

The question of proper quality reports are explored through the use of common examples faced by industrial organizations. Several principles emerge that can help an organization design and administer quality reporting systems to achieve desired results.

QUALITY ASSURANCE

D. W. N. Clayton, Crown Decorative Products Ltd., Paint Div.

Following the re-awakening to quality awareness in the U.K. and the implications of British Standard 5750 (Quality Systems), the maintenance of a quality system in a major British paint manufacturer is described and the opportunities surveyed.

OVEN VS SHELF STABILITY OF LATEX PAINTS

Chicago Society for Coatings Technology

One of the most important features of a coating is how well it stands up to extended storage. This property is particularly crucial in the trade sales area, where a paint may be stored for months or even years before being applied.

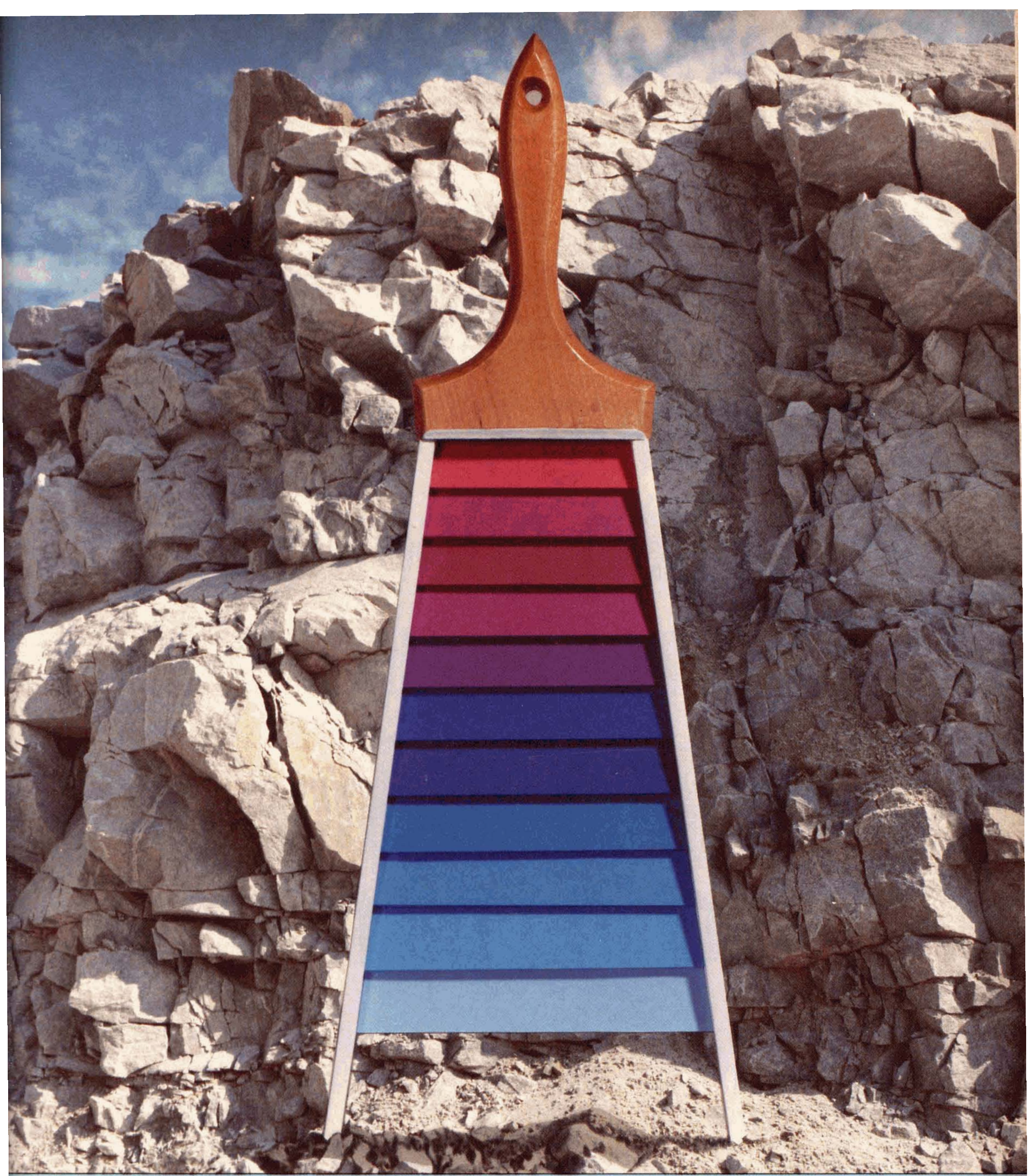
One of the most common of accelerated aging tests developed to predict a coating's reaction to long-term storage is the heat aging or "oven stability" test.

The oven stability test assumes that short-term changes of a paint's properties when stored at an elevated temperature (from 120° to 160°F) will accurately predict the long-term changes of a room temperature sample. While most experienced formulators feel this assumption is warranted, a literature search showed little actual documentation of hard data in confirmation. Also, test conditions such as storage temperature, length of test, and time intervals between data points vary widely from company to company. For these reasons, the Chicago Society Technical Committee undertook a study of this test, in an attempt to come up with a standard, usable methodology.

FREE VOLUME AND THE COATINGS FORMULATOR

Zeno W. Wicks Jr., North Dakota State University

Free volume is defined and the difficulties of quantification are pointed out. The relationship between free volume and viscosity is discussed, especially from the point of view of high solids coatings. The effects of free volume availability on film formation by solvent evaporation and by coalescence are treated. Recent work on the effects of free volume on the rate and extent of crosslinking and its implications for formulating ambient cure coatings is reviewed. Effects of free volume on coatings film properties are illustrated by brief discussions of popping, adhesion, corrosion control, and mechanical properties.



Leadership means greater responsibility to our customers. An important part of this responsibility is . . . to be flexible in fulfilling our customers' needs . . . to be at the forefront of technology with Minex and Minspar products . . . to provide our customers in the coatings industry with the most advanced assistance.

At Indusmin, we take our responsibility seriously.

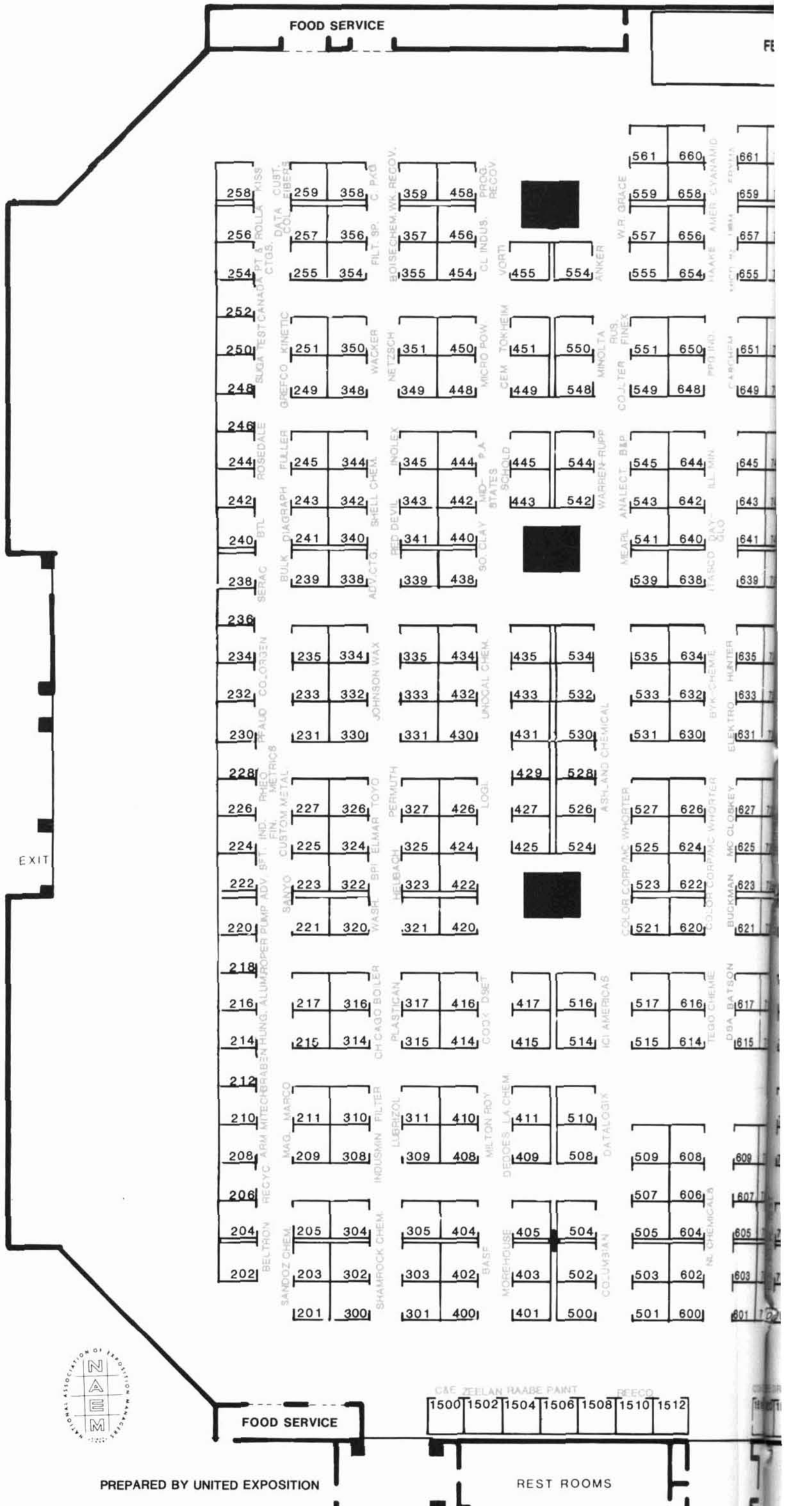
indusmin

Indusmin Incorporated
Sales and Marketing:
Box 14445, Columbus, OH 43214
Tel: (614) 262-1545

Indusmin Incorporated
Feldspar Operations:
Box 309, Spruce Pine, NC 28777
Tel: (704) 765-9621

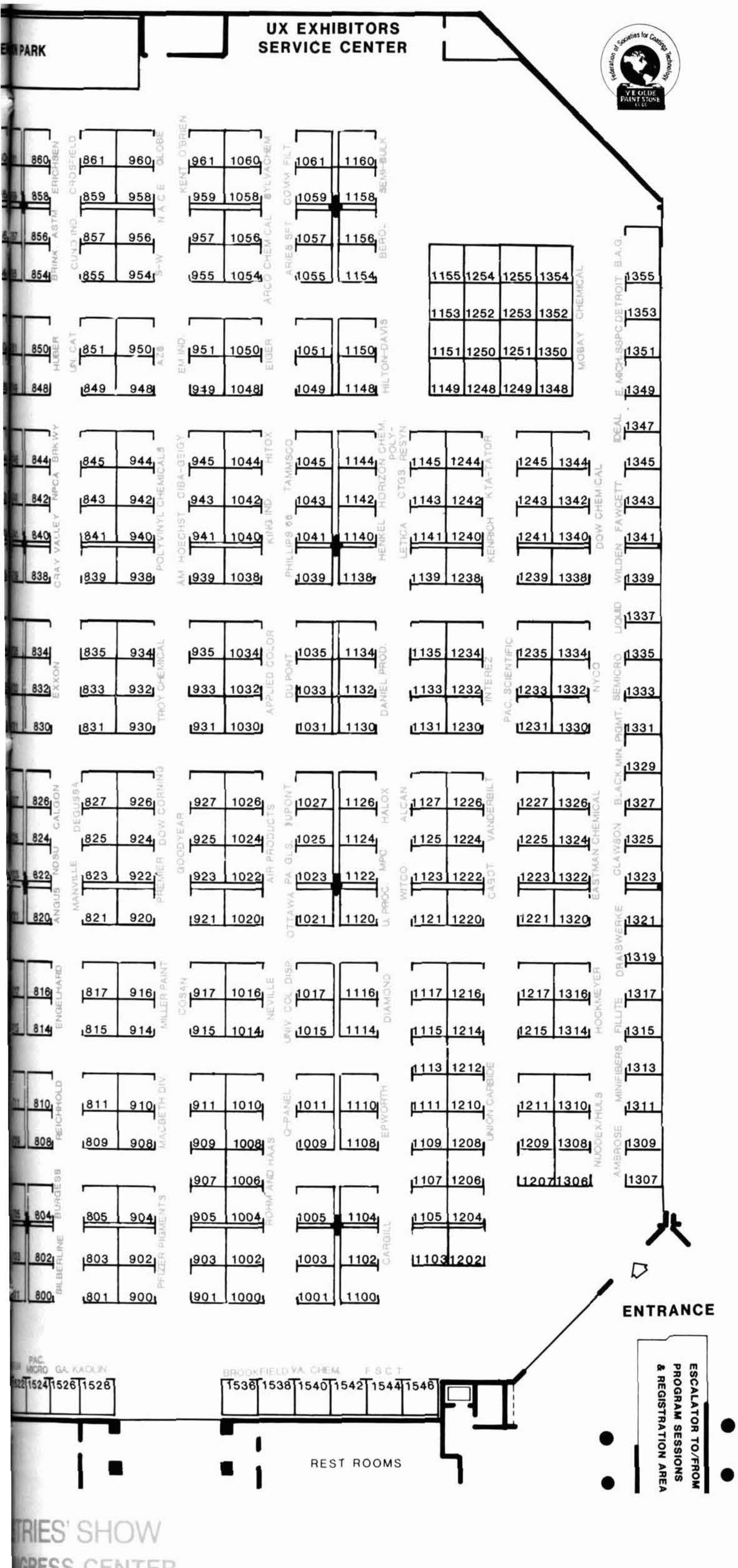
About controlling evaporation when choosing EEA replacements.

And the science of watching paint dry.



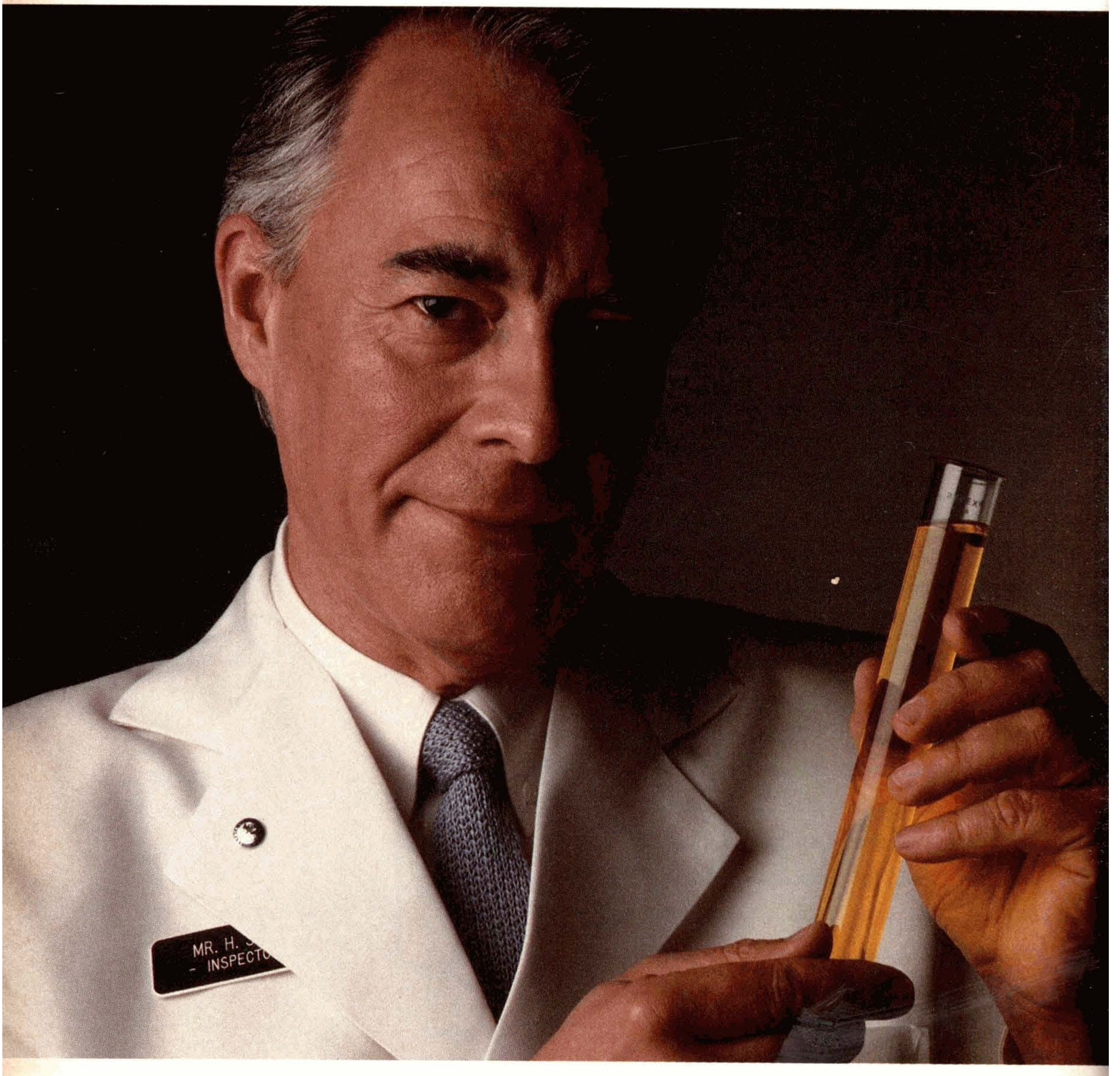
1986 PAINT IN[...]

GEORGIA WORLD [...]



TRIES' SHOW
GRESS CENTER

HOW YOU VIEW DEPENDS ON



Our inspectors never change. They're always tough and uncompromising. Which means different things to different people.

If you're a buyer of Henkel epoxy curing agents and acrylic resins, our inspectors take on heroic proportions. They carefully analyze your batch when it's being made and before it's shipped. In essence, they work for you making sure your order will deliver the results you want.

Our raw materials suppliers probably view us somewhat differently. In the first place, they have to pass a vendor approval process that's nothing

Biggest Paint Show to Be Staged at World Congress Center in Atlanta

The biggest Paint Industries' Show will share the spotlight with an excellent technical program at the Annual Meeting and Paint Show of the Federation of Societies for Coatings Technology at the Georgia World Congress Center in Atlanta, November 5-7.

242 EXHIBITORS THIS YEAR

From its inception in 1932, the Paint Show has mushroomed into an international event featuring—in 1986—242 exhibitors occupying 57,850 net square feet. More than 20% of those companies have been in the Show for 25 years or more.

The Show—biggest and best of its kind in the world—presents attractive exhibitor displays devoted to a wide variety of raw materials, production equipment, containers, laboratory apparatus and testing devices, and services furnished to the paint and coatings manufacturing industry.

The purpose of the Paint Show is to enable registrants to learn of the latest developments in these products and services and also to provide the opportunity to discuss them with the top technical/sales personnel of the exhibiting firms.

WELCOME TO NEW EXHIBITORS

The Federation is pleased to welcome the following new exhibiting firms into the Show this year: Advanced Software Designs, American Cyanamid Co., Analect Instruments, AZS Corp., Louis P. Batson, Inc., Boise Cascade Corrugated Container Div., B&P Environmental Resources, Inc., C.W. Brabender Instruments, Inc., BTL Specialty Resins Corp., Ciba-Geigy Corp., CL Industries, Inc., Coulter Electronics, Inc., Crosfield Chemicals, Inc., Datacolor, Erichsen Instruments, Inc., H.B. Fuller Co., Hungarian Aluminium Corp., Illinois Minerals Co., Kiss Packaging Products, Louisiana Chemical Polymers, Inc., Permuthane, Inc., Raabe Corp., Recyclene Products, Inc., Rhone-Poulenc, Inc., Rosedale Products, Inc., Semicro Corp., Suga Test Instruments Co., Ltd., Unimex Corp. and Washtech Systems, Inc.

FOURTH 50-YEAR EXHIBITOR

A fourth exhibitor—Nuodex/Hüls—joins three others this year as a 50-year exhibitor in the Show. Columbian Chemicals Co., Rohm and Haas Co., and Union Carbide Corp. attained the golden status in 1985.

EXHIBITORS

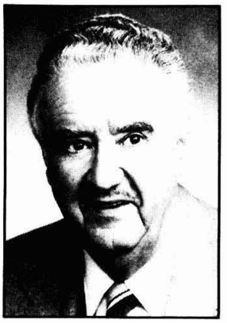
Aceto Corp.	721
Advanced Coating Technologies, Inc.	338
Advanced Software Designs	222
Air Products & Chemicals, Inc.	1020-1022
	1024-1026
Alcan Powders & Pigments	1125-1127
C.M. Ambrose Co.	1307-1309
American Cyanamid Co.	656-658-660
American Hoechst Corp.	939-941
Analect Instruments	543
Angus Chemical Co.	820
Anker Labelers Corp.	554
Applied Color Systems, Inc.	931-933-935
	1030-1032-1034
Arco Chemical Co.	955-957
	1054-1056
Aries Software Corp.	1055-1057
Armstrong Containers, Inc.	208
Ashland Chemical Co.	425-427-429
	431-433-435
	524-526-528
	530-532-534
ASTM	856
Atlas Electric Devices Co.	701-703-705
AZS Corp.	948-950
B.A.G. Corp.	1355
BASF Corp., Chemicals Div.	301-303-305
	400-402-404
Louis P. Batson, Inc.	617
Beltron Corp.	202-204
Berol Chemicals, Inc.	1154-1156
Blackmer Pump Div., Dover Corp.	1327
Boise Cascade Corrugated Container	355
B&P Environmental Resources, Inc.	545
C.W. Brabender Instruments, Inc.	212
Brain Power Incorporated/BPI	322
Brinkmann Instruments	854
Brockway Standard, Inc.	844
Brookfield Engineering Laboratories, Inc.	1536-1538
BTL Specialty Resins Corp.	240
Buckman Laboratories, Inc.	621-623
Bulk Lift International, Inc.	239
Burgess Pigment Co.	804
Byk-Chemie USA	531-533-535
	630-632-634
Cabot Corp., Cab-O-Sil Div.	1220-1222
Calgon Corp., Div. of Merck & Co., Inc.	824-826
Canada Talc Ltd.	252
Cargill, Inc.	1001-1003-1005
	1100-1102-1104
Caschem, Inc.	649-651
CEM Corp.	449
Chemical & Engineering News (ACS)	1500
Chemical Week/Indust. Chemical News	357
Chicago Boiler Co.	215-217
	314-316
CIBA-GEIGY Corp.	943-945
CL Industries, Inc.	454-456
Clawson Tank Co.	1323-1325
Coatings Magazine	1143
Color Corp. of America	521-523-525
	527-620-622-624-626
Colorgen, Inc.	232-234
Columbian Chemicals Co.	500-502-504

1986 Annual Meeting
Paint Industries' Show
November 5, 6, 7
Georgia World Congress Center
Atlanta, GA

OPENING SESSION
Wednesday, November 5

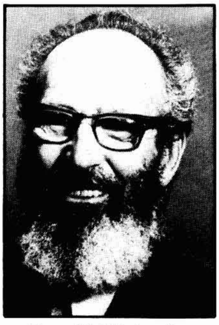
Keynote Address

"The American Mission"
Lee Sherman Dreyfus


Lee Sherman Dreyfus

Lee Sherman Dreyfus served as Governor of the state of Wisconsin from 1979 to 1983. Currently, he is President of Lee Sherman Dreyfus, Inc., which he started in 1984. Career highlights include serving as President of Sentry Insurance Co., Chancellor of the University of Wisconsin-Stevens Point, and Professor at the University of Wisconsin-Madison. Listed in *Who's Who in the World* and *Who's Who in America,* Mr. Dreyfus was the recipient of the President's Gold Medal through the Association of U.S. Army and the Distinguished Public Service Medal from the Secretary of Defense, plus numerous honorary degrees.

MATTIELLO LECTURE
Friday, November 7


Zeno W. Wicks, Jr.

"Free Volume and the Coatings Formulator"
Zeno W. Wicks, Jr.

Zeno W. Wicks, Jr., former Department Chairman of Polymers and Coatings at North Dakota State University, has conducted or directed industrial research projects in the areas of coatings, polymers, coated fabrics, printing inks, textile colorants, plastics, and sealants. In addition, he has served as a consultant to a number of governmental agencies with regard to environmental regulations in the coatings industry. Author of over 35 technical articles, Dr. Wicks has taught numerous courses in the U.S. as well as China, England, and France. Four of his research papers were awarded Roon prizes as the best technical papers offered for presentation at the Annual Meetings of the Federation of Societies for Coatings Technology.

WHEN FLOW CONTROL PROBLEMS SURFACE...

CAB-O-SIL® FUMED SILICA IS THE SOLUTION.

Control the paint and coatings formulation problems of oven sag, settling and edge-pull in conventional and high solids coatings with CAB-O-SIL fumed silica. As an effective rheology control agent, CAB-O-SIL fumed silica:

- Controls viscosity
- Prevents sagging—even during baking
- Prevents settling of heavy pigments

Cabot's unique hydrophobic grade of fumed silica—CAB-O-SIL TS-720 can improve the water resistance of your coatings offering benefits in anti-corrosion applications.

CAB-O-SIL TS-720 hydrophobic fumed silica also offers specific benefits in epoxy systems:

- Stable sag resistance to low molecular weight epoxies
- Improved high temperature viscosity stability

and in urethane systems:

- Low moisture content
- More efficient in polar systems

Find out how CAB-O-SIL fumed silica products can help you solve your formulation problems. Call our Technical Service Group at 1-800-CAB-O-SIL (in Illinois 1-800-252-3705), or write: Cabot Corporation, Cab-O-Sil Division, P.O. Box 188, Tuscola, IL 61953, (217) 253-3370.

CABOT

DISCOVER THE CABOT CONTRIBUTION.

VISIT US IN ATLANTA–1986 PAINT SHOW–BOOTH 1220-1222

EXHIBITORS

Listed by Product/Services Classification

This listing, followed by initial booth numbers, was compiled from information provided by the exhibitors.

Raw Materials

Additives

Aceto Corp. . . . 721
Air Products & Chemicals, Inc. . . . 1020
American Cyanamid Co. . . . 656
Angus Chemical Co. . . . 820
AZS Corp. . . . 948
Berol Chemicals, Inc. . . . 1154
Buckman Laboratories, Inc. . . . 621
Byk-Chemie USA . . . 531
Cabot Corp., Cab-O-Sil Div. . . . 1220
Calgon Corp., Div. of Merck & Co., Inc. . . . 824
Caschem, Inc. . . . 649
Cook Resins & Additives . . . 414
Cosan Chemical Corp. . . . 915
Cray Valley Products, Inc. . . . 838
Daniel Products Co. . . . 1130
Day-Glo Color Corp. . . . 640
Degussa Corp. . . . 825
Diamond Shamrock Chemicals Co., Process Chemicals Div. . . . 1114
Dow Chemical USA . . . 1239
Dow Corning Corp. . . . 924
Drew Chemical Corp. . . . 720
Eastman Chemical Products, Inc. . . . 1221
W.R. Grace & Co., Davison Chemical Div. . . . 555
Grefco, Inc., Dicaperl & Dicalite Depts. . . . 249
Henkel Corp. . . . 1138
Hercules Incorporated . . . 639
ICI Americas, Inc. . . . 415
Inolex Chemical Co. . . . 345
S.C. Johnson & Son, Inc., Johnson Wax . . . 231
Kenrich Petrochemicals, Inc. . . . 1238
King Industries, Inc. . . . 1038
The Lubrizol Corp. . . . 309
Magnesium Elektron, Inc. . . . 209
Manchem, Inc. . . . 743
Micro Powders, Inc. . . . 448
MiniFIBERS, Inc. . . . 1311
NL Chemicals/NL Industries, Inc. . . . 501
Nuodex/Hüls . . . 1207
NYCO . . . 1330
Pennsylvania Glass Sand Corp., Floridin Co. . . . 1023
Poly-Resyn, Inc. . . . 1145
PPG Industries, Inc. . . . 648
Rohm and Haas Co. . . . 901
Sandoz Chemicals Corp. . . . 201
Shamrock Chemicals Corp. . . . 300
Southern Clay Products, An ECCA Company . . . 438
Tego Chemie Service GmbH . . . 515
Troy Chemical Corp. . . . 831
Union Carbide Corp. . . . 1103
United Catalysts, Inc. . . . 849
R.T. Vanderbilt Co., Inc. . . . 1224
Wacker Chemical Co. . . . 348
Witco Chemical Corp., Organics Div. . . . 1121

Chemical Intermediates

American Cyanamid Co. . . . 656
Angus Chemical Co. . . . 820
Ashland Chemical Co. . . . 425
AZS Corp. . . . 948
Buckman Laboratories, Inc. . . . 621
Dow Corning Corp. . . . 924
Eastman Chemical Products, Inc. . . . 1221
Horizon Chemical . . . 1142
Louisiana Chemical Polymers, Inc. . . . 411
Mobay Chemical Corp. . . . 1149
Nuodex/Hüls . . . 1207
Phillips 66 Co., Catalyst Resources, Inc. . . . 1039
Polyvinyl Chemicals, Inc. . . . 839
Rhone-Poulenc Inc. . . . 758
Union Carbide Corp. . . . 1103
Virginia Chemicals, Inc. . . . 1540
Wacker Chemical Co. . . . 348

Colorants

BASF Corporation, Chemicals Div. . . . 301
Color Corp. of America . . . 521
Daniel Products Co. . . . 1130
Day-Glo Color Corp. . . . 640
EM Industries, Inc., Pigment Div. . . . 949
Harshaw/Filtrol Partnership . . . 730
Hilton-Davis Chemical Co. . . . 1049
ICI Americas, Inc. . . . 415
McWhorter, Inc. . . . 521
Mobay Chemical Corp. . . . 1149
Nuodex/Hüls . . . 1207
Permuthane, Inc. . . . 327
Sandoz Chemicals Corp. . . . 201
Universal Color Dispersions . . . 1015

Extenders

Burgess Pigment Co. . . . 804
Canada Talc Ltd . . . 252
Crosfield Chemicals, Inc. . . . 859
Engelhard Corp. . . . 814
Fillite USA, Inc. . . . 1315
Georgia Kaolin Co., Inc. . . . 1526
Grefco, Inc., Dicaperl & Dicalite Depts. . . . 249
Illinois Minerals Co. . . . 642
Indusmin Ltd. . . . 308
Manville . . . 821
NYCO . . . 1330
Ottawa Silica Co. . . . 1021
P.A. Industries . . . 444
Pennsylvania Glass Sand Corp., Floridin Co. . . . 1023
PPG Industries, Inc. . . . 648
Tammsco, Inc. . . . 1043
R.T. Vanderbilt Co., Inc. . . . 1224
Zeelan Industries, Inc. . . . 1502

Latices and Emulsions

Air Products & Chemicals, Inc. . . . 1020
American Cyanamid Co. . . . 656
AZS Corp. . . . 948
H.B. Fuller Co. . . . 245
ICI Americas, Inc. . . . 415
S.C. Johnson & Son, Inc., Johnson Wax . . . 231
The McCloskey Corp. . . . 625
NL Chemicals/NL Industries, Inc. . . . 501
Permuthane, Inc. . . . 327
Polyvinyl Chemicals, Inc. . . . 839
Reichhold Chemicals, Inc. . . . 709
Rohm and Haas Co. . . . 901
Union Carbide Corp. . . . 1103
Unocal Chemicals Div., Unocal Corporation . . . 331

Pigments, Inorganic

Aceto Corp. . . . 721
BASF Corporation, Chemicals Div. . . . 301
Buckman Laboratories, Inc. . . . 621
Columbian Chemicals Co. . . . 500
Degussa Corp. . . . 825
Dominion Colour Co. . . . 748
EM Industries, Inc., Pigment Div. . . . 949

Witcobond urethane dispersions for high performance coatings, binders and adhesives.

When you use Witcobond® urethane dispersions you'll get high performance.

They are available in a range of finishes based on your individual requirements. The finished coatings have outstanding physical properties, including toughness and resistance to abrasion, solvents and water.

Your job made easier.

Witcobond dispersions are waterborne and water-dilutable.

Wet films need merely to be dried to achieve the performance properties you want.

Choose from cationic or anionic dispersions, in a choice of grades, to yield nondiscoloring or conventional coatings or adhesives.

Whatever your application.

These versatile products are ideal for use in a wide range of applications, including coating on rigid and flexible foam, fiberglass and textile coatings and binders, floor coatings, sealers and polishes, as well as coatings on engineering plastics and polyester film.

Wherever you use them, you can be assured that you'll have the consistent quality made possible by our years of urethane experience.

Tell us your application and performance requirements.

Organics Division.

For more information, contact:
Witco Corporation, Organics Division, Dept. U, 2701 Lake Street, Melrose Park, IL 60160-3041.

Witco

Pigments, Organic

Pigments, Metallic

Plasticizers

Resins

Solvents

Production Equipment

Cleaning, Specialty Chemicals

Containers/Drums

Filling/Packaging/Labelling

Filtering/Straining

Grinding/Milling

Instrumentation & Control

- Macbeth Div. of Kollmorgen Corp. ... 809
- Marco Scientific, Inc. ... 211
- Mettler Instrument Corp. ... 756
- Micromeritics Instrument Corp. ... 655
- Minolta Corp. ... 548
- Mitech Corp. ... 210
- Tokheim Corp., Fluid Products Div. ... 451

Materials Handling

- B.A.G. Corp. ... 1355
- Bulk Lift International, Inc. ... 239
- Mid-States Engineering & Manufacturing Co., Inc. ... 442
- Semi-Bulk Systems, Inc. ... 1158

Mixing/Dispersing

- C.W. Brabender Instruments, Inc. ... 212
- Brain Power Incorporated/BPI ... 322
- Brinkmann Instruments ... 854
- Dedoes Industries, Inc. ... 409
- Draiswerke, Inc. ... 1317
- Epworth Manufacturing Co., Inc. ... 1108
- Fawcett Co., Inc. ... 1341
- Fryma, Inc. ... 659
- Globe Trading Co. ... 960
- Hockmeyer Equipment Corp. ... 1215
- Kinetic Dispersion Corp. ... 251
- Miller Paint Equipment, Inc. ... 815
- Morehouse Industries, Inc. ... 401
- Myers Engineering ... 715
- Premier Mill Corp. ... 920
- Red Devil, Inc. ... 339
- Schold Machine Co. ... 443
- Semi-Bulk Systems, Inc. ... 1158

Pumping/Metering

- Applied Color Systems, Inc. ... 931
- Blackmer Pump Div., Dover Corp. ... 1327
- CL Industries, Inc. ... 454
- Cuno Industrial Products ... 855
- Gorman-Rupp Co. ... 754
- Liquid Controls Corp. ... 1335
- Miller Paint Equipment, Inc. ... 815
- Neupak, Inc. ... 723
- Roper Pump Co. ... 218
- Tokheim Corp., Fluid Products Div. ... 451
- Viking Pump–Houdaille, Inc. ... 739
- Warren-Rupp-Houdaille, Inc. ... 542
- Wilden Pump & Engineering Co. ... 1339

Safety/Fire Protection

- CL Industries, Inc. ... 454

Tinting/Mixing

- Brain Power Incorporated/BPI ... 322
- Epworth Manufacturing Co., Inc. ... 1108
- Hockmeyer Equipment Corp. ... 1215
- Red Devil, Inc. ... 339

Air Pollution/Effluent Control

- Reeco ... 1508

Color Cards

- Macbeth Div. of Kollmorgen Corp. ... 809

Consulting/Testing

- Atlas Electric Devices Co. ... 701
- B&P Environmental Resources, Inc. ... 545
- Coulter Electronics, Inc. ... 549
- DSET Laboratories, Inc. ... 416
- Eastern Michigan University ... 1349
- KTA-Tator, Inc. ... 1242
- Mitech Corp. ... 210
- Raabe Corp. ... 1504
- Semicro Corp. ... 1333
- South Florida Test Service, Inc. ... 701

Educational

- American Society for Testing and Materials ... 856
- Coulter Electronics, Inc. ... 549
- University of Detroit ... 1353
- Eastern Michigan University ... 1349
- Federation of Societies for Coatings Technology ... 1542
- Kent State University ... 959
- KTA-Tator, Inc. ... 1242
- University of Missouri-Rolla ... 256
- National Association of Corrosion Engineers ... 956
- National Paint & Coatings Association ... 842
- North Dakota State University ... 822
- University of Southern Mississippi, Polymer Science Dept. ... 657
- Steel Structures Painting Council ... 1351

Exposure Testing

- Atlas Electric Devices Co. ... 701
- DSET Laboratories, Inc. ... 416
- KTA-Tator, Inc. ... 1242
- South Florida Test Service, Inc. ... 701

Publishing

- American Society for Testing and Materials ... 856
- Chemical & Engineering News ... 1500
- Chemical Week ... 357
- Coatings Magazine ... 1143
- Federation of Societies for Coatings Technology ... 1542
- Industrial Finishing Magazine ... 224
- KTA-Tator, Inc. ... 1242
- Modern Paint & Coatings Magazine ... 1122
- National Association of Corrosion Engineers ... 956
- National Paint & Coatings Association ... 842
- Paint & Coatings Industry Magazine ... 254
- Steel Structures Painting Council ... 1351

Research & Development

- C.W. Brabender Instruments, Inc. ... 212
- Coulter Electronics, Inc. ... 549
- DSET Laboratories, Inc. ... 416
- Eastern Michigan University ... 1349
- Eiger Machinery, Inc. ... 1048

Solvent Reclamation

- B&P Environmental Resources, Inc. ... 545
- Disti, Inc. ... 714
- Finish Co., Inc. ... 255
- The Pfaudler Co. ... 230
- Progressive Recovery, Inc. ... 458
- Recovery Filtration Products ... 359
- Recyclene Products, Inc. ... 206

Tanks

- Clawson Tank Co. ... 1323
- Custom Metalcraft, Inc. ... 225
- Epworth Manufacturing Co., Inc. ... 1108
- Hockmeyer Equipment Corp. ... 1215
- Itasco Industries Div., I.W.I., Inc. ... 638
- Washtech Systems, Inc. ... 320

Waste Disposal

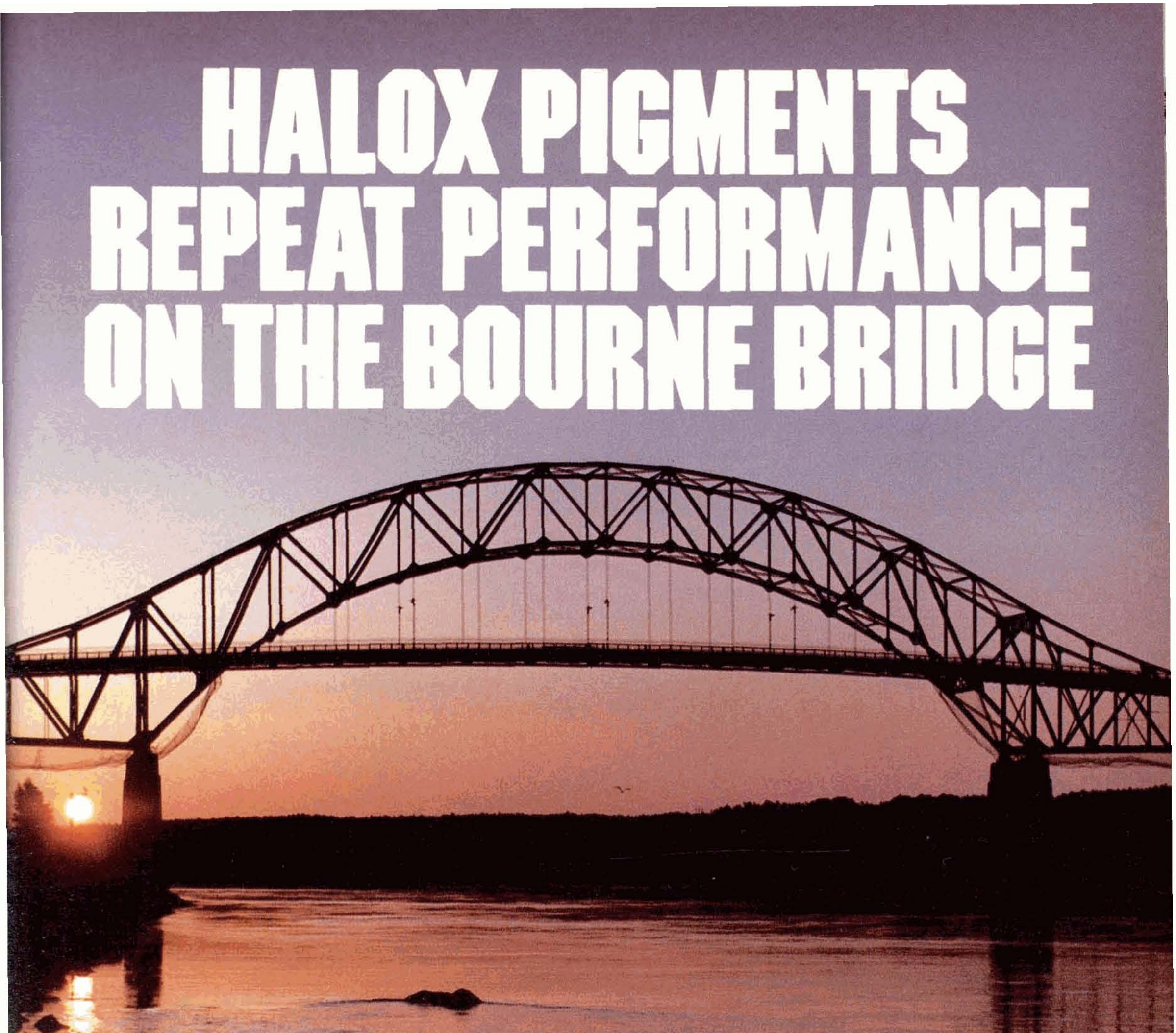
- Ashland Chemical Co. ... 425
- B&P Environmental Resources, Inc. ... 545
- The Pfaudler Co. ... 230

Accelerated Weathering

- Advanced Coating Technologies, Inc. ... 338
- Atlas Electric Devices Co. ... 701
- Louis P. Batson Co. ... 617
- DSET Laboratories, Inc. ... 416
- Erichsen Instruments, Inc. ... 858
- Harshaw/Filtrol Partnership ... 730
- Q-Panel Co. ... 1009
- South Florida Test Service, Inc. ... 701
- Suga Test Instruments Co., Ltd. ... 248

Coatings Application

- Byk-Chemie USA ... 531
- CEM Corp. ... 449
- Erichsen Instruments, Inc. ... 858



Lead- and chromate-free corrosion protection—HALOX calcium borosilicate pigment—specified for bridge painting and repainting!

In 1979, for the first time, a traditional alkyd paint system incorporating HALOX CW-2230 calcium borosilicate pigment was selected for rehabilitation and regular maintenance of the landmark Bourne Bridge over the Cape Cod Canal. The reasons then: paint system protection and performance in accelerated testing and field exposures...non-toxic environmental protection...anticipated service life... and the expectation of cost-effectiveness using established coatings technology and application techniques.

In 1986, the same system containing the same HALOX pigment was specified for regularly scheduled repainting. The reasons now are the same as in 1979—plus the proof of experience over the years. They are also the reasons why HALOX pigments protect all sorts of other local and interstate bridges, ramps, overpasses, and viaducts. For your reference, send a request on your letterhead for a copy of Bourne Bridge systems specifications and typical formulations, or contact HALOX for any other application information and detailed product data.

HALOX ®

Advanced technology applied against corrosion

HALOX PIGMENTS
Manor Oak One, 1910 Cochran Road
Pittsburgh, PA 15220, (412) 344-5811
A DIVISION OF HAMMOND LEAD PRODUCTS, INC.

HOTEL ROOM AND SUITE RATES[1]

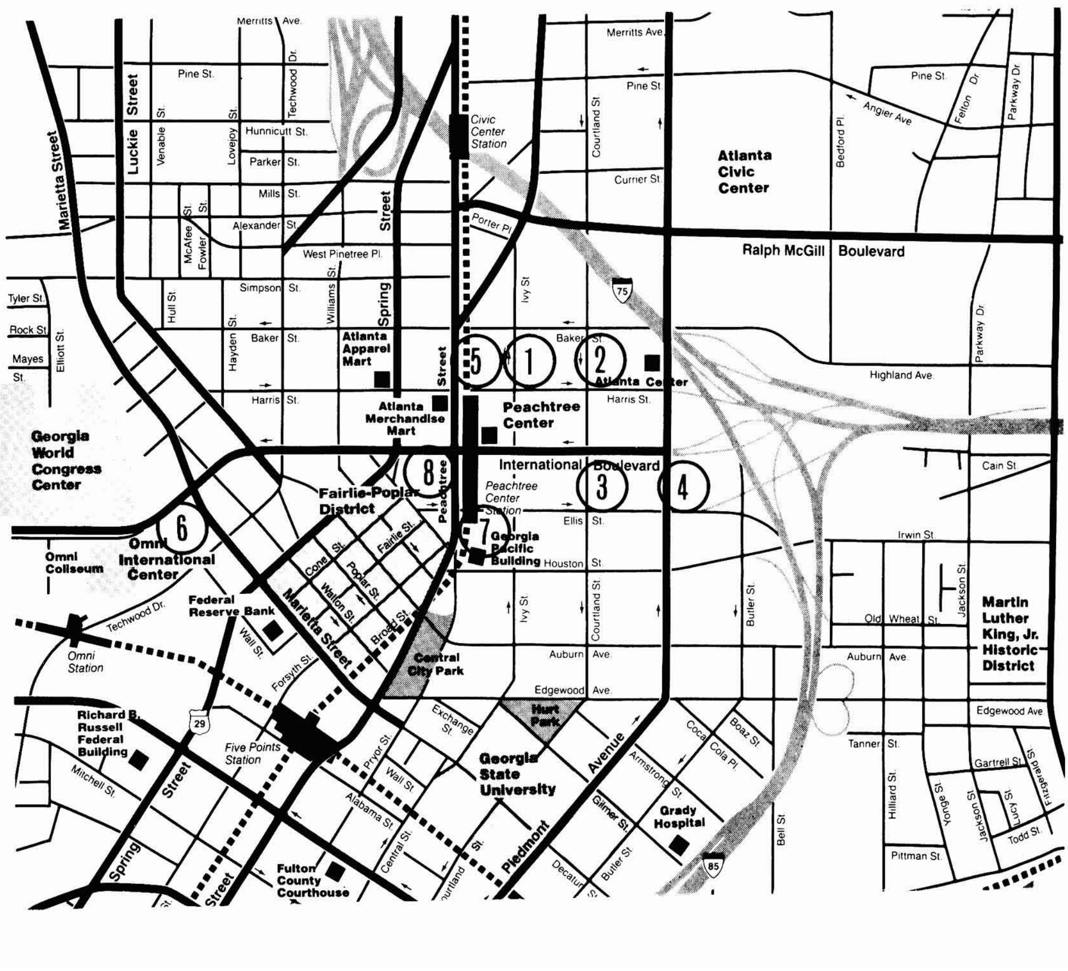
No. on Map	Hotel	Singles	Doubles	Suites
1.	**Marriott Marquis[2] (FSCT Headquarters)**	88/98/108 150 Concierge	108/118/128 170 Concierge	$275 & up
2.	**Hilton & Towers[3]**	82/92/102 135 Towers	102/112/122 155 Towers	250 & up
3.	**Marriott Downtown**	79	90	225 & up
4.	**Holiday Inn**	68	68	—
5.	**Hyatt Regency**	82/92/102	104/108/116	225 & up
6.	**Omni International**	88/98/108	108/118/128	250 & up
7.	**Ritz Carlton**	99/109	119/129	350 & up
8.	**Westin Peachtree Plaza**	80/90/100	90/100/110	250 & up

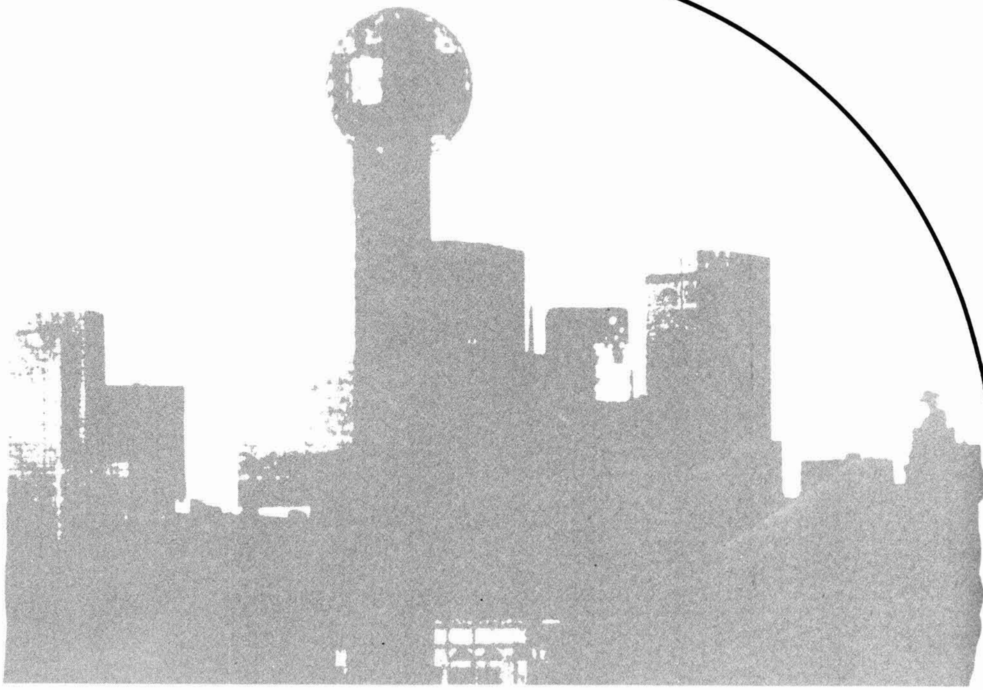
(1) All room rates are subject to an 8% City and Occupancy Tax.

(2) Requests for accommodations at the Marriott Marquis will be limited to six rooms per company. A parlor counts as one room.

(3) Reservations for the Atlanta Hilton will be accepted for arrival beginning Wednesday, November 5, only.

Note: Most hotels require deposits. Please read your confirmation carefully. If a deposit is required, please mail directly to the hotel.





1987 Paint Industries' Show

Dallas Convention Center • Dallas, Texas
Monday, Tuesday, and Wednesday • October 5, 6, 7, 1987
Sponsored by Federation of Societies for Coatings Technology

Battelle Offers Three-Phase Development and Commercialization Program

Coating companies now can cost-effectively evaluate new processes and products before making large investments in equipment, facilities, and marketing programs.

The new approach, being offered by Battelle, enables firms to enter into a phased program in coatings technology development and commercialization.

In the first phase, researchers demonstrate the technical feasibility of the concept. The second phase involves limited pilot-plant manufacturing of products at Battelle, along with the opportunity for a client to obtain licensing rights to the technology as applied to the client's product.

The final phase provides several options for mutual involvement by the client and Battelle in the firm's long-term production operations. These relate to equipment, layout, training, test marketing, and manufacturing ventures.

Being offered by the Electronic Materials and Advanced Coatings Section at Battelle's Columbus Division, this approach makes Battelle's coating expertise available for production-scale applications for a variety of deposition processes including:

- Chemical vapor deposition
  Conventional CVD
  Low pressure CVD
  Packed bed CVD
  MO-CVD
  Plasma CVD
  Laser CVD
- Physical vapor deposition
  Vacuum evaporation
  Magnetron sputtering
  Reactive sputtering
  Ion plating
  Plasma polymerization
  Ion beam deposition
- Thermal spray coatings
  Plasma arc spray
  Inert chamber plasma arc
  Flame spray
  Hypersonic powder spray
  Electric arc spray

Battelle's Dr. J. Wesley Cox says, "This arrangement enables companies to enjoy the traditional benefits of contract research, with the added attractions of phased development investments and the evaluation of market acceptance of new products before expenditure of large amounts of funds."

In the limited manufacturing phase, he explains, Battelle can produce an agreed-upon quantity of a prototype coating for the client to test in the marketplace. Battelle can work with the company in such aspects as: product conception; materials and process development; product coating; manufacturing cost analysis; market analysis; and product testing and market evaluation.

Additionally, Battelle technical experts can aid clients in deciding upon and installing on-site manufacturing equipment as well as with layout and facility modification.

Other services include manufacturing start-up, employee training, and quality control, Dr. Cox said.

Currently, Battelle coatings specialists are concentrating their efforts on four critical areas of application: corrosion and wear; structural and advanced composites; electronics and optics; and submicron particulates.

Further information may be obtained from Dr. J. Wesley Cox, Battelle's Columbus Division, 505 King Ave., Columbus, OH 43201.

Reichhold Adhesives Technology Licensed to People's Republic

The Emulsion Polymers Division of Reichhold Chemicals, Inc., Dover, DE, has licensed its technology for the production of vinyl acetate ethylene emulsion polymers to the China National Construction Co., the People's Republic of China.

As part of the agreement, a 15,000 metric ton/year plant will be built in Beijing, in the People's Republic, and operated by the Beijing Organic Chemical Co. Reichhold will supply the technology, a basic engineering package for high efficiency production of the polymers, including high-pressure reactors, computerized process controls, and other specialized equipment. The facility is scheduled to begin production in March 1988.

Reichhold technology will also be used by two other Chinese firms: Eastern Chemical Co., for the production of acrylic emulsions used in adhesives and Tianjin Paint Co., for manufacturing coatings emulsions.

Morton Thiokol Acquires Powder Coatings Business

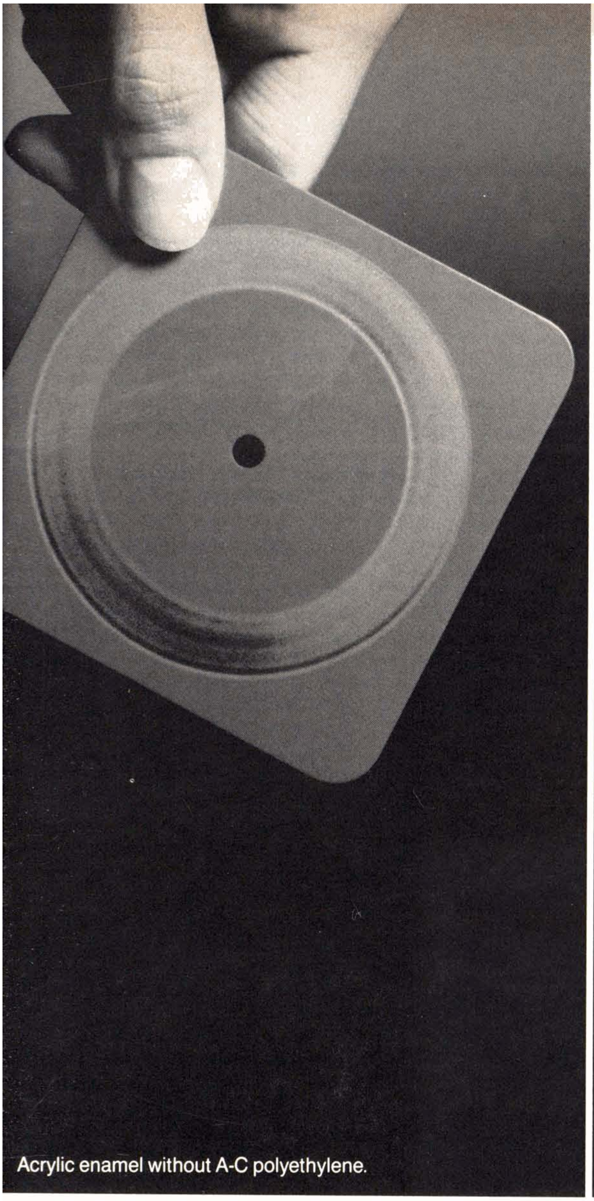
Morton Thiokol, Inc., Chicago, IL, has announced the acquisition of the powder coatings business of The Polymer Corp., Reading, PA, a wholly-owned subsidiary of Chesebrough-Pond's, Inc. The new acquisition is to be merged with Morton Chemical Division's existing powder coatings business (Armstrong Products, Warsaw, IN) and will be headquartered in Reading, PA.

Under the direction of Thomas J. Scattoloni, Vice-President, Powder Coatings, the new organization will operate as the Powder Coatings Group within the Morton Chemical Division. Manufacturing centers will be located in Reading, PA; Warsaw, IN; and Wyethville, VA. Sales offices have been established in Cincinnati, OH; Detroit, MI; Kansas City, MO; and Los Angeles, CA; as well as the new headquarters in Reading.

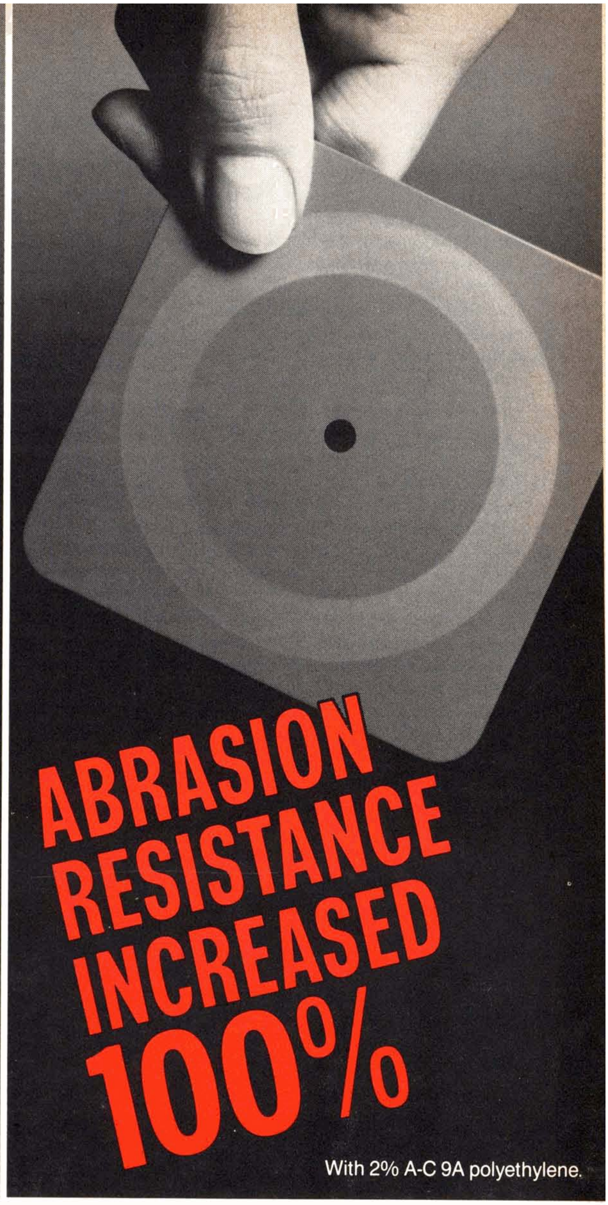
BASF Invests $25 Million in Geismar Facility

BASF Corporation, headquartered in Parsippany, NJ, has begun construction of a $25 million specialty chemicals plant at its Geismar, LA, facility. Slated for completion in October 1987, the new plant will manufacture tetrahydrofuran (THF) and polytetrahydrofuran (PTHF) and employ 26 full-time employees.

BASF Corporation is wholly-owned by BASF AG of West Germany. The Geismar plant has been in operation since 1958 and is BASF's largest chemical facility in the U.S.



Acrylic enamel without A-C polyethylene.



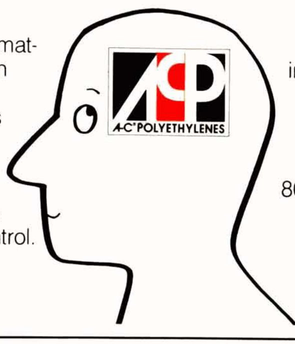
With 2% A-C 9A polyethylene.

WE ALSO HAVE SOME SMOOTH IDEAS TO HELP YOU IMPROVE SLIP, MOISTURE BARRIER AND OTHER PROPERTIES IN FINISHES AND COATINGS.

This demonstration shows how you can dramatically improve Taber abrasion resistance with just a small amount of A-C® Polyethylene.

But the beauty of this family of additives is more than skin deep.

A-C polyethylene waxes are also surprisingly cost-effective in improving rheological properties, grease and moisture resistance, melt flow, lubricity, and gloss control.



With years of experience applying these additives to finishes and coatings, our industry team can quickly help you zero in on the one best answer to your problem—even if it means creating a special wax for you.

Call or write for a free consultation or for our detailed, illustrated bulletin: 800-222-0094 (In New Jersey, 800-222-0095.) Accounts Manager, A-C® Polyethylene, Allied Corporation, P.O. Box 2332R, Morristown, NJ 07960.

ALLIED

Arco Chemical to Streamline Operations

Arco has announced that Arco Chemical Co. will expand its urethane-related and polystyrenics businesses. The company also plans to separately organize and consider as divestiture candidates its Arco Building Products unit, ChemLink group, and specialty chemicals and advanced materials units.

Arco Chemical, headquartered in Philadelphia, PA, is a division of Atlantic Richfield Co. and manufactures propylene oxide at company facilities in the U.S., Europe, and at a joint-venture facility in Japan. A $300 million new facility is under construction in southern France and is scheduled for completion in 1988.

Seegott Moves Headquarters

Seegott, Inc., has moved its corporate headquarters and northern Ohio warehouse to Solon, OH, a suburb of Cleveland. The new facility features specially designed offices and an adjoining warehouse.

The firm distributes to the chemical processing industries in 14 states. Branch offices are located in Pittsburgh, PA; Detroit, MI; and Cincinnati, OH; and affiliates operate in Parsippany, NJ and Baltimore, MD.

DeSoto Obtains 50% Equity in European Finishes Firm

DeSoto, Inc., Des Plaines, IL, has acquired 50% of the shares of Dufay Titanine p.l.c., Shildon, County Durham, England. The $6 million stock purchase agreement combines DeSoto with Dufay's Titanine Aircraft Finishes division, creating a new operation to be known as DeSoto Titanine. The new entity will supply aerospace coating products for commercial and military application worldwide.

Dufay manufactures coatings and finishes for the appliance, maintenance, and marine paints industries. The remaining stock is controlled by BTP p.l.c., Manchester, England.

ICI Purchases Glidden's US/Canadian Operations

Hanson Industries, New York, NY will sell the United States and Canadian operations of the Glidden Coatings & Resins Division of the SCM Corporation to Imperial Chemical Industries for approximately $580 million in cash. These businesses were bought by Hanson earlier this year as a division of SCM Corporation.

Glidden's headquarters are in Cleveland, OH. The company operates 12 manufacturing units and has 4500 employees in North America.

Resins Facility Planned by CIBA-GEIGY

CIBA-GEIGY Corp., Hawthorne, NY, will centralize and expand production of epoxy resins in McIntosh, AL, as it phases out industrial chemical synthesis at its Toms River, NJ, site. The phasing-in process will take place over the next several years. The McIntosh site includes a liquid epoxy resin and polyester resins plants which were completed in 1984.

Resins produced at Toms River include solid epoxies and many specialty products. The company plans to build a $90 million facility for pharmaceutical active ingredients at this location.

Rhone-Poulenc Increases Production Capacity

Rhone-Poulenc, Monmouth Junction, NJ, will increase its production capacity for two major components of polyurethane coating—the biuret (HDB) and trimer (HDT) derivatives of the hexamethylene diisocyanate (HDI).

The products, which have been marketed by the firm for three years, will be produced on two sites: Pont-de-Claix in France, and Freeport, Texas. The company plans a total capacity of 10,000 MT per year, divided equally between the two sites, which will be on stream by the end of 1987.

Tammsco Is Now Subsidiary of Unimin of Connecticut

Unimin, New Canaan, CT, has announced that Tammsco, Inc. has become a wholly owned subsidiary. Tammsco, Inc. will continue to operate with existing personnel and management in Tamms, IL.

Unimin operates 14 industrial silica mines and processing plants in the U.S. and a mica and primary kaolin mine in North Carolina.

Styrene Copolymers: Their Origin and Development

Raymond B. Seymour
University of Southern Mississippi*

Polystyrene is usually considered too brittle for use as a coating. However, it is useful as both a coating and a plastic when flexibilized by the addition of natural or synthetic elastomers. Copolymers with butadiene or isoprene and graft copolymers of styrene and acrylonitrile and butadiene are also used in coatings and for tough plastics. The terpolymer of styrene-maleic anhydride and acrylonitrile and blocks of styrene-maleic anhydride copolymers with elastomers are being used as coatings and as engineering plastics.

INTRODUCTION

Styrene monomer (SM) and its polymer (PS) were known over 150 years ago but commercialization was delayed because of a lack of knowledge of polymer science and because of the inherent brittleness of PS. In 1839, a pharmacist named Simon distilled storax resin and obtained a liquid which he called styrol.[1] When heated in sunlight, this oil produced a solid which he called styrol oxide.

In 1841, Gerhardt and Cahours obtained a similar product called cinnamol, by the distillation of cinnamic acid.[2] In 1845, Blyth and Hofmann repeated Simon's investigation and coined the name metastyrol to characterize the solid product.[3]

In 1866 and 1868, Berthelot[4] and Wagner[5] showed that styrol was converted to a solid in the presence of sulfuric acid or sodium hydroxide. In 1866, Erlenmeyer used the name vinylbenzene instead of styrol.[6] Many years later, this monomer was synthesized by the dehydration of phenylethyl alcohol[7] and by the dehydrogenation of ethylbenzene.[8] Yet, there was very little information available on polystyrene prior to the 1920's when Staudinger polymerized styrene monomer and wrote the correct structure for polystyrene.[9]

HIGH IMPACT POLYSTYRENE

In 1913, Matthews flexibilized this brittle material by polymerizing a solution of styrene and rubber.[10] Over a decade later, this high impact polystyrene (HIPS) was patented by Ostromislensky.[11] In 1943, Seymour obtained HIPS by blending polystyrene with copolymers of styrene and butadiene.[12]

During World War I, Boyer and McIntire commercialized Ostromislensky's HIPS.[13] Guss and Amidon provided interpolymer HIPS blends by the emulsion copolymerization of different ratios of styrene and butadiene. These HIPS, which were called Styralloy by Dow, were replaced after World War II by an emulsion copolymer of styrene (60) and butadiene (40). The latter was the basis for many latex paints and paper coatings.

Later, Dow made an interpenetrating network polymer by the bulk polymerization of a solution of SBR in styrene.[14] According to Boyer, Dow enjoyed overwhelming success in the marketplace with its Styron 475 brand HIPS. After considerable litigation, the Amos stirring process for making HIPS was declared invalid. Goodyear also produced a nonelastic styrene-butadiene copolymer which was used as a coating in place of cyclized rubber (Pliolite).

The emulsion polymerized SBR used to flexibilize PS has been replaced, to some extent, by solution polymers prepared by the anionic polymerization of butadiene.[15] Blends of block styrene-butadiene copolymers and PS are also used to produce HIPS.[16]

A diblock copolymer of styrene and butadiene (SB) called Solprene and K-resin was produced by the anionic

Presented in part at the American Chemical Society's Symposium on History of High Performance Polymers, New York City, 1986.
*Department of Polymer Science, Southern Station, Box 10076, Hattiesburg, MS 39406.

polymerization technique by Phillips Petroleum Company.[17-19] S-B-S tri-block, called Kraton, was introduced by Shell in the 1960's.[20-22]

The first styrene copolymer was a copolymer of a nonpolymerizable monomer viz., maleic anhydride and styrene (SMA).[23] This copolymer was not readily molded and was soluble in alkaline solutions. The copolymer of styrene and acrylonitrile (SAN) was patented by I.G. Farbenindustrie in the early 1930's but was not used, to any great extent, until after World War II.

STYRENE-ACRYLONITRILE COPOLYMER

SAN has been produced commercially by bulk, suspension, and emulsion polymerization techniques. In all cases, it is essential to remove the unreacted acrylonitrile monomer because of its toxicity and because it may form a homopolymer during subsequent thermal processing. The homopolymer will discolor when heated because of the formation of a cyclic product called "black Orlon."

The strength of SAN is related to the AN content. Copolymers with higher AN content than 78% are no longer amorphous and have reduced strength due to the presence of acrylonitrile homopolymer.[24] The barrier properties (impermeability to gases) of SAN are also related to the AN content.[25]

Acrylonitrile, like maleic anhydride, tends to form alternating copolymers with styrene.[26] The glass transition temperature of these SAN copolymers is related to the AN content.[27]

It is not possible to produce blocks of styrene of acrylonitrile macroradicals because of large differences in solubility, but block copolymers of styrene and acrylonitrile have been produced by reversing the order, i.e., adding acrylonitrile to styrene macroradicals.[28] The solubility parameters for SAN with varying amounts of AN have been reported.[29]

RAYMOND B. SEYMOUR has been associated with the coatings industry for a half a century. He invented and patented commercial protective coatings while employed by Goodyear (1937-1939), Atlas Mineral and Chemical Company (1939-1941, 1949-1955), and Monsanto (1941-1945). He is the author or coauthor of "National Paint Dictionary" (1948), "Hot Organic Coatings" (1959), "Plastic Mortars, Sealants and Caulking Compounds" (1969), "Macromolecular Solutions" (1982), and "Polymer Chemistry: An Introduction" (1981, second edition 1986), 25 other polymer-oriented books, 45 U.S. patents and over 1,400 technical publications.

He was born in Brookline, MA, and received a B.S. Degree in Chemical Engineering and an M.S. Degree in Chemistry from the University of New Hampshire and a Ph.D. Degree in Chemistry at the University of Iowa. He is an Emeritus Professor of Chemistry at the University of Houston and has been a Distinguished Professor of Polymer Science at the University of Southern Mississippi since 1976.

TERPOLYMERS AND BLOCKS BASED ON SAN

Since the ductility of PS has been improved by blending with natural and synthetic elastomers, it is logical to improve the ductility of SAN by similar techniques. The first products called ABS terpolymers were blends of SAN and NBR. While this ductile polymer was much more useful than SAN, it was inferior to graft copolymers of SAN and elastomers and to many other proprietary compositions which are included in the ABS classification.

The first commercial ABS was marketed by Borg-Warner Corp. after that company acquired Marsene Corporation in 1934. W. Calvert, who was using butyl rubber to flexibilize cyclized rubber, extended this investigation to the flexibilization of SAN and used the trade name Cycolac to describe this product.[30]

Improved resistance to weathering of ABS has been achieved by the substitution of acrylic elastomers for butadiene elastomers (ASA). Transparency has also been improved (light transmission 85%) by the substitution of methyl methacrylate for acrylonitrile (MBS). Even higher light transmission (90%) is obtained by the copolymerization of styrene and methyl methacrylate (MAS).

POLYPHENYLENE OXIDE

A. Hay, of G.E., produced polyphenylene oxide (PPO) by amine-copper catalyzed oxidation (by oxygen) of 2,6-dimethylphenol. PPO could be molded with difficulty, but was readily molded when blended with polystyrene. These blends are marketed under the trade name of Noryl.

STYRENATED OILS

Copolymers of conjugated fatty acids, such as α-eleostearic acid and styrene are produced by heating the reactants at elevated temperatures.[31] Reaction temperatures of at least 100°C must be used when styrene is reacted with non-conjugated fatty acids.[32] It is believed that the polystyrene produced reacts with the unsaturated fatty acid to yield graft copolymers (styrenated oils).[33] These oils have been replaced to a large extent by styrenated alkyds which are prepared by heating mixtures of styrene and alkyds.[34]

UNSATURATED POLYESTERS

In the 1930's, C. Ellis patented solutions of unsaturated polyesters in styrene.[35,36] These so-called unsaturated polyesters were admixed with fibrous glass and polymerized to produce polyester laminates (FRP). FRP has also been produced by the polymerization of solutions of styrene and vinyl esters of epoxy resins (vinyl esters) which are marketed under the trade name of Epocryl and Derakane resins.[37]

STYRENE MALEIC ANHYDRIDE

Because of its high softening point, the copolymer of styrene and maleic anhydride was not readily moldable.[38] Hence, the early uses of this copolymer were restricted to alkaline solutions whose viscosity could be increased by controlled crosslinking with traces of divinylbenzene (Stymer).[39] The flexibility was also improved by partial esterification of SMA. The half esters of SMA have been used as viscosity control agents in crude petroleum.[40]

In addition to being used as a textile assistant, dye paste, and dispersant, SMA was reacted with polyethylene oxide (Carbowax) to produce bonded fabrics.[41] Heavy metal salts of SMA were also used as controlled release biocides.[42]

Another styrene copolymer with heat resistance superior to polystyrene is a copolymer of styrene and fumaronitrile.[43] Fumaronitrile, like the corresponding anhydride (maleic anhydride), does not form homopolymers but copolymerizes with styrene to produce a copolymer with as much as 40% fumaronitrile. Because of the bulky groups present, this copolymer is only partially alternating, i.e., the sequence is not BABA but BABAA where B represents the fumaronitrile monomer and A represents styrene.

Monsanto attempted to commercialize the fumaronitrile copolymer under the trade name of Cerex. However, in spite of its superior thermal properties, the copolymer contained residual fumaronitrile which is a potent vesicant. Hence, plans for the commercialization of Cerex were abandoned in the early 1950's.

Nevertheless, a terpolymer of styrene-maleic anhydride and acrylonitrile (S/MA/AN) met the specifications of superior thermal properties but it was difficult to injection mold using the plunger-type presses available in the early 1940's. This objection was overcome by blending with NBR, SBR, or HIPS.

This terpolymer (S/MA/AN) and blends of SMA were investigated, patented, and produced in a pilot plant in the early 1940's under the trade name of Cadon.[44] However, because of a determination to commercialize Cerex and the resignation of the copatentees of Cadon, the excellent properties of this pioneer engineering polymer were overlooked until the patent had expired and other firms offered commercial polymers based on SMA.

K.W. Doak, of Koppers, in cooperation with G.N. Gaylord, C. Overberger, V. Stannett, and R. Porter reinvestigated SMA in 1956 and a pilot plant for random copolymers of SMA was built under contract with Sinclair-Koppers. Sinclair Oil which merged with Atlantic Richfield assumed half ownership of Sinclair-Koppers and produced SMA in the late 1960's. The name of Sinclair-Koppers was changed to Arco, which is now a division of Atlantic Richfield Corp. Arco produces a series of SMA copolymers under the trade name of Dylark.

The tendency for alternation of monomers in styrene-maleic anhydride and styrene-acrylonitrile copolymers at moderate temperatures has been attributed to the formation of a charge transfer complex (CTC) between a donor (D) and an acceptor (A). This CTC is readily detectable by UV or NMR spectroscopy. More important, the equilibrium constant decreases as the temperature is increased and this effect can be followed by instrumental analysis. Thus, it is possible to extrapolate to a higher temperature at which the CTC does not exist.[45] Thus, by proper temperature control, it is possible to produce SMA alternating copolymers, block copolymers of vinyl monomers with both alternating and random SMA[46] and completely random copolymers of SMA.[47]

Monsanto has extended the SMA terpolymer (Cadon) investigation to include random copolymers and alternating copolymers in which the copolymers of SMA are acrylonitrile, ethyl acrylate, isobutylene, methyl acrylate, and methyl methacrylate.[48] These terpolymers (S/MA/X) and rubber modified Cadon have created an entire new family of engineering polymers.[49] New patents have been issued for both glassy terpolymers and rubber-modified S/MA/AN.[50, 51] As might be expected, the incompatible blends are characterized by two glass transition temperatures (T_g).[52]

New patents have also been issued on rubber-modified Cadon,[53] SMA grafted on EPDM,[54] terpolymers with alpha-methylstyrene (S/MA/AN/AMS),[55, 56] S/MA/AN,[57] blends of SMA and HIPS,[58-60] and SMA/PPO.[61]

SUMMARY

In spite of being known for over 150 years, styrene polymers had limited use until after World War II. The use of polystyrene in coatings has been limited because of its lack of ductility. However, blends of polystyrene with elastomers (HIPS) are more flexible.

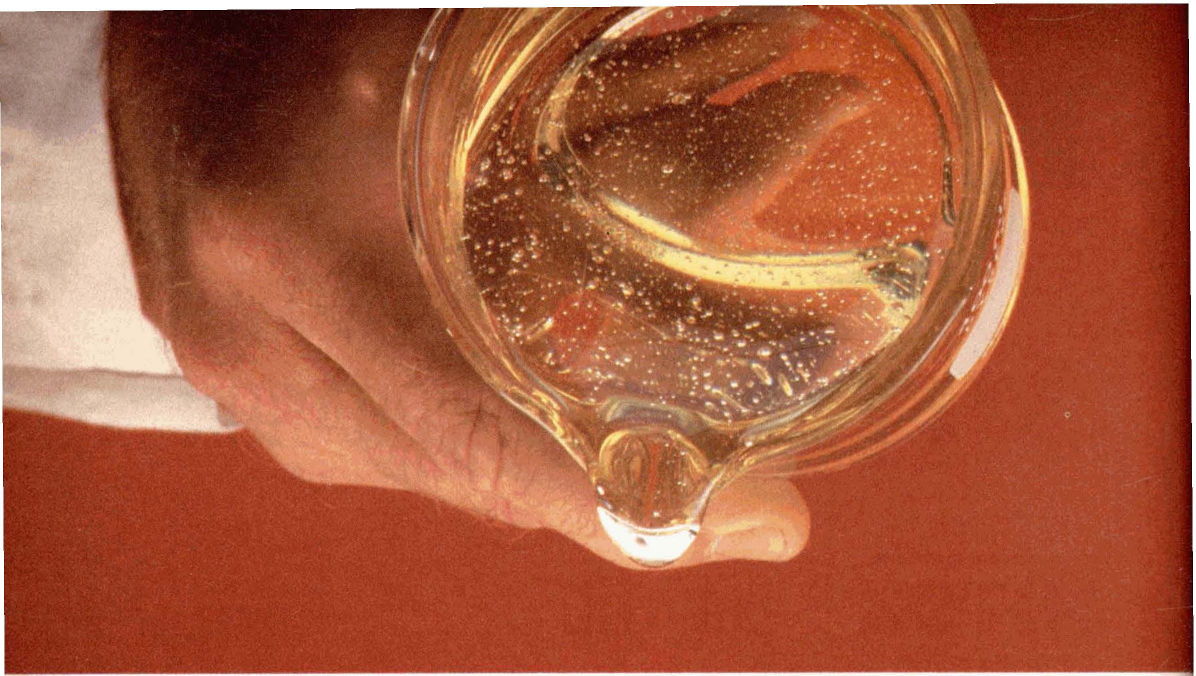
More ductile products have been obtained by making blends of block copolymers of styrene and acrylonitrile copolymers and elastomers. Styrenated oils have been produced by heating styrene and unsaturated fatty acids but these have been displaced by styrenated alkyds.

Solutions of unsaturated polyesters of styrene have been polymerized to produce protective coatings and laminates. Engineering polymers have been produced from blends of terpolymers of styrene-maleic anhydride copolymers with elastomers or acrylonitrile. These commercial products are being widely used by both the coatings and plastics industries.

References

(1) Simon, E., *Ann.*, *31*, 265 (1839).
(2) Gerhardt, C. and Cahours, A.A.T., *Ann.*, *38*, 96 (1841).
(3) Blyth, J. and Hofmann, A.W., *Ann.*, *53*, 289 (1845).
(4) Berthelot, M., *Bull. Soc. Chim. France*, *6*, 294 (1866).
(5) Wagner, G., *Ber.*, *11*, 1258 (1868).
(6) Erlenmeyer, E., *Ann.*, *137*, 353 (1866).
(7) Sabatay, S., *Bull. Soc. Chim. France*, *45*, 69 (1920).
(8) Ostromislensky, I. and Sheppard, M.G., U.S. Patent 1,552,543 (1924).
(9) Staudinger, H., "Die Hochmol Org. Verbind," Springer, Berlin, 1932.
(10) Matthews, F.W., Fr. Patent, 459,134 (1913).
(11) Ostromislensky, I., U.S. Patent 1,643,673 (1927).
(12) Seymour, R.B., U.S. Patent 2,574,438 (1951).
(13) Boyer, R., Chapter 20 in "History of Polymer Science and Technology," Seymour, R.B., Ed., Marcel Dekker, New York, NY 1982.
(14) Amos, J.L., McIntire, O.R., and McCurdy, J.L., U.S. Patent 2,694,692 (1954).
(15) Forman, L.E., in "Polymer Chemistry of Synthetic Elastomers," Vol. II, Kennedy, J.P. and Tornqvist, E.G.E., Eds., Interscience, New York, NY 1969.
(16) Durst, R.E., U.S. Patent 3,906,057; 3,906,058; 3,907,929; 3,907,931 (1975).
(17) Kirkland, C., *Plast. Technol.*, *29*, (10) 49 (1983).
(18) Crouch, W.M. and Short, J.N., *Rubber Plastics Age*, *42*, 276 (1961).

(19) Railsback, H.E. and Short, J.N., *Rubber Plastics Age, 94,* 583 (1964).
(20) Porter, L.M., U.S. Patent 3,149,182 (1964).
(21) Bailey, J.T., Bishop, E.T., Hendricks, W.R., Holden, G., and Legge, N.R., *Rubber Age,* Oct., 1966.
(22) Legg, N.R., Davison, S., De La Nare, H.F., Holden, G., and Martin, M.K., Chapter 9 in "Applied Polymer Science," Tess, R.W. and Pohlein, G.E., Eds., American Chemical Society, Washington, D.C., 1985.
(23) Wagner-Jauregg, T., *Ber., 63,* 343 (1930).
(24) Hendy, B. N., *Adv. Chem. Ser.,* 142, 115 (1975).
(25) Hall, W. J. and Chi, H. K. SPE NATEC, Cleveland, OH, Oct. 1976.
(26) Seymour, R. B., Garner, D. P., Stahl, G. A., Knapp, R., and Sanders, L., *Polymer, 18,* 128 (1977).
(27) Johnson, N. W., *J. Macromol Sci.-Rev. Macromol. Chem. C14,* 215 (1976).
(28) Seymour, R. B., Stahl, G. A. and Wood, H., *Polymer Preprints, 16,* (1) 470 (1975).
(29) Seymour, R. B. and Wood, A. A., Chapter 8 in "Structure-Solubility Relationships in Polymers," Seymour, R. B. and Stahl, G. A., Eds., Academic Press, New York, NY 1977.
(30) Calvert, W., U. S. Patent 3,238,275 (1966).
(31) Croft, J., *J. Appl. Chem. (London), 5,* 88 (1955).
(32) Mayo, F. R. and Gould, C. W., *J. Am. Oil Chemist. Soc., 41,* 25 (1964).
(33) Ridknap, E. J., *J. Oil & Colour Chemist's Assn., 43,* 260 (1960).
(34) Kovacs, L. and Charlesworth, *D., J. Oil & Colour Chemists' Assn., 46,* 47 (1963).
(35) Ellis, C., U. S. Patent 2,195,362 (1964).
(36) Ellis, C., U. S. Patent 2,255,313 (1941).
(37) Launikitus, M. B., Proceedings 31st SPI Annual Conf., 1976.
(38) Wagner-Jauregg, T., I. G. Farbenindustrie, Brit. Patent 376,479 (1932).
(39) Seymour, R. B., U. S. Patent 2,574,438 (1951).
(40) Miller, R. F., Chapter 13 in "The Effect of Hostile Environments on Coatings and Plastics," Garner, D. P. and Stahl, G. A. Eds., *ACS Symposium Series, 229* (1983).
(41) Seymour, R. B. and Schroeder, G. M., U. S. Patent 2,456,803, 4, 5, 6 (1949).
(42) Seymour, R. B., U. S. Patent 2,577,041 (1951).
(43) Fordyce, R. G., Chapin, E. C. and Ham, G. E., *J. Am. Chem. Soc., 10,* 2489 (1948).
(44) Seymour, R. B. and Kispersky, J. P., U. S. Patent 2,439,227 (1948).
(45) Seymour, R. B. and Garner, D. P., *Polymer,* 17 (1) 22 (1976).
(46) Seymour, R. B., Kincaid, P. D. and Owen, D. R., *ACS Adv. Chem. Ser.,* Washington, D.C., 1973.
(47) Muskat, I. E., U. S. Patent 3,085,934; 3,175,335 (1963); 3,338,106; 3,418,292 (1965); 3,415,979 (1969).
(48) Hall, W. J., Kruse, R. L., Mendelsohn, R. A., and Trementozzi, Q. A. in "The Effects of Hostile Environments on Coatings and Plastics," Chapter 5, Garner, D. P. and Stahl, G. A., Eds., *ACS Symposium Series, 229,* 1985.
(49) Olabisi, O., Robeson, I. M., and Shaw, M. T., "Polymer-Polymer Miscibility," Chapter 5, Academic Press, New York, NY 1979.
(50) Lee, Y. C. and Trementozzi, Q. A., U. S. Patent 4,197,376 (1980).
(51) Lee, Y. C. and Trementozzi, Q. A., U. S. Patent 4,205,869 (1981).
(52) McKnight, W. J., Karasz, F. E., and Fried, F. R., "Polymer Blends," Chapter 5, Paul, D. R. and Newman, S., Eds., Academic Press, New York, NY, 1978.
(53) Lee, Y. C. and Trementozzi, G. A., U. S. Patent 4,241,695 (1982).
(54) Japan Synthetic Rubber KK Ja. P. 82-031,913 (1982).
(55) Mitsubishi Rayon KK Ja. P. 81-081,322 (1981).
(56) Monsanto, U. S. Patent 4,298,716 (1981).
(57) Mitsubishi Monsanto KK Ja. P. 81-041,215 (1981).
(58) Arco, U. S. Patent 4,325,037 (1982).
(59) Arco, U. S. Patent 4,336,354 (1982).
(60) G. E., U. S. Patent 4,108,925 (1978).



CIBA-GEIGY epoxy resins and the winning battle against VOC's.

Now, for the first time, you can formulate low-solvent or solvent-free coatings with an epoxy phenol novolac resin.

It's common knowledge that epoxy phenol novolac resins possess outstanding resistance to elevated temperatures as well as to chemicals.

Yet, due to their extremely viscous nature, employing these resins in coatings formulations has required solvent levels as high as 50% by volume. Quite naturally, this has severely limited their use.

A technological award-winner.

Today, however, there's a new epoxy phenol novolac from CIBA-GEIGY that's a veritable breakthrough. This resin is so unique and so much less viscous than its predecessors it's received an IR-100 award as one of the most significant technological developments of the year.

A break with the past.

Called XB 3337, the uniqueness of this extraordinary resin lies in the fact that it possesses three to as much as thirty times lower viscosity than previous commercial EPN resins.

Used with appropriate curing agents, XB 3337 can be

At room temperature, conventional epoxy phenol novolac resins (left) are thick and virtually uhmoving. While XB 3337 from CIBA-GEIGY (right) proves its remarkably low viscosity by pouring freely.

formulated without high levels of environmentally objectionable solvents—thereby extending the significant advantages of multifunctional epoxy phenol novolac resins to applications that can most benefit from them. These include chemical processing plants, pipelines, marine structures, pulp and paper mills, refineries, food and beverage processing plants.

Resin XB 3337: typical properties

Visual Appearance	Clear
Color, Gardner	6 max.
Viscosity at 25°C, cP	30,000 to 50,000
Epoxy Value, eq/100g	0.54-0.58
Weight per Epoxide	173-185
Hydrolyzable Chlorine, %	0.12 max.
Total Chlorine, %	0.4 max.
Pounds per gallon, lb.	10
Volatile content, %	0.1 max.

High performance with environmental safety.

With the typical properties shown below, XB 3337 is recommended for solvent-free and high solids coatings for ambient temperatures and high temperature service—thereby setting a whole new standard for epoxy phenol novolac resins.

Among its many advantages: low viscosity as compared to other EPN resins; higher functionality than bisphenol A epoxy resins: excellent chemical, heat and solvent resistance; good mechanical properties. In addition, XB 3337 is also compatible in all proportions with liquid bisphenol A and bisphenol F epoxy resins—providing still other possibilities for formulating solventless and high solids coatings.

To learn more, please call Laura Poulos at 800-431-1900 (in New York, 914-347-4700). Or write Plastics Department, CIBA-GEIGY Corporation, Three Skyline Drive, Hawthorne, New York 10532.

CIBA–GEIGY

Unsolved Problems of Corrosion Protection by Organic Coatings: A Discussion

W. Funke,* H. Leidheiser, Jr., R.A. Dickie, H. Dinger
W. Fischer, H. Haagen, K. Herrmann, H.G. Moslé
W.P. Oechsner, J. Ruf, J.S. Scantlebury
M. Svoboda, and J.M. Sykes

FOREWORD

On the instigation of Professor Werner Funke, of the University of Stuttgart, and the Forschungsinstitut für Pigmente und Lacke, a discussion was held at the Institute on May 5-7, 1986. The subject was "Unsolved Problems of Corrosion Protection by Organic Coatings," and the 13 discussion participants are the authors of this article. They include:

W. Funke	Forschungsinstitut für Pigmente und Lacke e.V., Stuttgart, West Germany
H. Leidheiser, Jr.	Lehigh University, Bethlehem, PA
R.A. Dickie	Ford Motor Co., Detroit, MI
H. Dinger	Herberts, Wuppertal, West Germany
W. Fischer	Fachhochschule Hagen, Iserlohn, West Germany
H. Haagen	Forschungsinstitut für Pigmente und Lacke e.V.
K. Herrmann	Daimler-Benz AG, Sindelfingen, West Germany
H.G. Moslé	University Duisburg, West Germany
W.P. Oechsner	Lechler Chemie, Stammheim, West Germany
J. Ruf	Akzo Coatings, Stuttgart-Feuerbach, West Germany
J.S. Scantlebury	University of Manchester, United Kingdom
M. Svoboda	G.V. Akimov State Research Institute for Materials Protection, Prague, Czechoslovakia
J.M. Sykes	Oxford University, United Kingdom

Several months before the meeting, participants were requested to submit critical questions that should be addressed in the areas of (a) metal surface structure and pretreatment of metal surfaces; (b) corrosion mechanisms under coatings and mechanisms of coating failures by corrosion; (c) adhesion of organic coatings on metals; (d) permeability of corrosive agents; (e) anticorrosive pigments and corrosion inhibitors; (f) practical corrosion testing and electrochemical testing of organic coatings; and (g) corrosion protection by coating systems. These questions were assembled and distributed to participants before the meeting. Formal presentations were not made and the meeting was pursued successfully in a true discussion mode.

The participants included three representatives of coating manufacturers, two representatives of coating users, three investigators concerned primarily with practical problems, and five university scientists primarily concerned with fundamentals. There was a very good balance in the discussion between applied problems and fundamental problems.

Each of the participants was asked to submit a short written statement within a few days following the conclusion of the meeting. Profs. Funke and Leidheiser assembled these statements, along with the comments that represented the sense of the discussion during the meeting. The assembled report then was transmitted to all authors, corrections and additions were made, and the final report was composed. It must be recognized that not all statements in the report reflect the exact phraseology or degree of preciseness that suited all authors, but all authors agree that the statements made herein reflect at a minimum a majority viewpoint.

*Forschungsinstitut für Pigmente und Lacke e.V., Allmandring 37, D-7000 Stuttgart 80 (Vaihingen) West Germany.

Fifty critical questions and problems related to corrosion protection by organic coatings are summarized in the subject areas of metal surface structure and pretreatment of metal surfaces, corrosion mechanisms under coatings and mechanisms of coating failures by corrosion, adhesion of organic coatings on metals, permeability for corrosive agents, anticorrosive pigments and corrosion inhibitors, practical corrosion testing and electrochemical testing of organic coatings, and corrosion protection coating systems.

INTRODUCTION

One of the important applications of organic coatings is the protection of metal surfaces from corrosion. A large use of protective coatings is for atmospheric exposure of such products as vehicles, buildings, bridges, appliances, and support structures. Other coatings are required to protect metals from very aggressive industrial fluids and yet others are used to protect underground and underwater structures. Coatings are also used in smaller quantitities to protect expensive components of electronic equipment both during manufacturing and during service. The demands on coating systems cover a very wide range.

The technology of protective coatings has advanced greatly in the past few decades. Automobile coating systems have been developed that, under favorable circumstances, last the lifetime of the vehicle. Water-borne coating systems, high solid systems, and solventless coating systems have been developed that meet all environmental constraints. Anticorrosive pigments are being researched that will help to substitute hazardous lead and chromate materials that have served the industry well in the past. Progress has been made and is being made daily in product laboratories. However, it is fair to say that both coating technologists and coating scientists believe much is unknown and that new processes and new understanding provide catalysts and stepping stones for further progress. It is the authors' hope that this article will serve to focus attention on the unsolved problems and that it will thereby assist investigators in selecting problems for study that offer promise for new major advances.

STATEMENT OF PROBLEMS AND QUESTIONS

Metal Surface Structure and Pretreatment of Metal Surfaces

Thirteen specific questions were raised: several of a very applied nature and others of a very fundamental nature.

(1) What is the influence of steel composition on corrosion protection by organic coatings?

It is well known that carbonaceous material, not removable by organic solvents and present on steel prior to phosphating, has a deleterious effect on the performance of organic coatings used on automobiles exposed to deicing salts. It does not appear, however, that surface carbon is the only element that increases the porosity of the phosphate pretreatment. There is some evidence that manganese and sulfur have a deleterious effect. Perhaps other elements such as copper, nitrogen, and silicon also have an effect on performance. A study of behavior of coating systems in an accelerated test as a function of steel surface composition is needed. Another way to phrase the question is: "What are the mechanisms by which steel surface composition affects phosphate structure, bonding, and resistance against corrosive agents?"

(2) How can one develop a steel surface that is reproducible in chemical composition and reproducible in the distribution of secondary elements on the metal surface?

Coating systems with superior and long-term corrosion protection require a pretreatment that works in conjunction with the organic coating. This pretreatment, or conversion coating, is designed to operate on metals with a reproducible composition. Commercial lots often differ greatly in the alloying agents present at the surface.

(3) How can differences between the performance of protective coatings on low carbon steel and low alloy steels be explained?

Several participants mentioned that better performance of some coating systems was observed on low alloy steels as compared to low carbon steels. Such a behavior suggests that minor changes in steel surfaces composition may have an important effect on the protective properties of organic coatings in aggressive environments.

(4) How does stress in the metal prior to coating affect the performance of the organic coating?

The surface of the metal, prior to coating, may be under a high stress as a result of rolling, deforming, shot peeling, or abrasive blasting. The consequences of this stress, either good or bad, are not known.

(5) How is the protective effect of zinc phosphate layers on aluminum, steel, zinc, and other metal surfaces explained?

Various explanations based on physical and chemical protection, ion exchange properties, and better bonding between the coating and the substrate have been proposed, but proof of the validity of an explanation has not been offered. A better understanding of this system might aid the development of additional superior pretreatment processes.

The location of paint failure on phosphated steel appears to be at or near the phosphate/paint surface interface in some systems and at the metal/phosphate interface in other systems. The rate of failure, and possibly the exact locus, also depends on the composition of the paint. There is a remarkable change in surface appearance and complexity of failures with alkali-resistant paint films. Certain organic post-treatments greatly improve phosphate performance. These observations raise the subsidiary questions: How do phosphate coatings and organic coatings interact? How can interaction be optimized? How does the specific interaction between the phosphate and the coating influence long-term performance?

(6) What is the chemical and physical nature of the bond between a phosphate conversion coating and an organic coating?

Much controversy exists on whether the phosphate, because of its rough crystalline surface, simply provides sites for mechanical locking of the organic coating to the surface or whether the chemistry of the surface bond is the important issue. Techniques are required for studying the phosphate/organic coating interface in a non-destructive way.

(7) How can a phosphate layer be formed that covers the metal surface completely so that no chromate or other finishing step is required?

Industrial phosphating is based on the fact that the metal surface actively corrodes with the formation of anodic and cathodic areas that facilitate the precipitation of phosphate crystals. As soon as 95-99% of the surface is covered with phosphate, the active deposition of phosphate stops and some of the metal surface remains uncoated. Thus, the metal is not completely protected and will rust rapidly at certain sites when immersed in a mildly corrosive medium. Chromate and, more recently, organic inhibitor solutions have been used to provide temporary protection to the uncoated areas. It would be advantageous to have a surface conversion process that provides complete coverage of the base metal without the need for a finishing step. An alternate way to address this question is to determine how pretreatments function and what alternatives to phosphating there are to achieve improved performance.

(8) How can one explain that identical coatings on different production charges of standard-phosphated steel panels behave differently? Why do these differences sometimes occur with certain corrosion tests?

It is the experience of coatings technologists that different panels, ostensibly prepared identically, show different behaviors in such tests as salt spray, scab tests, condensing humidity, etc. In fact, different performances are often observed on different portions of the same panel. The differences may arise from the metal, the pretreatment, the coating, or accidental contaminants picked up during the preparation process. Detective work often discovers the reason for transitory problems on a production line, but no adequate studies of a range of coating systems have been performed.

(9) What is the role of abrasives in controlling the performance of coatings?

Abrasives affect the surface morphology and surface stress, but there is also evidence that the abrasives affect the surface chemistry of the abraded metal. This effect may be on the composition of the oxide film or may result simply from the embedding of the abrasive. Some abrasives have surface compositions different from the bulk composition by choice of the manufacturer or as a result of accidental contamination during processing or storage.

Moreover, it has been claimed that a short exposure of sand-blasted steel to humidity, prior to the appearance of flash rush, may have a beneficial influence on adhesion.

(10) A pretreatment process for many metals is required that removes no material from the metal substrate and yet allows a high resistance to water disbondment.

Electronic devices are often constructed of thin films of metals that must be protected by an organic coating. The thickness of the film is critical and no change in dimension can be tolerated in a pretreatment process. Reactive silanes, silane coupling agents, and titanium coupling agents have been utilized, but superior methods are still needed.

(11) Is the chemical or adhesive bonding at the interface the same when the coating is applied to the metal as when the metal is applied to the coating?

The question is not trite since the processing of electronic components often requires that the metal be evaporated or sputtered onto an organic material. Differences in performance can be expected because the evaporated metal in contact with the organic coating is not expected to be covered with an oxide film and the exterior of a baked coating may be very different in chemical nature than the portion of the coating nearest the metal.

(12) A better knowledge is required of the role of inhomogeneities in the metal surface in causing regions of low electrical resistance in the coating.

Corrosion under protective coatings generally starts locally. These sites are often under regions in the coating which exhibit low electrical resistances. Are the locations of these sites determined by the chemistry and topology of the metal surface or are they caused by inhomogeneities in the coating?

(13) Suitable methods should be found to characterize metal surfaces, conversion layers, and organic coatings as to the relationship between their property profiles and an optimum corrosion protection by the whole system?

Corrosion Mechanisms under Coatings and Mechanisms of Coating Failures

(1) What are the rate-controlling steps in the rusting of steel beneath organic coatings?

There was unanimous agreement among the participants that rusting beneath organic coatings is electrochemical in nature and the mechanism is identical to that of the rusting of bare steel. Of course, there are mass transport steps that differ in the two cases and the corrosion product is confined in a localized area beneath the coating. The consensus was that the probable rate-controlling step for corrosion at the coating/metal interface is the formation of a conductive aqueous phase of a sufficient dimension to support an electrochemical reaction. However, this impression has not been definitely proven and research is needed to answer this question unequivocally. It was also stressed that studies are needed to determine the rate-controlling step in the initiation and the propagation of corrosion.

(2) How can rate-controlling steps in rusting of steel beneath organic coatings be inhibited? How can this knowledge be utilized to reduce the rate of rusting or increase the protective properties of a coating?

An answer to question (1) is required before this question can be addressed.

(3) How many water molecules constitute an aqueous phase?

This was one of the most provocative questions raised at the meeting. An electrochemical reaction requires an aqueous phase and sufficient conductivity within the liquid to permit charge transport. The number of water molecules that constitute an aqueous phase is an important question, but an equally important question is how thick need a water layer be to support an electrochemical reaction?

(4) Is the phenomenon of electroosmosis important in the corrosion protective properties of coatings?

It is well known that an electrical field across the coating may increase the rate of water transport through the coating. Electroosmosis is generally studied in capillary tubes and it is improbable that capillaries of the appropriate dimension and with the appropriate surface properties are present in the coating to support conventional electroosmosis. Additional research of a fundamental nature is required to understand better the effect of an electrical field on the transport of water through an organic coating and in the coating/metal interface.

(5) What is the mechanism of underfilm darkening observed with coatings on steel? What is the composition of this dark layer and what role does it play in corrosion protection?

Instances arise where thin solid films develop beneath organic coatings when exposed to the atmosphere or when exposed to an aggressive electrolyte without loss in adhesion or loss in protective property of the coating. Such films are not well characterized and their formation is not well understood. There exists the possibility that the formation of such films in a controlled manner could provide the means of obtaining greatly improved coating performance. There was conjecture that such films are formed by a reaction of steel with water in a type of topochemical reaction as opposed to an electrochemical reaction.

(6) Under what conditions are polymeric hydrated oxides formed in the shape of membranes? What is the physicochemical character of these membranes and how do they influence underrusting, blistering and filiform corrosion?

Ferric oxides form in many corrosion processes beneath organic coatings and they usually follow the contour of the organic coatings, since the source of oxygen is through the coating. The transport properties of these membranes, their electrical charge, and their role in the reduction of adhesion of the coating to the metal on exposure to water is little understood.

(7) What determines the sites of neutral and cathodic blisters? Are blisters formed randomly or are they associated with particular sites on the substrate or at sites of high mass transport through the coating?

Studies to answer this question will be demanding and require a dedicated effort over a long time period. They are badly needed, nonetheless.

(8) Can defects that lead to localized corrosion beneath an organic coating be detected at an early stage by non-electrochemical methods?

Electrochemical methods involving impedance scanning are useful in determining latent defects and active defects. However, the method requires that the coating be in contact with an aqueous phase. Techniques are required that do not involve an aqueous phase in contact with the coating.

(9) What is the detailed mechanism of cathodic blister formation, particularly with respect to water transport and the lack of effect with divalent ions?

The application of a cathodic potential to a coated steel while immersed in an alkali metal electrolyte leads to blisters with a high pH in the liquid beneath the coating. The alkaline solution is formed because the ionic current which supports the cathodic reduction of oxygen is carried in part by cations passing inward through the coating. The process is controlled by the resistance of the polymer to ion transport. More mobile ions cause more rapid blistering. Divalent ions such as Ba^{++} which can form strongly alkaline solutions do not cause blistering. The mobility of divalent ions in the coating and the effect of carbon dioxide on the process should be studied. The blisters form first at sites where ions can pass through the film more easily and the nature of the sites should be investigated.

(10) What is the detailed mechanism of filiform corrosion?

Although much is known about this process, the site of the cathodic reaction is still controversial. Is it in front of the tip or in the rear part of the filiform head? Different authors have made different observations. Is the process the same in all coatings and on all metals? The direction taken by the filiform threads has possibly different causes.

(11) What role do mechanical stresses arising from alternating exposure to wet and dry conditions play in the development of corrosion beneath organic coatings?

Additional research is needed on the magnitude of the stress developed as a function of time when a coated metal is exposed to alternating wet and dry conditions. Such research should use coatings that have T_g's both above and below the temperature of the experiment.

(12) Is the delamination of a coating determined by its internal stresses?

It was noted that examples exist in which thin coatings exhibit better adherence and better corrosion protection than do thicker coatings. The greater magnitude of stress in the thicker coatings is a possible explanation. The query was also raised as to the magnitude of the stress as a function of time of atmospheric exposure. The importance of the stress relaxation processes was also queried. Stress effects on corrosion performance show up very clearly in work on adhesive bonding of steel. For example, the loss of strength of an adhesive upon environmental exposure is a function of the chemistry of the adhesive. In some cases, swelling by water reduces strength, but in others cathodic disbonding appears to play a significant role. Interfacial failure processes are strongly influenced by fatigue loading. There is a synergism of cyclic mechanical loading and environmental exposure.

Studies of stress effects in organic coatings should include the development of a method of measuring and an assessment of loading encountered in practice.

Adhesion of Organic Coatings

Much of the discussion centered around the inadequate knowledge of the bonds involved in adhesion and what tools could be used to expand this knowledge. Non-destructive techniques that give information about metal/organic coating interface have not yet been applied in an aggressive manner by investigators.

(1) Which adhesion mechanisms are important in the case of protective bonding of coatings?

Both chemical and physical interactions are important in bonding of coatings to metals. The chemical interactions are of two kinds: those strictly limited to the formation of interfacial chemical bonds and those in which chemical changes in the interfacial region occur.

There are many processes that appear to involve specific chemical interactions at the interface: adhesion promoters by phosphoric acid partial esters; phosphoric acids and silanes used as constituents of coatings and pretreatments; and reactive polymeric post-treatments for inorganic phosphate conversion coatings.

Experimental evidence is available which indicates that baked coatings to some extent react chemically with the oxide present on steel and copper surfaces. In the case of air-drying coatings, the evidence is less clear. The acid-base concept of surface bonding is in the direction of quantitative understanding but this concept must be unerringly predictive to be useful. The role of water on bonding also is not clear.

Chemical effects involving more extensive changes in resin composition have been reported for certain oxidizing coatings. The formation of oxidized species in this case results in excellent mechanical (dry) adhesion and good resistance to water disbondment. However, the coating is disbonded by strong alkaline solutions or by cathodic treatment that generates alkali beneath the coating.

(2) Are non-bonded areas present at the metal/coating interface?

Such non-bonded areas, or voids, are locations for the accumulation of liquid water that can support an electrochemical corrosion reaction. The nature of these voids and their sizes should be investigated. Non-destructive techniques for investigating voids down to a few nm in diameter are required. It is also interesting how pigments and fillers that adjoin the interface affect void formation.

(3) How does water interact in the interfacial region when the coated metal is exposed to high relative humidities or liquid water?

It is well known that metal oxides can adsorb multilayers of water at relative pressures below one. Do the oxides in the interfacial region have similar water adsorption properties?

(4) How is adhesion of organic coatings reduced on exposure to water?

It is well known that adhesion of organic coatings decreases on exposure to liquid water or high humidity. Experimental evidence indicates that this decrease of adhesion proceeds discontinuously and that at least one intermediate state exists for some time from which adhesion may recover more or less completely when the coating is allowed to dry out after exposure to water. This state of reduced or residual adhesion seems to be also a prerequisite for blister formation.

It should be known which kind and structure of bonding is responsible for this reduced adhesion, which obviously is still strong enough to resist osmotic forces in blistering.

Moreover, it is not known whether the interaction of water with oxidized metal surfaces differs from that with conversion layers like a phosphate layer.

(5) What is the mechanism of water disbondment?

Many coating systems, when subjected to high relative humidity or an aqueous solution, lose adhesion and the coating delaminates when subjected to a tensile or a tearing force. This effect is often termed poor wet adhesion. A similar phenomenon occurs with other polar liquids, such as methanol. A detailed mechanism for the process is lacking. It was emphasized that studies of wet adhesion should be made on polymers with controlled and varied structures.

(6) How does one measure adhesion when the coating is exposed to water?

Answering the question is particularly difficult in the case of coatings exhibiting poor wet adhesion. The attachment of an adhesive to the coating which was previously exposed to water and still contains water requires time. Some of the adhesion properties may be regained as a consequence of the partial drying of the coating on exposure to the atmosphere before testing.

Improved methods for accurately measuring the rate of adhesion decrease on exposure to water are still needed. It was suggested that scanning acoustic microscopy is able to detect changes in elastic properties and damping characteristics on areas as small as one μm^2 and may have application to a non-destructive evaluation of adhesion.

Of all factors that control corrosion resistance, the molecular structure of the coating is the one that is (at least in principle) completely under control. There are experimental results that suggest that both the locus and mechanism of adhesion loss change from one coating to another. These facts are a compelling reason for better theoretical models of chemical interactions at the interface. Such models might be very useful in the molecular design of coatings.

Surface infrared spectroscopy has great promise for a better knowledge of the interfacial region. Modifications of existing techniques to increase sensitivity and depth resolution are desirable.

Permeability of Corrosive Agents

Much work has been done on the permeability of water and oxygen through coatings and free films but lesser amounts of work have been done on the permeability of ions, of SO_2, of CO_2, of O_3 and of minor organic contaminants in the atmosphere.

(1) *Can permeability measurements be used as a standard method for evaluating corrosion protection by organic coatings?*

It was agreed that such measurements provide an important clue to the performance of coatings designed to serve as barriers to corrosive agents. However, the reversibility of the water permeability as a function of wet-dry cycling is also an important consideration. It was also agreed that permeability measurements cannot be used as the sole method of evaluation. More convenient methods are needed for laboratory tests with variable humidity gradients and testing temperatures.

(2) *Are permeability measurements on free films representative of the behavior of coatings?*

Participants were skeptical that free films would always behave identically to coatings on metals. The boundary conditions are different and the free film exposes both sides to the atmosphere whereas the coating on the metal is not in contact with the atmosphere. Boundary conditions of 100% RH/50% RH seem more appropriate than 100% RH/0% RH for studies of free films.

(3) *What is the most important source of $SO_4^{=}$ at the metal surface beneath the coating?*

The sulfate ion is known as a stimulator of corrosion. It may be present at the metal surface prior to the application of the coating in a form known as "sulfate nests." It may also be present as a consequence of diffusion of sulfate ions through the coating or the conversion of SO_2 to sulfate at the metal surface.

(4) *If SO_2 diffuses through a coating, what is the mechanism of conversion of the molecule to a reactive species?*

A correlated question is how can SO_2 permeation through a coating be reduced or prevented. Also, can catalysts be incorporated in coatings to promote the conversion of SO_2 to sulfate with subsequent trapping of the sulfate as an insoluble sulfate?

(5) *What is the state of an ion in a coating?*

This question encompasses a potentially fruitful area of research. The relative permeability behaviors of the alkali metal ions suggest that the ion is highly hydrated, but independent confirmation should be made. Studies should also be made of the permeation rates of anions with and without an applied potential.

(6) *Do pores exist in organic coatings? What are their dimensions and shapes? What role do they play in the permeability of ions through a coating?*

Electrochemical measurements indicate that localized regions in a coating have low electrical resistance, suggesting that they are sites for relatively rapid charge transport. Independent studies of such low resistance regions should be made using non-electrochemical techniques.

(7) *Can ion exchange resins be incorporated in coatings and thereby influence the transport of certain ions across the coating?*

Some work has been published in this field, but the practical application of ion exchange resins in coatings is limited!

Anticorrosive Pigments and Corrosion Inhibitors

(1) *What is the mechanism of action of anticorrosive pigments such as zinc phosphate?*

The use of lead compounds and chromate compounds as corrosion inhibitors in coatings has been restricted in many countries because these pigments are considered to be hazardous. The mechanism of action of these inhibitors has been well studied and the theories for their action are acceptable to most scientists. The mechanism of action of zinc phosphate is not understood. This compound is effective in some binders and ineffective in others. The compound is also used in conjunction with another inhibitor, such as a molybdate, and the mechanism of action becomes more complicated in the case of two or more inhibitors in the same formulation.

(2) *What is the effect of pH on the activity of corrosion inhibitors?*

Aqueous solutions in contact with anodic areas tend to become acidic in nature and aqueous solutions in contact with cathodic areas become alkaline in nature. The normal range is 3-12. An ideal corrosion inhibitor should be effective over a wide pH range.

(3) *What is the mechanism of diffusion of soluble inhibitors in a coating? Do they diffuse through an aqueous pathway to the interface? Are the pigments in direct contact with the surface the only particles that are effective?*

These questions all relate to the mechanism by which soluble fractions of the pigment compound move through the coating under various conditions of relative humidity and contact with an exterior aqueous phase.

(4) *Does the corrosion inhibitor affect the adhesion of the coating to the metal under conditions of alternate wetting and drying?*

(5) *How is the permeability of the top coat related to the functioning of the inhibitor?*

Many inhibitors are only effective in the presence of an oxidizing agent such as oxygen. If such inhibitors are incorporated in the primer, it should be considered whether the top coat will pass enough oxygen to allow the inhibitor to function effectively and whether adequate oxygen permeability is a requirement for top coats.

Practical Corrosion Testing and Electrochemical Testing of Organic Coatings

The most spirited discussion at the meeting was in the subject area of accelerated corrosion testing and the application of electrochemical tests to an understanding of corrosion behavior under organic coatings.

There has been a flurry of interest recently in the application of electrochemical testing to study the electrochemical properties of the coating and the metal/coating interface. These studies have been fruitful in understanding better the presence of conductive pathways in a coating. However, tests for evaluating coatings have not yet been developed. In some cases, electrochemical tests are considered to be a valuable adjunct to appraise known and contemplated formulations in coatings laboratories.

(1) *Is it possible to correlate accelerated corrosion tests with service behavior?*

The attitude of participants ranged from hopeful to severely pessimistic. It was agreed that many accelerated tests discriminate between bad and good coatings, but the industrial need is to select the best coating from among a group of coatings that all give nearly acceptable to superior behavior. The ultimate decision, however, is based on service experience and there seems little likelihood that service experience will be supplemented by an accelerated test. It was recognized that accelerated tests do work when the mechanism of coating failure is known and when the test causes failure in the same type of environment and by the same mechanism. It was agreed that very little sophisticated work is going on with the objective of development of appropriate accelerated corrosion tests.

(2) *What are the factors that influence aging and what is its role in corrosion protection?*

Aging is a complex problem that involves the effects of dimensional change, solvent release, ultraviolet effects, thermal cycling, humidity cycling, etc. Basic research on these effects of variables on the properties of the polymers are the most likely route to an understanding of the aging of coatings. Catalytic effects that occur at polymer/pigment and polymer/filler interfaces are also areas for additional research. In the case of epoxies, chalking of the surface in relation to protective behavior is a problem. The surface area, the surface wettability, and hydrophility of the surface all change as a result of chalking. The role of the changed surface properties on corrosion protection is inadequately understood.

(3) *There is need for simple and cheap corrosion sensors and adhesion monitors to operate beneath an organic coating.*

Many coating systems such as those on tall structures, those underground, and under the ocean, are inaccessible except at great economic cost. It would be desirable to have the capability to implant sensors or monitors under the coating that could provide valuable information to a remote control station about the integrity of the system. Monitors that operate under coatings exposed to hazardous conditions would also be useful. It is especially desirable that such sensors operate without wires and without external power sources.

Electronic packaging is becoming of increasing importance and new techniques for applying protective coatings are needed. New sensors to detect undesired conductive pathways under the coating might be useful in exploratory research.

(4) *What is the appropriate role for electrochemical testing of organic coatings?*

It was pointed out that the only standardized electrochemical test that has been accepted by industry is the cathodic delamination test used to determine the expected performance of pipeline coatings subjected to cathodic protection. In this test, capacitance is measured simultaneously with the applied potential to determine the delaminated area non-destructively.

Electrochemical corrosion requires a transport of ions. The importance of the charge transport through organic coatings and its relation to ion migration below the layer is not sufficiently known: Are coatings to be considered as an ion-conducting continuum or are conductive pathways like pores or defects required for the charge transport?

During the exposure of coated metals to solutions of electrolytes adhesion may be reduced or even lost. It still is not completely clarified whether electrochemical corrosion already takes place during this stage of reduced adhesion. It is necessary to provide experimental evidence for the existence of very small delaminated areas, e.g., by thermometry.

The resistivity of the coating can be used to distinguish between poor and good coatings, but the test provides inadequate ranking of high performance coatings. It was lamented that the vast number of publications on organic coatings has not led to an accelerated test. The university representatives defended their accomplishments by stating that their goal had been to understand the deterioration process and was not aimed at the development of a test.

Good progress had been made in applying impedance spectroscopy to study the mechanism of coating failure. This method, like all electrochemical tests, requires that the coating be in contact with a conducting medium. Electrochemical testing does not look promising as a substitute for atmospheric testing or gaseous environment testing. A plea was made by industrial representatives for the application of impedance testing to panels with known service behavior.

Corrosion potential measurements, although providing useful information under some circumstances, hold very little promise as a sensor of corrosion. Corrosion potential measurements in combination with other electrochemical and nonelectrochemical methods may provide very important information.

It is known that corrosion may occur at those sites in the coating where the resistance is low. The cathodic sites are presumed to be at those sites with a higher resistance. In such a corrosion cell, the current would have to cross the coating twice, once at the anodic site and once at a cathodic site. Of these two resistances connected in series, that on the cathode should be the greater and in the absence of other protective mechanisms, control the corrosion rate. In an electrochemical impedance measurement on a large sample, these two resistances are connected in parallel and the measured values will be determined largely by the smaller resistance. A fuller understanding requires that independent study be made of the conductive paths over an anodic site and over the cathodic site.

The importance of ionic migration through a coating was stressed by several participants. Electrochemical measurements are one approach to a better understanding of ionic migration. Very little information is available on the thermodynamic activity of ions (or salts) in coatings as a function of concentration of ions in the external medium. Much more work is required on understanding the motion and complex formation of ions in organic coatings.

Corrosion Protective Systems

(1) *Are water-based coatings adequate for corrosion protection?*

The feeling was that big improvements are being made in water-based coatings formulations baked at elevated temperatures. Water-borne coating drying at ambient temperatures is still problematic, especially in the case of very corrosive environments in which most water-borne coatings need anticorrosive pigments for adequate protection. The emulsifier is often a cause of poor corrosion behavior. Removal of the emulsifier during the setting of the coating leads to improved behavior.

(2) *Why is corrosion protection by electrocoats (ca. 20 μm film thickness) frequently better at coating defects than a complete coating system (ca. 150 μm) when applied to this basecoat?*

The mechanism of the superior protection offered by electrocoats is still far from clear. Additional research to understand the process in terms of the corrosion protection is advisable.

(3) *Is it possible to develop base coats which form chemical bonds with the metal surface?*

It is assumed that chemical bonding provides optimal adhesion. This assumption is supported by the performance of wash-primers on different metal surfaces. Chemical bonding by complex-formation, e.g., oxycarbonic acid structures (tannin or 8-hydroxy-quinoline) is still an open issue.

* * *

The authors recognize that the 50 questions listed in this summary could be expanded. It is felt, however, that they are the critical questions. Answers to these questions could result in major advances in coating technology. Many important and basic studies in the past and also results and conclusions drawn from these experiments refer to classical coating systems. It is a question whether and how far results obtained with these materials are relevant and transferable to modern coating systems. It cannot be excluded as well that for questions cited in this report useful answers are already available for special coatings or certain model systems. However, experts know well how questionable unchecked generalizations are in view of the large diversity of corrosion protective coatings.

The participants gratefully acknowledge the support of the Stiftung Volkswagenwerk.

OPEN FORUM

Solvent Evaporation at Baking Temperatures

Harold L. Jackson
Du Pont Company*

Introduction

For a solvent-based coating composition, the evaporation behavior of the solvent is probably second in importance only to its solvency. Solvent evaporation controls the setting or drying time of a coating and also affects flow. In turn, this can affect gloss, leveling, adhesion, sagging, and film thickness.

In the case of a neat solvent, evaporation rate is not an absolute value in practical situations because it depends not only on the chemical structure of the solvent, but also on environmental conditions. Temperature, air movement, presence of a solute, surface area, and humidity are all factors that affect evaporation. For a coating formulation comprising a solution of a resin in a blend of solvents, factors influencing solvent evaporation become even more complex. Included are solvent-resin bonding, cosolvent interactions, and film permeability, each of which can significantly affect solvent evaporation, adding to the complexity of the coating formulation process.

When selecting solvents in coatings formulations, it is customary to simplify the process as much as possible. Generally, solvent choice is based on cost, solvency, and evaporation rate in the absence of resins and other coating components. The evaporation rates normally used are those of the neat solvents. Such evaporation rate data are relative, with one solvent being compared to another under the same conditions.

Various methods are used to measure solvent evaporation rate with the most common being:

(1) Comparison of the evaporation rate with a common solvent, such as butyl acetate or diethyl ether. The comparison is normally made at room temperature.

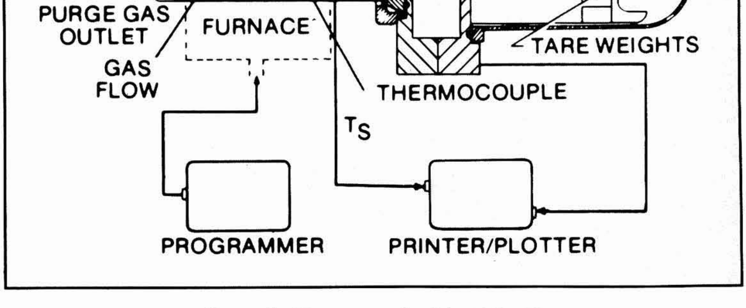


Figure 1—Thermogravimetric analyzer

*Petrochemicals Dept., Wilmington, DE 19898.

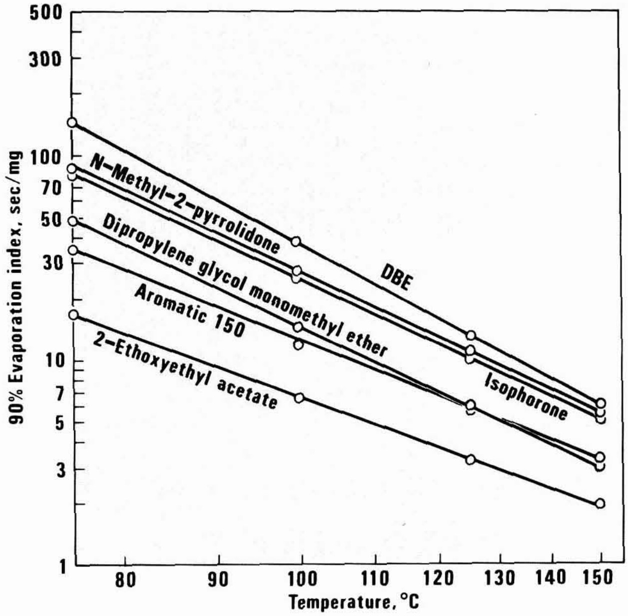


Figure 2—Coating solvents, evaporation vs temperature

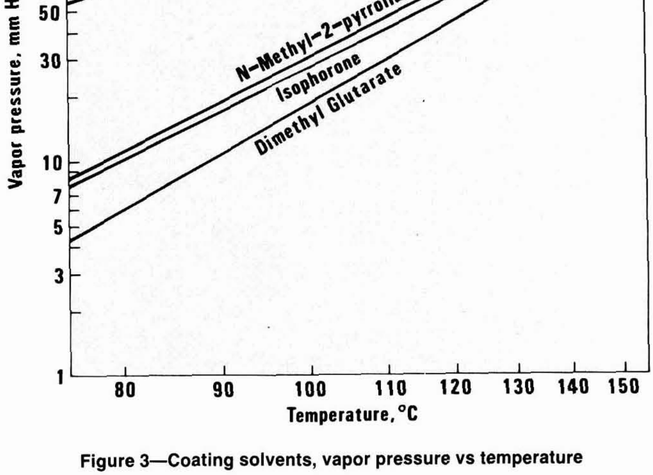


Figure 3—Coating solvents, vapor pressure vs temperature

(2) Electrobalance measurements of weight loss under a specified air or nitrogen flow at 25°C. The Shell Evaporometer or the Chevron Evapograph are specialized instruments for such measurements.

(3) Vapor pressure data provide the most precise measure of evaporation, although values over a range of temperatures often are unavailable.

(4) Boiling temperatures used to estimate relative evaporation rates, with the lowest boiling solvent being taken as the fastest to evaporate.

Evaporation at Elevated Temperature

Solvent evaporation rate data determined at room temperature can give a false picture of what occurs at elevated temperatures such as those experienced by coating compositions during baking. This has been demonstrated in studies using Du Pont's DBE dibasic ester solvent.

DBE is a mixture of the dimethyl esters of succinic (17%), glutaric (66%) and adipic (17%) acids. Its boiling temperature of 196-225°C and 90% evaporation time of 72,000 sec (as measured in the Shell Evaporometer) indicate that it is a slow evaporating solvent. The following comparison of DBE's 90% evaporation time with other coating solvents shows that, by this measure, DBE is slower than such solvents as isophorone, N-methyl-2-pyrrolidone, and 2-butoxyethyl acetate. In spite of this slow evaporation time as measured at room temperature, coatings producers using DBE noted that, at baking temperatures, it evaporated at about the same rate as isophorone, a rate much faster than suggested by DBE's 90% evaporation time.

90% Evaporation Time
(Shell Evaporometer, 25°C)

Solvent	Seconds
DBE	72,000
Isophorone	14,716
N-methyl-2-pyrrolidone	15,120
Aromatic 150	13,000
2-Butoxyethanol	7,092
2-Butoxyethyl acetate	14,310
Propylene glycol monomethyl-ether acetate	1,530
2-Ethoxyethyl acetate	2,980

A study of evaporation rate vs temperature was undertaken because of the apparent, faster-than-predicted, 90% evaporation time of DBE at baking temperatures measured at 25°C.

Experimental Method

A thermogravimetric method was used to measure evaporation over a temperature range of 75-150°C. The apparatus was a Du Pont 951 thermogravimetric analyzer

(TGA) that was connected to a Du Pont 990 thermal analyzer for data recording. The TGA was operated in the isothermal mode. Throughout each measurement, a nitrogen flow of 50 mL/min was maintained over the sample.

The 951 TGA is shown in *Figure* 1. Its heart is a small electrobalance. The solvent sample is held in a balance pan inside of a quartz tube, which is surrounded by a furnace.

At the start of the procedure, the quartz tube in the furnace was disconnected from the balance housing. Using a hypodermic syringe, approximately 15 mg of the solvent being tested was placed on the balance pan. The balance assembly then was inserted immediately into and secured to the hot quartz tube in the furnace. After about 15 seconds—needed to bring the solvent sample to temperature—the thermal analyzer plotter was started.

Weight loss as a function of time was recorded. Each run was continued until all solvent evaporated, as indicated by the plot weight vs time reaching a flat baseline. Several times during the run, temperature and nitrogen flow were checked to ensure that they were constant. For good reproducibility of evaporation results, it was particularly important to maintain constant geometry in the system, i.e., to maintain in all runs the same position of the balance pan relative to the nitrogen flow.

For each solvent, measurements were made at 75°, 100°, 125° and 150°C. The time in seconds for the sample to lose 90% in weight was read from the resulting graphs of weight vs time. A value designated 90% evaporation index was calculated for each temperature by dividing the 90% evaporation time by the original sample weight in milligrams.

$$\text{90\% Evaporation Index} = \frac{\text{seconds for 90\% weight loss}}{\text{milligrams of sample}}$$

The plot of the logarithms of 90% evaporation index at each temperature vs the logarithm of the temperature is a straight line.

Solvents tested were Du Pont's DBE dibasic ester solvent, N-methyl-2-pyrrolidone, isophorone, dipropylene glycol monomethyl ether, Exxon's aromatic 150 solvent, and 2-ethoxyethyl acetate.

Results

As shown in *Figure* 2, for the series of solvents measured, DBE has the steepest slope. This means that DBE has a faster decrease in evaporation time with temperature elevation than do the other solvents. For example, DBE and isophorone have almost the same evaporation rate at 150°C; whereas at 25°C, the 90% evaporation time of DBE is about five times longer than that of isophorone.

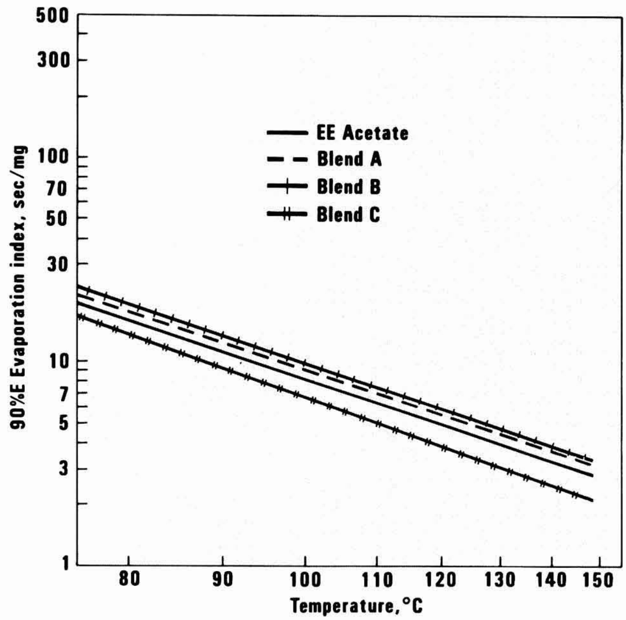


Figure 4—Solvent blend replacements for 2-ethoxyethyl acetate, evaporation vs temperature

Limited vapor pressure data available for the solvents tested confirm the relationships of evaporation vs temperature determined by the TGA method. As shown in the graph of vapor pressure vs temperature (*Figure* 3), dimethyl glutarate, the major component of DBE, has a greater increase in vapor pressure with temperature than the other solvents, which means that it has a faster decrease in evaporation time with increase in temperature than the other solvents.

In view of these data, it is understandable why coatings producers were able to use DBE solvent at baking temperatures lower than predicted by the 90% evaporation time determined at 25°C.

In addition, the described TGA procedure is useful for comparing the evaporation of solvent blends at elevated temperatures. For example, *Figure* 4 shows three solvent blends, A, B, and C. Formulated as replacements for 2-ethoxyethyl acetate, the new blends were measured and shown to have relationships of 90% evaporation vs temperature comparable to that of the 2-ethoxyethyl acetate (*Table* 1). The three solvent blends have solvency similar to that of the 2-ethoxyethyl acetate. Resin solutions in these blends have lower viscosities than in 2-ethoxyethyl acetate.

The TGA procedure is proving useful in studies measuring solvent evaporation from solutions of resins. This work is aimed at gaining better evaluations of solvent evaporation from coatings under baking conditions.

Table 1—Replacements for 2-Ethoxyethyl Acetate

	Solvent Blend (Vol %)		
Solvent	A	B	C
DBE	25	25	20
n-Butanol	40	50	30
2-Methoxy propanol acetate	20	—	—
Methyl ethyl ketone	15	—	20
Xylene	—	25	30

Conclusions

A thermal gravimetric analysis procedure provides a quick and convenient method for measuring and comparing solvent evaporation rates at baking temperatures.

Prediction of solvent evaporation rate at baking temperature using evaporation data measured at room temperature can be misleading.

DBE dibasic ester solvent has a faster decrease in evaporation time with temperature elevation than do the other solvents tested.

Wacker HDK®

Fumed Silica

A name which stands for Reliability and Versatility – Wacker HDK® Fumed Silica

Wacker HDK as thixotropy and thickening agent in plastics, (for example, UP resins, Epoxy resins)

Wacker HDK in printing inks of various systems to obtain a better printed picture

Wacker HDK in primers and surface coatings as thixotropy, thickening and anti-settling agent

Wacker HDK for improv ment of mechanical qua in RTV and HTV silicone acrylates and polysulph etc.

HK 286 b

Paint Calculations in a Five Ounce Nutshell

Ronald J. Petry
BASF Inmont Corporation*

A very powerful program has been developed for use with a Texas Instruments TI-66 Programmable Calculator. This program enables the paint technician to very quickly calculate important mathematical values for paint, such as VOC, lbs/gal, % N.V., PVC, etc.

Introduction

A calculation program has been developed for the paint formulator or field worker which can quickly and easily compute most of the pertinent constants associated with paint, i.e., VOC, lbs/gal, PVC, % N.V., etc.

Most calculator and computer programs are specific to the type and brand of equipment. Therefore, the program was developed to be used with the Texas Instruments TI-66 Programmable Calculator, which is battery operated and weighs just five ounces. Other similar computers, such as a Hewlett-Packard HP-15C, lend themselves just as well to a paint program of this type. The TI-66 choice was somewhat random.

*1244 N. Lemon St., P.O. Box 3938, Anaheim, CA 92803.

Formulators or field workers who do not have access to a large computer will find this program to be powerful, valuable, and inexpensive. It can be used in the laboratory to calculate a paint formula, or in the factory to quickly recalculate variables such as VOC or % N.V. following factory adds to batches of paint. It can be used by paint users to quickly calculate a new VOC after a thinner add is made. It can determine how much solvent can be added to a paint without exceeding a VOC limit. As an operator becomes familiar with how to use this program, many more applications will arise.

No computer literacy is needed to use the program other than simple computer arithmetic ability. Once the text has been read, using the programs can be learned quickly—in about ten minutes. Actually, it takes longer to read the instructions than to learn to use the computer.

The program can be entered into the calculator in about ten minutes and is stored in the computer's memory. It will remain stored, even when the computer is turned off, until the program is erased. The program is entered by pressing the keys in succession as shown in *Appendix* 1. The program contains 354 steps. Each time a key is pressed, the function will be displayed by the computer. Starting at Col 1, keys are pressed in order from top to bottom of each column. For convenience, at the end of each column is shown the step number and mnemonic display of the calculator. This will show that keys have been pressed correctly to that point. Of course a detailed understanding of the system can be gained from the text book (about $50) which accompanies the calculator.

After entering the program, the computer is now ready for use. The calculator is designed to use labeled keys to run programs. Variables are entered into a program through labeled keys, and up to 60 labels can be used. Inspection of the program in *Appendix* 1 shows the use of labeled keys for the paint program. *Appendices* 2 and 3 give a complete list of labels used, and indicate their use for input of variables and output of data.

To use the program, up to seven variables for each ingredient will be needed, and in many cases only two or three. For convenience, these should be listed in a reference notebook for easy access. The seven possible variables are:

(1) lbs of ingredients
(2) lbs/gal bulking value
(3) % Non-volatile
(4) % Vehicle solids
(5) % Volume solids
(6) % Pigment volume solids
(7) % Water

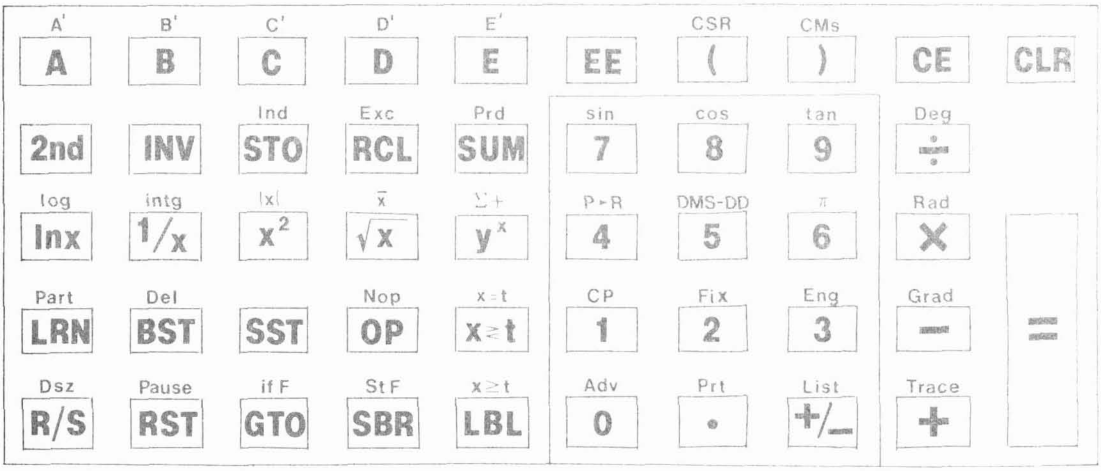


Figure 1—Representation of keyboard from Texas Instruments TI-66 Programmable Calculator

Paint Calculations

To compute a paint formula, each ingredient is entered into the computer consecutively. Before proceeding to the next ingredient, all variables which apply must be entered. To illustrate the method, the following formula will be entered. (Refer to the keyboard picture (*Figure* 1) to help visualize data input and output.)

Ingredient	Weight	Variables
1. Alkyd resin solution	300	8.3 lbs/gal, 60% N.V., 100% vehicle solids, 55% volume solids
2. Titanium dioxide	100	35 lbs/gal, 100% N.V., 100% volume solids
3. Xylene	50	7.25 lbs/gal
4. Phthalo blue tinting paste	25	8.4 lbs/gal, 45% N.V., 40% vehicle solids, 30% volume solids, 14% pig. vol.

Before entering any new data, press *2nd, CMs* to clear all memory banks.

Item 1 :	Enter 300	Press *A* lbs
	Enter 8.3	Press *B* lbs/gal
	Enter 60	Press *C* % N.V.
	Enter 60	Press *D* % vehicle solids
	Enter 55	Press *E* % volume solids
Item 2 :	Enter 100	Press *A* lbs
	Enter 35	Press *B* lbs/gal
	Enter 100	Press *C* % N.V.
	Enter 100	Press *E* % volume solids
	Enter 100	Press *SBR*, y^x % pigment volume
Item 3 :	Enter 50	Press *A* lbs
	Enter 7.25	Press *B* lbs/gal
Item 4 :	Enter 25	Press *A* lbs
	Enter 8.4	Press *B* lbs/gal
	Enter 45	Press *C* % N.V.
	Enter 40	Press *D* % vehicle solids
	Enter 39	Press *E* % volume solids
	Enter 14	Press *SBR*, y^x % pigment volume

The formula is entered. Computer is now ready for output.

Press Keys	*Display*
RCL, 01	475 total lbs
RCL, 02	48.87 total gallons
2nd, A'	21.32 % pigment
2nd, B'	40.00 % vehicle solids
2nd, C'	61.32 % N.V.
2nd, D'	9.72 lbs/gal
2nd, E'	450.52 grams/liter VOC
SBR, $\sqrt{x}$	48.9 % volume solids
SBR, 2nd, sin	0 % water
SBR, 2nd, cos	.14 PVC
SBR, 2nd, tan	.53 p/b ratio

"What If" Capability

At any time during entry of a formula, all output data can be quickly determined. If a formula exceeds a desired value or falls short, the operator can "what if" the computer. By entering or subtracting a hypothetical ingredient, new data is quickly determined. For example, if the formula exceeded a VOC limit, the formulator can subtract xylene, e.g., 100 lbs. Enter 100, press change sign key (+/−); press *A*. Then enter 7.25 lbs/gal and press *B*. Now pressing *2nd E'* will give a new VOC of 286.07 g/L.

This valuable capability can also be used for factory production batches. All that needs to be done is to enter the weight of the batch along with the variables which apply. It is now possible to hypothetically add or subtract ingredients to make a fit for a certain standard limit such as % N.V.

The program can be used to recompute data after adds have been made to a factory batch or a dip tank. Care must be taken to remember that every time pounds of ingredient are added or subtracted at KEY *A*, all applicable variables must be entered in accordance with the entry format.

Using the "what if" approach allows the formulator to approach a set point rapidly but not exactly. The VOC program, which is a sub-routine of the overall program, does not rely on the "what if" approach. It precisely calculates VOC according to preset algebraic formulae. This program is described in detail.

VOC Computation

The program was developed to calculate VOC quickly and easily. A generalized VOC formula has been developed and put into the program. The derived formulae are shown in *Appendices* 4 and 5 (for the curious).

With this program, it is possible to compute the VOC of any paint system. It is also possible to re-compute VOC after ingredient adds have been made. More importantly, the program computes how much solvent can be added to a paint without exceeding a specified VOC limit. The VOC of a solvent or water-borne paint can be quickly determined. These programs and how to run them are listed in *Appendix* 6.

It is unfortunate that what would normally take five to ten minutes to demonstrate takes much longer to write out. It's like putting together a toy at Christmas; reading and understanding the instructions takes longer than the doing! It is enough to say that with all its seeming complexity, the program is simple and quick to learn and run. For those who wish to avail themselves of the program, most details were put in Appendix form. With them, anyone can program and learn to use the system. With a little more effort, improvements and revisions can be made as well.

It has been pointed out that each time an ingredient or formula entry is made, it must be followed with the seven applicable variables. A "little black book" listing these is essential to efficient use of the program. With a larger RAM memory capability, this would not be necessary. But that's another story—a bigger nutshell.

Reference

(1) Texas Instruments, *TI-66 Programmable Manual,* copyright 1983, Kenneth E. Heichelheim and Robert E. Whitsitt II.

APPENDIX 1
Paint Program

Column

1	2	3	4	5	6	7	8	9	10	11	12	13	14
On	02	RCL	03	SBR	SBR	E'	(	)	RCL	÷	X	)	INV
2nd	SUM	00	-	LBL	LBL	(	1	-	02	RCL	100	INV	SBR
Part	07	)	RCL	2nd	EE	119.83	+	RCL	)	07	)	SBR	LBL
15	STO	SUM	04	C'	(	X	RCL	09	)	)	INV	LBL	2nd
2nd	11	04	)	(	X	(	08	)	)	INV	SBR	y^x	Tan
CP	INV	INV	÷	RCL	RCL	SBR	)	÷	INV	SBR	LBL	(	(
LRN	SBR	SBR	RCL	03	00	2nd	)	(	SBR	LBL	x^2	x	(
LBL	LBL	LBL	01	÷	X	Deg	INV	RCL	LBL	2nd	(	.01	RCL
A	C	E	X	RCL	.01	X	SBR	09	2nd	Rad	X	X	03
SUM	(	(	100	01	)	(	LBL	-	Grad	(	.01	RCL	-
01	X	X	)	X	STO	1	lnx	(	STO	RCL	)	11	RCL
SUM	.01	.01	INV	100	12	-	(	119.83	10	03	STO	)	04
06	X	X	SBR	)	INV	SBR	(	X	INV	÷	08	SUM	)
STO	RCL	RCL	LBL	INV	SUM	2nd	(	RCL	SBR	RCL	INV	13	÷
00	00	11	2nd	SBR	06	Rad	119.83	10	LBL	06	SBR	INV	RCL
INV	)	)	B'	LBL	(	)	X	)	1/x	)	LBL	SBR	04
SBR	SUM	SUM	(	2nd	÷	+	SBR	)	STO	INV	2nd	LBL	)
LBL	03	05	RCL	D'	8.33	(	2nd	)	09	SBR	Sin	2nd	INV
B	INV	INV	04	(	)	RCL	Deg	X	INV	LBL	(	cos	SBR
(	SBR	SBR	÷	RCL	INV	08	X	(	SBR	$\sqrt{x}$	RCL	(	LRN
1/x	LBL	LBL	RCL	01	SUM	X	(	100	LBL	(	12	RCL	
X	D	2nd	01	÷	07	RCL	1	X	2nd	RCL	÷	13	
RCL	(	A'	X	RCL	INV	10	-	(	Deg	05	RCL	÷	
00	X	(	100	02	SBR	)	SBR	RCL	(	÷	01	RCL	
)	.01	(	)	)	LBL	)	2nd	07	RCL	RCL	X	05	
SUM	X	RCL	INV	INV	2nd	÷	Rad	÷	06	02	100	)	
017	**045**	070	**098**	122	150	179/	207	240/	261	284	313	383>	354
SUM	X	**RCL**	**INV**	**INV**	**LBL**		RAD		06	02	0		RTN

APPENDIX 2
Input Labels

Label Keys	Entry Function
A	Pounds of an ingredient
B	lbs/gal of an ingredient
C	% N.V.
D	% vehicle solids
E	% volume solids
SBR, EE	% water
SBR, y^x	% pigment volume
SBR, 1/x	Desired VOC
SBR, X^2	% volume reduction
SBR, 2nd, Grad	lbs/gal of reducing solvent

Labels A thru y^x enter the seven variables for paint formula calculations.
Lables 1/x to Grad are used for special VOC calculations.

APPENDIX 3
Output Labels & Keys

Keys	Function Displayed
RCL, 01	Total pounds
RCL, 02	Total gallons
RCL, 03	Total pounds of non-volatile
RCL, 04	Total pounds of vehicle solids
RCL, 05	Volume solids, gallons
2nd, A′	% pigment
2nd, B′	% vehicle solids
2nd, C′	% non-volatile
2nd, D′	Pounds/gallon
2nd, E′	VOC (grams/liter)
SBR, $\sqrt{x}$	% volume solids
SBR, 2nd, sin	% water
SBR, 2nd, cos	PVC
SBR, 2nd, tan	P/B ratio
SBR, lnx	% volume reduction to achieve desired VOC

APPENDIX 4
By Definition

$$\text{VOC (lbs/gal)} = \frac{\text{lbs volatile}}{\text{gallons paint}}$$

The lbs of volatile in a gallon of paint is found by multiplying the weight/gallon (A) by the percent fractional percent (B) and subtracting from the weight. Then

$$\text{VOC (lbs/gal)} = A - AB \text{ or } A(1 - B)$$

If the paint is thinned with known percent volume reduction C, the additional pounds of volatile is C × D where D is the lbs/gal of reducing solvent. This must be added in, so

$$\text{VOC (lbs/gal)} = A(1 - B) + CD$$

But at the same time the volume has been increased by 1 + C. Then our correct expressions is

$$\text{VOC (lbs/gal)} = \frac{A(1 - B) + CD}{(1 + C)}$$

Using the mensuration constant of 119.83 to convert lbs/gallon to grams/liter, the generalized VOC (E) formula is

$$E \text{ (grams/liter)} = \frac{A(1 - B) + CD}{(1 + C)} \times 119.83$$

This formula was programmed into the computer.

APPENDIX 5

Many times it is desired to know how much a paint can be thinned to get a certain VOC limit. In order to do this, the generalized VOC formula is solved for C as follows:

Let E = E′ VOC limit
C = C′ volume reduction required
119.83 = F to simplify algebra.
THEN:

$$E' = \frac{\{A(1-B) + (C'D)\}}{(1 + C)} F \quad \text{Divide by } (1 + C')$$

THEN:

$E'(1+C') = [A(1-B) + (C'D)]F$ Rearranging gives

$E'(1+C') = AF(1-B) + C'DF$ Subtract C′DF & rearranging gives

$E'(1+C') - DFC' = AF(1-B)$ Multiply left side out:

$E' + E'C' - DFC' = AF(1-B)$ Subtracting E′ yields:

$E'C' - DFC' = AF(1-B) - E'$ Rearrange to:

$C'(E' - DF) = AF(1-B) - E$ Divide by (E′ − DF) gives:

$$C' = \frac{AF(1-B) - E'}{(E' - DF)}$$

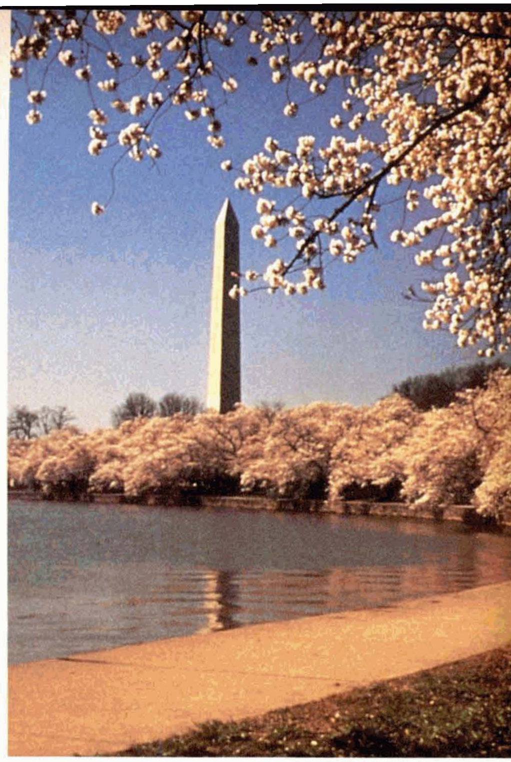
Reinsert F = 119.83 gives final solutions:

$$C' = \frac{119.83A(1-B) - E'}{(E' - 119.83D)}$$

This formula was entered into the computer. In the VOC programs it permits the paint technician to easily determine how much a paint formula or batch of paint may be thinned by fractional volume without exceeding a desired VOC limit (E′). These problems and their computer solutions are given in *Appendix* 6.

APPENDIX 6

Problem	Data Needed	Inputting Data	Answer (Output)
1. Calculate VOC of a solvent or water-borne paint.	1. lbs/gal of paint 2. % N.V. of paint 3. % water if applicable	Enter lbs/gal; Press Key A, then B. Enter % N.V.; Press C. Enter % water (skip if there is none). Press SBR; EE.	Press keys 2nd, then E′. VOC is displayed.
2. Re-calculate VOC of field reduced paint when reduced by known weight.	1. lbs/gal of paint 2. % N.V. of paint 3. lbs of paint 4. lbs of solvent added 5. lbs/gal of solvent 6. % water (if any)	Enter lbs of paint, Press A. Enter lbs/gal of paint, Press B. Enter % N.V. of paint, Press C. Enter lbs of solvent, Press A. Enter lbs/gal of solvent, Press B. Enter % water (if any), Press SBR, then EE.	Press keys 2nd and E′. New VOC is displayed.
3. Re-calculate VOC of reduced paint by volume.	1. lbs/gal of paint 2. % N.V. of paint 3. % water (if any) 4. % volume reduction 5. lbs/gal of solvent	Enter lbs/gal at A & B Enter % N.V. at C Enter % water (if any) at SBR:EE Enter % volume reduction at SBR:X^2 Enter lbs/gal of reducing solvent. Press SBR, 2nd, Grad.	Press keys 2nd and E′. New VOC is displayed.
4. Calculate % volume reduction permitted for a given VOC limit.	1. lbs/gal of paint 2. % N.V. of paint 3. % water of paint (if any) 4. lbs/gal reducing solvent 5. VOC limit	Enter lbs/gal at A & B Enter % N.V. at C Enter % water (if any) at SBR:EE Enter lbs/gal of solvent at SBR, 2nd, Grad. Enter VOC limit at SBR, 1/x	Press keys SBR, 2nd and lnx. % allowable volume reduction for the given VOC is displayed.

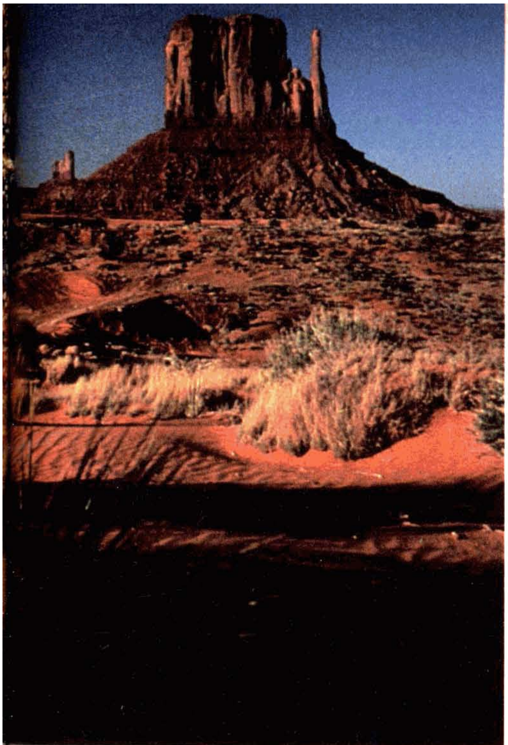


A **Sun** for all seasons.

SUNFAST® organic blues, greens, reds and oranges offer the exceptional fastness properties required by the coatings producer. SUNFAST® organic pigments are dry toners designed to meet the exacting requirements of outdoor exposure and long term fastness to weathering.

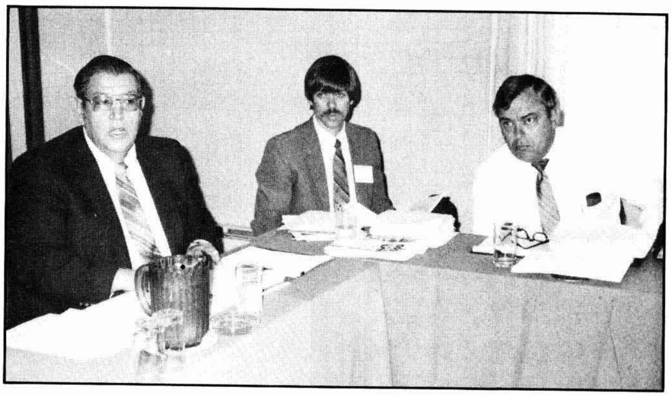
SUNSPERSE® high solids presscakes are standardized presscakes with a controlled pigment solids of 50 ± 1%. Containing only pigment and water, SUNSPERSE® high solids presscakes result from careful drying and blending of regular solids presscake. These high solids presscakes contain 50% pigment and 50% water, they contain no additives or surface active agents and are free-flowing, non-dusting, semi-dry materials standardized to the same exacting standards as Sun Chemical Corporation's SUNFAST® dry toners.

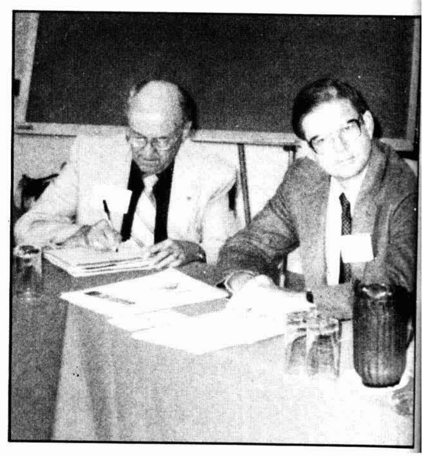
Sunfast® / Suns




TORONTO


BALTIMORE
CHICAGO






GOLDEN GATE
KANSAS CITY
LOS ANGELES
LOUISVILLE
NEW ENGLAND

Academic and Society Programs Reviewed At FSCT/Society Educational Committee Meeting

Representatives of Society Educational Committees and university coatings programs met recently with members of the Federation Educational Steering Committee to discuss their respective programs. Topics of discussion included scholarships, promoting career opportunities, and Society-sponsored coatings courses at local colleges.

The meeting, held April 22 in Atlanta, was chaired by Joseph Vasta, of Philadelphia Society, Chairman of the FSCT Educational Steering Committee.

In addition to Chairman Vasta, the following Steering Committee members attended: James Geiger (Southern); John Gordon (Detroit); John Oates (New York); and Joseph Vona (New York).

Society Educational Committee representatives included: Ken Bristow (Baltimore); Ted Fuhs (Chicago); Jim Flanagan (C-D-I-C); Sharon Kaffen (Cleveland); Dan Melnyk (Detroit); Dan Gilbert (Golden Gate); Jim O'Brien (Kansas City); Melinda Rutledge (Los Angeles); Paul Baukema (Louisville); Brad Brakke (New England); Al Yokubonis (Northwestern); Richard Granata (Philadelphia); Don Boyd (Pittsburgh); Dick Mullen (Rocky Mountain); Richard O'Kragly (St. Louis); Brian Budzien (Southern); and Roy Donnelley (Toronto).

University representatives in attendance were: Carl Knauss (Kent State University); Jim Stoffer (University of Missouri-Rolla); Frank Jones (North Dakota State University); and Charles Hoyle (University of Southern Mississippi).

Also attending were: Roy Brown, FSCT Technical Advisor; Bob Ziegler, Editor of JCT; and Tom Kocis, FSCT Director of Field Services.

Scholarships

Funding for the Federation scholarship program was increased for 1986-87 by the Board of Directors to $31,000. The recipient schools are: University of Detroit—$4,000; Eastern Michigan University—$6,000; Kent State University—$3,000; University of Missouri-Rolla—$6,000; North Dakota State University—$6,000; and the University of Southern Mississippi—$6,000.

Representatives of these schools were invited to the meeting to review their coatings programs. Their comments are summarized below:

UNIVERSITY OF DETROIT—Dan Melnyk reported on activities at U of D, where Society-sponsored evening classes are held. Curriculum (established in 1969) offers polymers and surface coatings courses in both undergraduate and advanced degree programs.....Research activities include cooperative projects with Society Technical Committee.....This is inner-city school, which has difficulty attracting adequate funding.

EASTERN MICHIGAN UNIVERSITY—Coatings program, described by Johnny Gordon, is now in its sixth year, and 25 of its 28 graduates are employed in the coatings industry.....Approximately 80 students are currently enrolled in the program, two-thirds of whom commute.....EXPOCOAT event, which hosts area high school and community college students, attracted 12 students to coatings program in 1985 and four more in 1986.....Students must spend at least four months in full-time co-op program, and EMU has no trouble placing them with coatings firms..... Has introduced series of short courses as part of continuing education activities .....Recently received state funding to help establish Coatings Research Institute; will seek industry and public sector contributions to augment state money to carry out applied research projects.....Will host area high school science teachers in June for week-long introductory course on coatings technology.....Student scholarship grants based on entrance exam scores and grade point average.

KENT STATE UNIVERSITY—Carl Knauss reported on Kent State's program, now in its 14th year. Six coatings-related courses are offered to students in chemistry for meeting elective requirements, and are given for recipients of coatings scholarships .....Currently, nine students receive scholarship money, which is awarded at completion of term; three recipients are children of FSCT members.....Scholarship funds, awarded on basis of grade point average, are paid in increasing amounts, starting at $250 for Freshmen and rising to $500 for Seniors.....Short courses include offerings on rheology, dispersion, and adhesion, as well as coatings technology, painting processes, and chromatography.....Research activities currently focus on surface chemistry, dielectrics, adhesion, and rheology.

UNIVERSITY OF MISSOURI—ROLLA—Jim Stoffer discussed the Polymers and Coatings Science program at Rolla, where undergraduate and advanced degrees are offered.....Faculty has recently been expanded.....Scholarship funds are awarded to students on a sliding scale—$100 to $200 per semester as Freshmen, then increase as student progresses..... Short courses, held in Spring and Fall, average 250-300 attendees; new courses are "Introduction to Polymer Chemistry—Applications in Coatings" and "Modern Instrumentation for Coating Science" .....DSC and FTIR units have been added to coatings lab; funds being sought to add color computer.....Research currently includes work on chlorinated solvents, liquid crystals, and foams.

NORTH DAKOTA STATE UNIVERSITY—Frank Jones reported on program at NDSU which was initiated 80 years ago, when paint chemistry course was introduced there. Polymers and Coatings Department was established in 1962.....Approximately 100 students currently enrolled (25 are post-grads); 40 are on scholarships, and receive grants of $500 to $2,000 annually, awarded on basis of grade point average .....Over half of school's graduates enter coatings industry.....Seeking funds to expand faculty and purchase lab equipment.....Short courses offered each summer, along with undergraduate research Fellowships (supported by funds from PPG).....Much recent research work has been in the field of high-solids coatings and polymers for petroleum recovery.

UNIVERSITY OF SOUTHERN MISSISSIPPI—USM's Polymer Science program was described by Charles Hoyle. Currently, there are 50 undergraduate and 39 graduate students enrolled; 26 students receive an average of $500 in scholarship grants, based on grade point average. Funds are distributed at completion of term.....Each undergrad must complete year-long senior research project.....Active recruiting program at junior colleges in Southeast has been successful in bringing students into program (USM's polymer courses are scheduled in junior and senior years)..... Recently initiated short course on "Water-Soluble Polymers," and plan another on "Introduction to Polymer Science," as part of continuing education program ..... Funding for coatings research is highest in history; current projects include research on fungicidal coatings, polymer flammability, radiation curing, and oligomers for higher-solids coatings.

* * *

Society Reports on Activities

The following are summaries of reports on Society Educational activities:

Baltimore

Sponsored February meeting presentation on Statistical Process Control ..... Continuing scholarship award program, which now totals $1,000 annually.

Chicago

Newly-established Master of Science program in coatings technology at DePaul University is doing well in its first year, with 16 students participating in the lecture portion, and 8 in the coatings technology lab..... Continuing efforts to establish baccalaureate program in coatings technology..... Annual Management Development Seminar and SYMCO symposium continue to be successful; both are jointly sponsored with Chicago Paint and Coatings Association..... Continuing scholarship awards program and support of local Science Fair.

C-D-I-C

Primary activity is selecting post-dinner speakers for Society monthly meetings, which feature two speakers: pre-dinner presentation deals with technical or manufacturing topic relating to paint and coatings; after-dinner speaker focuses on subjects of general interest. Recent meetings have included presentations on: Halley's Comet; Tax Planning; Personnel Training; and Product Liability.

Cleveland

Continuing sponsorship (in conjunction with local PCA) of student paper competition for college juniors; cash prizes are awarded for winning research paper..... Also continuing support of local high school Science Fair, judging entries and providing prizes. Major activity is development of annual technical conference, "Advances in Coatings Technology." Usual two-day format will be expanded this year to three days (Apr. 29-May 1) to accommodate tour of NASA Research Center; four half-day symposia will address: technical advances; vinylidene chloride; physical chemistry; and curing.

Dallas

Sponsoring May seminar on Statistical Quality Control; included will be presentations on applications to automotive finishing, practical control charts and histograms for quality control, and quality as a formulation ingredient.

Detroit

Continuing sponsorship of evening coatings courses at Univ. of Detroit: Surface Coatings Technology; Fundamentals of Automotive Paint Systems; Principles of Color Technology; Polymer Technology for Coatings; and a Coatings Lab course. Two polymer courses are also offered, credits for which students may apply toward a Bachelor or Graduate degree at the University. Also considering introduction of a lab course on Polymer Synthesis ..... Continuing $1,000 annual scholarship award to Eastern Michigan Univ. ..... Held annual FOCUS symposium on April 8; topic, "Troubleshooting—Part II," was follow-up to 1985 program..... Again held Education Night, to which local high school science teachers are invited; guest speaker was Dr. Thomas Miranda (Whirlpool Corp.), Technical Editor of *Journal of Coatings Technology*..... Have added Color-Matching Aptitude Test Set to library of Federation slide/tape programs, which are made available on loan basis to area paint companies and students in coatings courses..... Continuing two-hour adult education lecture series on "Automotive Refinishing Basics"..... Planning videotape of lecture portion of Principles of Color Technology.

Golden Gate

Jointly sponsor with local PCA a four-part, 26-week basic coatings technology course, held in conference room of area coatings manufacturer; course includes tours of paint plants and raw materials facilities. Current class has 21 students enrolled..... Continuing scholarship program, as well as support of coatings section at Redwood City Public Library.

Kansas City

Principal activity is support of local Science Fair, judging entries and providing awards. Each of three winners receives savings bonds (their school science departments receive check in matching amount); these are presented at Society monthly meeting, at which winning exhibits are displayed..... Continuing contribution to scholarship program at Univ. of Missouri —Rolla; funds are matched by local PCA.

Los Angeles

Sponsorship of introductory paint technology course continues; aim is to impart formulating skills to students ..... Studying feasibility of sponsoring four-year coatings degree program at Cal-Poly San Luis Obispo ..... May sponsor technical conference in Spring of 1988 ..... Continuing scholarship program and maintaining coatings section at City of Commerce Public Library ..... Textbook Committee has completed initial chapter of a text for use in teaching introductory coatings technology.

Louisville

Sponsorship of coatings courses at University of Louisville continues. These form a five-part continuing education program on surface coatings technology and cover: synthetic resins; formulation of chemical coatings; quality control of raw materials and finished paint products; instrumental analysis; and principles of formulation and paint calculations.

New England

Planning videotape production to promote careers in coatings, for showing to high school and college students ..... Co-sponsoring Spring seminar (May 15-16), "Launching the New Revolution—Compliance for the 21st Century" ..... Sponsored technical paper competition for area college students; awarded cash prizes ($300 and $200) for the two top entries on coatings-related topics; hope to expand competition for the coming year ..... Continue to support and publicize coatings courses (undergraduate and graduate) at University of Lowell.

New York

Continuing joint sponsorship (with local PCA) of two-year, four-semester course, Understanding the Basics of Coatings, which is given at Fairleigh Dickinson University. Each one-year, two-semester module of the program is a complete course in itself and may be independently taken; each semester qualifies for three CEU's of credit ..... Laboratory Course for Paint Technicians, designed for newcomers to the industry, consists of basic theory, demonstrations, and "hands-on" lab exercises; lectures are presented by industry specialists and given at laboratory of lecturer's employer. Course is offered every two to three years, per survey of membership to determine interest ..... Pursuing efforts to establish a Coatings Center at Fairleigh Dickinson; plan development of a teaching outline and laboratory exercise curriculum for their review ..... Continuing participation in Career Day programs at area schools; seeking support material for this effort—literature and lab experiments (college level).

Northwestern

Continue to maintain close liaison with North Dakota State University. Students are hosted at Society monthly meeting each Spring, as part of two-day visit which also includes tour of local paint plants ..... Support NDSU scholarship fund for polymer science students.

Philadelphia

Current focus is on promoting coatings interest among area college students. Initiated Educator's Night at March meeting. Department Chairmen and placement service personnel at area colleges were invited to hear industry personnel discuss career opportunities in coatings; approximately eight colleges were represented ..... Students attending monthly meetings are accorded reduced dinner prices ..... Society providing support for student doing research on summer project at Lehigh on Cathodic Disbondment Properties of Anti-Fouling Paints.

Piedmont

Continuing sponsorship of introductory polymer course at University of North Carolina—Greensboro; Society provides financial support for program ..... Sponsored half-day mini symposium in March on "Quality Team Circles" and "Statistical Process Control" ..... Hosted chemistry students from Appalachia State University at March monthly meeting ..... Will invite area chemistry teachers to April monthly meeting.

Pittsburgh

Initiated program of visits to area colleges, promoting career opportunities in the coatings industry; presentations are usually directed to ACS Student Affiliates or members of Chemistry (Science) Clubs ..... Continuing participation in Regional School Science and Engineering Fair, providing awards and assisting in judging for coatings-related projects ..... Participate in Youth Leadership seminar, which provides opportunity for high school students to meet with area representatives of business, industry, government, and education ..... Sponsoring undergraduate research project at Indiana State University on Preparation of Copolymers Based on para Diisopropenylbenzene; have appropriated funds for purchase of equipment and materials for the project.

Rocky Mountain

Sponsored seminar on compliance with government regulations ..... Planning slide program for presentation to general public, designed to promote the industry image and tell the "coatings story."

St. Louis

Maintain close relationship with University of Missouri—Rolla. Sponsored February seminar on basics of coatings technology, featuring presentations by UM-R faculty members ..... Eleventh annual Education Night will be held in April, to which local science teachers are invited to acquaint them with industry career opportunities; Dr. James Stoffer, UM-R Professor of Chemistry, is guest speaker ..... Continuing to provide cash awards for winning coatings-related exhibits in Science Fair for high school students ..... Administered Ralph Gatti Award competition to recognize accomplishments of local paint technicians ..... Continuing support of scholarship program at UM-R.

Southern

Close liaison continues to be maintained with University of Southern Mississippi, through support of scholarship program, as well as sponsorship of annual Water-Borne and Higher-Solids Coatings Symposium ..... Annual Society Meeting program theme was "Back to School," and featured presentations by prominent educators from polymers and coatings field, who discussed such topics as: principles of film formation; chain growth polymerization; alkyds and polyester resins; high solids coatings; fundamentals of UV curing; and paint testing and quality assurance ..... Society established A. L. Hendry Memorial Award—\$1,000 cash prizes for each of the two best student-authored papers on some aspect of coatings technology.

Toronto

Continuing sponsorship of coatings courses at George Brown College ..... Ontario Ministry of Education has certified two-year course at George Brown and appropriated \$30,000 to the school in support of the course.

Western New York

Initiated scholarship program, awarding two recipients \$400 each; applicants must be full-time college students and dependents of current Society members.

Definition.

Future Society Meetings

Baltimore

(Oct. 16)—"In-House Solvent Recovery"—Michael J. Schmutzer, Disti, Inc.
(Nov. 20)—Annual Awards Night.
(Jan. 15)—Federation Night. "Tools and Rules of Adhesion Science"—Douglas B. Rahrig, S.C. Johnson & Son, Inc.

Birmingham

(Nov. 6)—"Avoidance of Adhesion Problems with Coatings on Zinc"—A. Stoneman, Zinc Development Association.
(Dec. 4)—"Test Parameters in Artificial Weathering"—E. Preininger, CIBA-GEIGY Basle.
(Jan. 8)—"Particle-Size Reduction in Wet Systems"—D. Palmer, Marchant Bros. Ltd.
(Feb. 5)—"Epoxy-Curing Agents"—W. Burrell, Anchor Chemicals Ltd.
(Mar. 5)—"Determination of Short and Long Term Protection Offered by Chromate-Free Anti-Corrosion Paints"—Mr. Nitsche, BASF Stuttgart.
(Apr. 2)—Memorial Lecture for E.A. Bevan "Amino Resin Development"—R. Barrett, B.I.P. Chemicals Ltd.

Chicago

(Nov. 3)—"Comparative Analysis of Salt Fog and Exterior Exposure Results"—Robert Day, NL Industries. "Polymers for VOC Compliant Coatings"—Vince Calder, S.C. Johnson & Son, Inc.
(Jan. 5)—"The PVC of Latex Paints and Formula Optimization"—William Meadows, Cyprus Industrial Minerals.
(Feb. 2)—"When the OSHA Inspector Calls, Be Prepared by Establishing Procedures"—Hobart G. Miller, Label. "On Site Recovery and EPA Compliance"—Fred Slock, Progressive Recovery, Inc.
(Mar. 2)—"How Close is Close Enough"—Terry Downes, Applied Color Systems, Inc. "Effective Filtration of Industrial Coatings"—Carney Likens, Commercial Filters.
(Apr. 6)—"New Insights into the Chemistry of Silicones for the Coatings Industry"—speaker from Byk Chemie USA. "High Solids Urethane Coatings"—Bernard Taub, Spencer Kellogg Products, NL Chemicals/NL Industries, Inc.

Dallas

(Nov. 13)—"Calcium Carbonates in Coatings"—K.A. Hargenson, Thompson, Wienman & Co.
(Dec. 11)—"Corrosion Inhibitive Pigments"—M.C. McLaurin, Buckman Laboratories, Inc.

Golden Gate

(Nov. 17)—"New Insights into the Chemistry of Silicone for the Coatings Industry"—Jan Van Zelm, Byk Chemie USA.
(Jan. 19)—"Effective Filtration of Industrial Coatings"—Carney Likens, Commercial Filters.
(Mar. 16)—"New Developments in High Solids Coatings"—Richard Johnson, Cargill, Inc.
(Apr. 13)—"Vinyl Rheology Modified Systems"—Rick Caudwell, Reichhold Chemicals, Inc.
(May 18)—"Advantages of Predispersed Polyethylenes and Waxes in High Performance Coatings"—Elio Cohen, Daniel Products Co.

Houston

(Nov. 12)—"Calcium Carbonates in Coatings"—K.A. Hargenson, Thompson, Wienman & Co.
(Dec. 12)—"Corrosion Inhibitive Pigments"—M. C. McLaurin, Buckman Laboratories, Inc.

Los Angeles

(Nov. 12)—"New Insights into the Chemistry of Silicone for the Coatings Industry"—Jan Van Zelm, Byk Chemie USA.
(Jan. 14)—"Effective Filtration of Industrial Coatings"—Carney Likens, Commercial Filters.

(Mar. 11)—"NEW DEVELOPMENTS IN HIGH SOLIDS COATINGS"—Richard Johnson, Cargill, Inc.

(Apr. 8)—"VINYL RHEOLOGY MODIFIED SYSTEMS"—Rick Caudwell, Reichhold Chemicals, Inc.

(May 13)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

New England

(Oct. 16)—"RHEOLOGICAL ADDITIVES FOR NON-AQUEOUS COATINGS"—Bob Dey, NL Industries, Inc.

(Nov. 20)—"WATER-BORNE EPOXY TECHNOLOGY FOR COATINGS"—Rick Irizarry, Interez.

New York

(Nov. 11)—"THE POTENTIAL OF BIOLOGICAL TREATMENT AS A HAZARDOUS WASTE TREATMENT TECHNOLOGY"—Gordon Lewandowski, New Jersey Institute of Technology.

(Jan. 13)—"THE CASE FOR IN-HOUSE SOLVENT RECOVERY"—Michael Schmutzer, Disti, Inc.

(Feb. 26)—JOINT MEETING WITH NYPCA. "LEGISLATIVE UPDATE."

(Mar. 10)—"HARDENERS FOR EPOXY COATINGS"—John Sinclair, Pacific Anchor Chemical.

(Apr. 7)—"UPDATE ON POWDER COATINGS"—Sid Harris, Consultant.

(May 12)—PAST-PRESIDENTS' NIGHT. PAVAC AWARDS PRESENTATION.

Northwestern

(Nov. 11)—"EVERYTHING YOU WANT TO KNOW ABOUT CARBON BLACKS"—Alex Elbrechter, Degussa Corp.

(Dec. 2)—"THE USE OF DIATOMITE IN COATINGS"—Thomas Remmers, Manville Corp.

Pacific Northwest Portland, Seattle, and Vancouver Sections

(Oct. 14-16)—"THE MICROBIOLOGY AND PRESERVATION OF PAINT AND LATEX"—Terry B. Young, ICI Americas.

(Nov. 18-20)—"NEW INSIGHTS INTO THE CHEMISTRY OF SILICONE FOR THE COATINGS INDUSTRY"—Jan Van Zelm, Byk Chemie USA.

(Jan. 20-22)—"EFFECTIVE FILTRATION OF INDUSTRIAL COATINGS"—Carney Likens, Commercial Filters.

(Mar. 17-19)—"NEW DEVELOPMENTS IN HIGH SOLIDS COATINGS"—Richard Johnson, Cargill, Inc.

(Apr. 14-16)—"VINYL RHEOLOGY MODIFIED SYSTEMS"—Rick Caudwell, Reichhold Chemicals, Inc.

(May 19-21)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

Philadelphia

(Nov. 13)—"STATISTICAL PROCESS CONTROL"—Jack McCall, Valspar Corp.

(Dec. 11)—"ALUMINUM PIGMENTS: PAST, PRESENT, FUTURE"—Russell L. Ferguson, Silberline Mfg. Co., Inc.

Piedmont

(Oct. 15)—"HOW CLOSE IS CLOSE ENOUGH"—Terry L. Downes, Applied Color Systems, Inc.

(Nov. 19)—"THE DISPERSION PILOT PLANT—SHORTEST DISTANCE BETWEEN LAB AND PRODUCTION"—Martin Feldman, Nuodex.

(Dec. 17)—"ENVIRONMENTAL COMMITTEE PRESENTATION"—Ed West, General Steel Drum.

(Jan. 21)—"APPLICATION OF JEFF-

MEMBERS OF THE FEDERATION

Use This Form to Order (or Renew) Your Subscription to OCCA Journal In 1987 at Special Rate of $65.00

1987

Here is your opportunity to renew—or to place for the first time—your personal subscription to the *Journal of the Oil and Colour Chemists' Association*. Under the special exchange agreement between the Federation and the Oil and Colour Chemists' Association, Federation members are permitted to subscribe to this outstanding monthly technical journal at the special rate of $65.00 a year.

Order your 1987 subscription now by filling out the order form below. Send the order, with check or money order enclosed, to the Federation office in Philadelphia.

This OFFER GOOD TO FEDERATION MEMBERS ONLY. All others must order subscriptions directly from the Oil and Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex, England HAO 2SF, at the regular subscription rates.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1315 Walnut Street
Philadelphia, Pennsylvania 19107

Please enter my subscription to the *OCCA Journal* for 1987. (Subscriptions accepted on a calendar year basis only).

My check or money order for $65.00 is enclosed. (Please make checks payable to the Federation of Societies for Coatings Technology). U.S. Funds.

NAME ____________________

COMPANY ____________________

STREET (OR BOX NO.) ____________________

CITY ____________________

STATE OR PROVINCE ____________________ ZIP CODE __________

COUNTRY ____________________

I am a member of the ____________________ Society for Coatings Technology

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Martin's Market Square, Towson, MD). HELEN KEEGAN, Valspar Corp., 1401 Severn St., Baltimore, MD 21230. Virginia Section—Fourth Wednesday, Ramada Inn-East, Williamsburg, VA.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.M. HEATH, Holden Surface Ctgs. Ltd., Bordesley Green Rd., Birmingham B9 4TQ England.

CHICAGO (First Monday—meeting sites vary). EVANS ANGELOS, Kraft Chemical Co., 1975 N. Hawthorne Ave., Melrose Park, IL 60160.

CDIC (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; and Nov., Feb. in Dayton). CAROLYN TULLY, Sun Chemical Corp., 4526 Chickering Ave., Cincinnati, OH 45232.

CLEVELAND (Third Tuesday—meeting sites vary). R. EDWARD BISH, Jamestown Paint & Varnish Co., 108 Main St., Jamestown, PA 16134.

DALLAS (Thursday following second Wednesday—Executive Inn. Near Lovefield Airport). BRUCE ALVIN, DeSoto, Inc., P.O. Box 461268, Garland, TX 75046.

DETROIT (Fourth Tuesday—meeting sites vary). JOANNE CEDERNA, Inmont Corp., 26701 Telegraph Rd., Southfield, MI 48086.

GOLDEN GATE (Monday before third Wednesday—Alternate between Francesco's in Oakland, CA and Leaning Tower Restaurant in S. San Francisco). EDWARD SOLDAVINI, Nuodex Huls, 5555 Sunol Blvd., Pleasanton, CA 94566.

HOUSTON (Second Wednesday—Sonny Look's, Houston, TX). JAMES TUSING, PPG Industries, Inc., P.O. Box 1329, Houston, TX 77251.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). ROGER HAINES, Tnemec Co., Inc., P.O. 1749, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). PARKER PACE, Behr Process Corp., P.O. Box 1287, Santa Ana, CA 92702.

LOUISVILLE (Third Wednesday—Breckinridge Inn, Louisville, KY). LOUIS HOLZKNECHT, Devoe Marine Coatings, 1437 Portland Ave., Louisville, KY 40203.

MEXICO (Fourth Thursday—meeting sites vary).

MONTREAL (First Wednesday—Bill Wong's Restaurant). R. FERRIS, Canbro Ltd., 29 E. Park St., Valleyfield, Que., Canada J6S 1P8.

NEW ENGLAND (Third Thursday—LeChateau Restaurant, Waltham, MA). ROGER WOODHULL, California Products Corp., P.O. Box 569, Cambridge, MA 02139.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). DAVID PENICHTER, D.H. Litter Co., Inc., 116 E. 16th St., New York, NY 10003.

NORTHWESTERN (Tuesday after first Monday—Jax Cafe, Minneapolis, MN). RICHARD KARLSTAD, Ceramic Industrial Coatings, 325 Hwy. #52-South, Osseo, MN 55396.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). JOHN DALLER, McCloskey Corp., 4155 N.W. Yeon, Portland, OR 97210.

PHILADELPHIA (Second Thursday—Dugan's Restaurant, Philadelphia, PA). LAWRENCE J. KELLY, Peltz-Rowley Chemicals, 5700 Tacony St., Philadelphia, PA 19135.

PIEDMONT (Third Wednesday—Howard Johnson's, Brentwood Exit of I-85, High Point, NC). BARRY YORK, Reliance Universal, Inc., P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (First Monday—Montemurro's, Sharpsburg, PA). RICHARD G. MARCI, Royston Laboratories, 128 First St., Pittsburgh, PA 15238.

ROCKY MOUNTAIN (Monday following first Wednesday—Bernard's Arvada, CO). JEFFREY B. JOHNSON, Sashco, Inc., 1395 S. Acoma, Denver, CO 80223.

ST. LOUIS (Third Tuesday—Engineers Club). ROBERT L. WAGNON, Mozel Chemical Products Co., 4003 Park Ave., St. Louis, MO 63110.

SOUTHERN (Gulf Coast Section—Third Thursday; Central Florida Section—Third Thursday after first Monday; Atlanta Section—Third Thursday; Memphis Section bi-monthly on Second Tuesday; Miami Section—Tuesday prior to Central Florida Section—R. SCOTT MCKENZIE, Southern Coatings & Chemicals, P.O. Box 2688, Sumter, SC 29150.

TORONTO (Second Monday—Cambridge Motor Hotel). LARRY HAM, Stochem Inc., 5200 Dixie Rd., Suite 201, Mississauga, Ont., Canada L4W 1E4.

WESTERN NEW YORK (Third Tuesday—meeting sites vary). MARK K. MARKOFF, Spencer Kellogg Prods., NL Chemicals/NL Industries, Inc., 4201 Genessee St., Buffalo, NY 14225.

AMINE® COATINGS IN THE INDUSTRY"—W.C. Crawford, Texaco Chemical Co.

(Mar. 18)—FEDERATION NIGHT.

(Apr. 15)—"CAREER ENHANCEMENT"—Richard Fayssoux, Jr., Eastman Chemical Products, Inc.

(May 20)—"CURRENT DISPERSION MILLING METHOD"—Armin Szatmary, Premier Mill Corp.

(June 17)—"AN INTRODUCTION TO APPEARANCE ANALYSIS"—Richard W. Harold, Hunter Associates Laboratory, Inc.

Pittsburgh

(Nov. 10)—"TITANIUM CHELATES—A NOVEL APPROACH TO RHEOLOGICAL CONTROL IN LATEX PAINTS"—J.E. Hall, Tioxide Canada, Inc.

(Dec. 8)—"HIGH SOLIDS COATINGS"—Richard Johnson, Cargill, Inc.

(Jan. 5)—"FLOW AND LEVELING OF COATINGS"—Robert Vash, Byk-Chemie USA.

(Feb. 2)—"EFFECTS OF GOVERNMENT REGULATIONS ON LAB FACTORY SCALE-UP"—Hillary Holste, PPG Industries, Inc.

(Mar. 2)—"EPOXY CURING AGENTS"—Wheeler Crawford, Texaco.

(Apr. 6)—"NEW EPOXY RESINS TECHNOLOGY"—Marcel Gaschke, CIBA-GEIGY Corp.

(May 4)—"IN-STORE COMPUTER MATCHING"—Dennis Dempsey, Color Corp. of America.

Rocky Mountain

(Nov. 10)—"NEW INSIGHTS INTO THE CHEMISTRY OF SILICONE FOR THE COATINGS INDUSTRY"—Jan Van Zelm, Byk Chemie USA.

(Jan. 12)—"EFFECTIVE FILTRATION OF INDUSTRIAL COATINGS"—Carney Likens, Commercial Filters.

(Mar. 9)—"NEW DEVELOPMENTS IN HIGH SOLIDS COATINGS"—Richard Johnson, Cargill, Inc.

(Apr. 6)—"VINYL RHEOLOGY MODIFIED Systems"—Rick Caudwell, Reichhold Chemicals, Inc.

(May 11)—"ADVANTAGES OF PREDISPERSED POLYETHYLENES AND WAXES IN HIGH PERFORMANCE COATINGS"—Elio Cohen, Daniel Products Co.

St. Louis

(Oct. 21)—"CROSSLINKER CHEMISTRY"—Nick Albrecht, American Cyanamid.

(Nov. 18)—"TiO_2 REVIEW"—speaker from Du Pont Co.

(Jan. 20)—"EDUCATIONAL NIGHT" AND JOINT MEETING WITH SLPCA.

(Mar. 17)—"SAFETY."

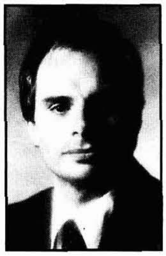
(Apr. 21)—MANUFACTURING SEMINAR.

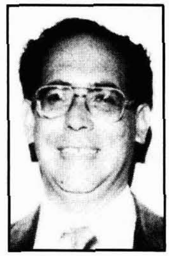
(May 19)—ELECTION OF OFFICERS.

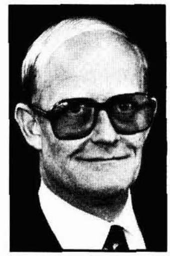
(June 12, 13)—JOINT MEETING WITH KANSAS CITY SOCIETY.

Joseph M. Behrle, Director of Corporate Research, Lilly Industrial Coatings, Inc., Indianapolis, is the 1986 recipient of the ASTM's Henry A. Gardner Award. The award is presented to a member of Committee D-1 who has demonstrated sustained outstanding competence in managing a unit of the committee so that its productivity is high. Mr. Behrle is first Vice-Chairman of Committee D-1 and is Chairman of Subcommittee D01.91 on By-laws and Scopes. Mr. Behrle is a member of the C-D-I-C Society.


J. Behrle


P. Reitano


R.T. Marcus


L.A. Henning

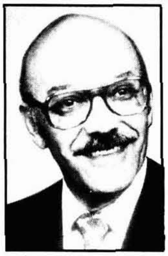
PPG Industries, Coatings and Resins Group, Allison Park, PA, has announced the appointment of **Peter Kamarchik** to the post of Senior Research Associate in its Research and Development Center. Dr. Kamarchik is a member of the Pittsburgh Society.

Blue Ribbon Paint Co., Wheeling, WV, has named **Charles William Bowman** as President and **Richard G. Bowman** as Vice-President. Charles Bowman previously served as Executive Vice-President. Richard Bowman joined the company in 1965 as Technical Director. A member of the Pittsburgh Society, he will continue to act as the Laboratory and Plant Manager of the firm.

Philip A. Reitano has joined the Charles A. Wagner Co., Inc., Philadelphia, PA, as Vice-President. Mr. Reitano will be responsible for sales management, new products development, and technical services. Mr. Reitano most recently served as Manager, polymers, resins, and coatings for Inolex Chemical Co. He is the immediate Past-President of the Philadelphia Society.

Macbeth, a division of Kollmorgen Corporation, has announced the appointment of **Robert T. Marcus** to the post of Director of the Munsell Color Products Group laboratory in Newburgh, NY. Dr. Marcus brings more than 12 years of industrial color technology and scientific computer systems experience to this new position.

Howard Jerome, Past-President (1981-82) of the Federation, has retired following a career in the coatings industry which began in 1947, when he was a co-op student attending Northeastern University, Boston.



During his career, Mr. Jerome worked for E. & F. King Co., Celanese Corp., Tennessee Products & Chemicals, Waterlac Co., Morris Paint Co., Spatz Vane-Calvert Paint Co., and Spatz Paint Industries, Inc. He retired as Vice-President and Technical Director of Spatz Paint, Inc., St. Louis, div. of Southern Coatings, on June 30, 1986.

In a long and distinguished career in Federation activities, Mr. Jerome was a member of the Federation Board for 14 years, of its Executive Committee for eight years, and was Chairman of the Technical Advisory, By-Laws, Finance, Nominating, and Annual Meeting Host Committees. The latter was for both the 1979 and 1985 Annual Meetings in St. Louis.

He was also a Trustee of the Paint Research Institute.

Mr. Jerome's Society activities included being President of the New England Society (1964), where he is also an Honorary Member, and Society Representative to both the New England and St. Louis Societies. Currently, he is in his second term as Treasurer of the St. Louis Society.

In addition, Mr. Jerome is a Past-President of the St. Louis Paint & Coatings Association.

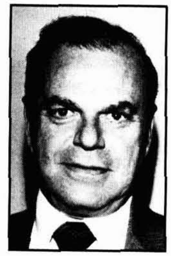
DeSoto, Inc., Des Plaines, IL, has appointed **Lester A. Henning** to the position of Director of Quality Excellence for the Chemical Coatings division. Among his responsibilities will be initiating and overseeing an ongoing training process in quality problem-solving techniques for all division employees in the U.S. and Canada. Mr. Henning is a member of the Chicago Society.

Richard W. Drisko, veteran Chemist at the Naval Civil Engineering Laboratory and a Navy expert in protective coatings, recently was honored for his contributions to the industry. Dr. Drisko was recognized for his work as a Technical Lecturer and Consultant to the annual Western States Corrosion Seminars, sponsored by the National Association of Corrosion Engineers. Additionally, he was the recipient of a special award "for excellence in technology transfer" by the Federal Laboratory Consortium, in Annapolis, MD. Dr. Drisko is a member of the Los Angeles Society, the National Association of Corrosion Engineers, and the Steel Structures Painting Council.

Charles J. Hoar has been promoted to the position of Senior Area Manager for the solvent and chemical business unit of the Petrochemical Group of Unocal Chemical Div., Unocal Corp., Schaumburg, IL. Mr. Hoar is a Past-President of the New England Society.

The Coatings Division of Ferro Corporation has named **Ippolito A. (Tony) Magnelli** to the post of Key Accounts Manager for Vedoc® Powder Coatings. Mr. Magnelli joined the company in 1970.

Saul Spindel, President of D/L Laboratories, New York City, is a recipient of the 1986 ASTM Award of Merit. Mr. Spindel was honored for his meritorious service on Committee C-24 on Building Seals and Sealants, and for active participation on administrative and technical subcommittees and in the development of over 19 ASTM standards.



The Award of Merit, and accompanying title of Fellow of the Society, were established in 1949 to recognize productive service to ASTM, marked leadership, outstanding contribution, or publication of papers.

Mr. Spindel, also a member of ASTM Committee D-1 on Paint and Related Coatings and Materials, has been an active member of Committee C-24 since 1974. He has been chairman of Subcommittee C24.82 on Criteria for Evaluation of Sealant Testing Laboratories since 1980 and is a member of eight other subcommittees in C-24. He was named the 1985 recipient of ASTM's "Sealants Man of the Year" Award.

Mr. Spindel, a graduate of Brooklyn College, was a control chemist for E.M. Wanderman from 1947-1948, and a chemist with Clover Leaf Paint and Varnish from 1948-1959. He joined David Litter Labs (now D/L Laboratories) as a technical chemist in 1959 and assumed his present position in 1983.

In the Federation, Mr. Spindel is a member of the Executive Committee, Society Representative to the Board from the New York Society, and Chairman of the Technical Advisory Committee. He is also the Federation's delegate to NPCA's Scientific Committee. A long-time member of the New York Society, he was its President in 1979.

In addition, Mr. Spindel is a member of the American Chemical Society, National Association of Corrosion Engineers, and the Washington Paint Technical Group.

Hercules Incorporated, Wilmington, DE, has appointed **David A. Needham** Vice-President—Marketing Services and Director of Marketing—Resins. He will assume responsibility for sales and marketing of organic resins, while continuing to provide the company with marketing services.

Jerry A. Windisch has been named Account Supervisor for organic resins sales in the Technical Marketing Group of Hercules. He reports to **Martin J. Gregor**, Supervisor of the Group.

Joseph Fiore III has been promoted to Development Chemist for Rubicon Chemicals, Inc., ICI Polyurethanes Group, ICI Americas Inc. He will be headquartered at the Polymer Engineering and Applications Research Laboratory in West Deptford, NJ.

As part of a series of organizational changes, ICI Specialty Products with the ICI Chemicals Group, Wilmington, DE, has announced the following appointments: **David W. Barber**—Director of Marketing; **James E. DiGuglielmo**—Business Manager, polyols; **Warren A. Scott**—Director, applications research and technical service; and **Carl W. Thompson III**—Director of Sales.

James B. Johnston has been named Coordinator of Planning for The McCloskey Corp., Philadelphia, PA. In his new position, Mr. Johnston will have responsibility for determining new markets and channels of distribution, evaluating new business opportunities, and identifying needs for new products. He is a member of the Philadelphia Society.

Color Corporation of America, a division of The Valspar Corp., Minneapolis, MN, has appointed **Robert E. Robinson** as Western Regional Sales Manager. In his new position, Mr. Robinson will be responsible for the company's line of colorants, color systems, and pigment dispersions in eleven western states. He will report to **Dennis Dempsey**, National Sales Manager.

Edward M. Kane has been named General Manager of Macco Adhesives, headquartered in Eastlake, OH. Macco is a business unit of Cleveland-based Glidden Coatings & Resins. Mr. Kane formerly served as Director of Glidden's Midwest Trade Sales Region.

At the Annual Conference of the Paintmakers' Association, **L.A. O'Neill** was awarded the Silver Medal for Meritorious Service, in recognition of his work for the industry in over 50 years at the Paint Research Association. Contributions cited include his application of scientific research on paint media and properties to improve formulation; the development of analytical techniques for paints and their components, using the newly available instruments and principles; and his acknowledged expertise on health and safety matters.

Wallace N. Cox has been appointed a Technical Representative in the Chemicals Laboratory at Eastman Chemical Products, Inc., Kingsport, TN. Prior to this, Mr. Cox was a Technical Representative in the Health and Nutrition Laboratory of the firm.

In addition, Eastman Chemical Products has appointed **James L. McGee** and **James C. Haas** to new international marketing posts. Mr. McGee has been named Asia and Australia Area Marketing Manager, and Mr. Haas is now District Manager for Hong Kong.

The appointment of **Craig Lampani** as Marketing Manager for coatings to the office furniture industry has been announced by Guardsman Chemicals, Inc., Grand Rapids, MI. Mr. Lampani was previously with the 3M Company.

William Holland has joined the technical sales force of Jordan Chemical Co., a wholly-owned subsidiary of PPG Industries. His account responsibilities will be in western Michigan, Indiana, Kentucky, Tennessee, and southern Illinois.

John D'Amigo has been elected President of the New York Paint and Coatings Association. He succeeds **Michael H. Lurie** of Hoboken Paint Co.

Morton Chemical Division of the Morton Thiokol, Inc., Chicago, IL, has promoted **Michael J. Scherrer** to the position of Technical Director of polysulfide applications and technical service. He will be based in Woodstock, IL.

The company also has named **Bruce E. Streeter** to the post of Insulated Glass Sealant Technical Manager. He will be responsible for IG glass sealants and thermal break materials.

The Chemicals Group, Pigments Division of Degussa Corporation, Teterboro, NJ, has appointed **Robert L. Niccol** to Southwest Regional Sales Manager (pigments) with sales responsibility for Texas, Oklahoma, Louisiana, and Arkansas. Mr. Niccol is a member of the Philadelphia Society.

Anita G. Etheridge has been named Research Chemist at Croda Ink Corporation's Corporate Research and Development facility in Atlanta, GA.

In addition, **Dean V. Speese** has joined Croda Ink as a Laboratory Technician in its Dallas, TX laboratory.

Union Carbide Corp., Danbury, CT, has announced the appointment of two Vice-Presidents in its Solvents and Coatings Materials Division. **Karl J. Hutchinson** will serve as Vice-President and General Manager of the UCAR Emulsion Systems Department and **Paul J. Johnston** will become Vice-President and General Manager for the UCAR Coatings Resins Department. Both will report to **Dr. Nathan L. Zutty**, President of the division.

A NEW MASTERPIECE

Rembrandt by Rembrandt
Oil on canvas (c. 1629)
Walker Gallery, Liverpool
England.

Rembrandt by Crosfield paint using HP200 Flatting Agent (1986)

for easier dispersion, superior flatting efficiency and smoother finish.

Two European masterpieces – one of art nd one of science. Like Rembrandt, Crosfield is a naster in its field. For over a century Crosfield Chemicals, part of the Unilever Group of Companies, has been involved in silicate chemistry.

Now Crosfield is introducing to the US narket a range of flatting agents based on both gel nd precipitate technology. The new Crosfield HP200 gel silicas offer greater flatting efficiency, apid dispersion and improved smoothness. For all igh quality flat finishes Crosfield silicas provide he high performance answer.

CROSFIELD CHEMICALS

Crosfield HP200 Series – a new masterpiece.

CROSFIELD CHEMICALS INC.
Park West One, Suite 470,
Pittsburg. PA 15275
Tel: (412) 787 7887

CROSFIELD CHEMICALS
P.O. Box 26, Warrington,
Cheshire. England. WA5 IAB
Tel: (925) 31211 Telex: 627067 XFIELD G

Cook Paint and Varnish Co., Kansas City, MO, has announced the following promotions: **Bob James** will assume the position of Vice-President of reinforced polyester composites, urethane foams, specialty resins, and additives and **Bob Carlson** will serve as Vice-President of industrial coatings and heavy duty protective coatings. Each will be responsible for the marketing, sales, and research for their prospective product lines.

Anthony R. Mancuso has joined Polychrome Chemicals Corp. as Senior Vice-President. Mr. Mancuso, who has been acting as a Consultant to the company since January 1986, was employed with Union Carbide Corp. for 27 years.

Glenn S. Miller has been named Product Manager for dry colors at the Harshaw/Filtrol Partnership, Cleveland, OH. He will be responsible for all manufacturing and marketing activities associated with the company's line of dry color pigments for the coatings, plastics, and ink industries.

Chris Sghibartz and **Allen Barnatt** have been appointed Business Development Managers at RTZ Chemicals Ltd., London, England. Dr. Sghibartz, formerly Research Manager at Jotun Marine Coatings, will be responsible for coordinating group R&D in the areas of specialty monomers, organo-metallics, and electronic chemicals.

Dr. Barnatt, previously Technical Manager of Baxenden Chemicals, will be involved in the application and development of existing technology, with emphasis on polymers.

Frank J. Clark, retired Sales Representative from SCM Pigments, Jackson, MI, was recently honored by the Memphis Section of the Southern Society for his service to the section. He is also a member of the Baltimore Society.

Dale H. Morehouse has been appointed to Executive Vice-President and Chief Operating Officer of Morehouse Industries, Inc., Fullerton, CA.

Richard Manning has been promoted to the position of Vice-President of Manufacturing by Rust-Oleum Corp., Vernon Hills, IL. Mr. Manning joined the firm in 1973. Most recently, he held the position of Director of Manufacturing.

G. Sheldon Veil has been appointed to the position of Manager of Corporate Development for Haden, Inc., Madison Heights, MI. Mr. Veil brings over 30 years experience in the paint and coatings industry to his new position.

Clawson Tank Company, Clarkston, MI, has named **Tom Jackson** to the post of Regional Sales Manager for its underground storage tank, jumbo shipping container, and process tankage products. He will operate out of Illinois and concentrate on midwestern states.

Leo Goldberg, Executive Vice-President of Dexter Chemical Corporation since 1979, has been appointed President and Chief Operating Officer of the firm. **Dr. Sidney M. Edelstein**, Chairman of the Board and Chief Executive Officer, previously held the position of President for 41 years.

Also announced by the company were the following promotions: **David H. Abrahams**—Vice-President of Research and Development; **Leonard A. Sitver**—Vice-President; **L. Thomas Holst, Jr.**—Vice-President, Textile Chemicals Division; and **Gregory J. Hopkins**—Manager of the Technical Service Department. Mr. Sitver is a member of the New York Society.

In a series of managerial changes, the following appointments have been announced by Amchem Products, Inc., Ambler, PA: **Peter J. Callahan**—General Manager, Automotive Division; **Donald M. Herrington**—General Manager, Container Division; and **Edwin C. Nusbaum, Jr.**—General Manager, Diversified Products Division.

Paul R. Pomp has assumed the position of Senior Technical Service Representative of Gulf Coast Chemical Corp., Tampa, FL.

James A. Einspanier has been appointed General Manager of Spatz Paints, a unit of Southern Coatings, Inc., Sumter, SC. Mr. Einspanier formerly held key positions with Mallinckrodt, Inc., Chemtech, and Carboline Coatings.

AZS Corporation, Atlanta, GA, has appointed **Glenn H. Petschke** as Group Leader, urethane chemicals, within its Coatings and Adhesives Division. He will oversee the R&D effort relating to urethane chemicals including aliphatic polyisocyanates and curatives.

Also announced by the Coatings and Adhesives Division of the firm is the appointment of **Timothy S. Hyde** to the position of Northeast Regional Manager. He will be responsible for direct sales for the company's product line, including epoxy curing agents, reactive diluents, acrylic dispersants, and high performance urethane chemicals.

Thomas Elias has been promoted to Sales Manager for Dar-Tech, Inc., Cleveland, OH. A member of the Cleveland Society, Mr. Elias joined the company in 1981.

In addition, Dar-Tech has announced that **Dan Asche** has joined the firm as Sales Representative in Pittsburgh and western Pennsylvania.

Ron Robertson has been named Executive Vice-President of the Western Decorating Products Association, a regional affiliate of National Decorating Products Association. Mr. Robertson most recently served as District Manager for Minwax.

Obituary

John C. Woodruff, Vice-President of Sales for Whittaker, Clark & Daniels Co., S. Plainfield, NJ, died suddenly July 18. He was 59.

Mr. Woodruff, who joined the company in 1969, worked for more than 35 years in the coatings industry. He was previously Manager of Chemical Specialties for Nuodex Div. of Tenneco Chemicals, and was a sales executive with Reichard-Coulston, Inc.

A member of the New York Society and the New York Paint & Coatings Association, he is survived by his wife, Lora, two daughters, Kathleen W. Barrett and Sally Jeanne D'Alessio, and a son, John C.D., who is also active in the industry.

Robert S. McKay II, former President of the Dean and Barry Company, Columbus, OH, died on July 17. He was 63.

Mr. McKay, who was employed with Dean and Barry Co. for 34 years, was a recipient of the George Baugh Heckel Award of the National Paint and Coatings Association. He also served as President of the Coatings Research Group, Inc.

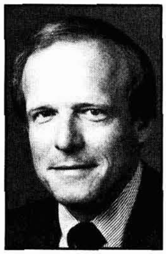
Univ. of Detroit Incorporates Polymer Institute

The University of Detroit has announced that its Polymer Institute will operate as a corporate subsidiary, Polymer Technologies, Inc.

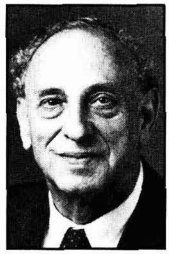
The Institute, which for the past 18 years, has performed polymer research for corporate clients, will be under the overall direction of Dr. Nicholas J. DeGrazia, who will serve as President and Chief Executive Officer. Dr. DeGrazia will continue to serve in his present capacity as University Vice-President for Finance and Treasurer.

The founder and director of the Polymer Institute, Dr. Kurt C. Frisch, will serve as Vice-President and Director of Research in the new firm. Dr. Frisch, a pioneer in polyurethanes, is internationally known in his field and was the recipient of the Society of Plastics Engineers 1986 Award of Outstanding Achievement in Plastics Education.

In addition to Dr. Frisch, who is a full-time research professor, the Institute currently staffs five full-time research scientists and three adjunct professors: Dr. Kaneyoshi Ashida; Dr. Taki Anagnostou; Dr. Adolph Damusis; Dr. Daniel Klempner; Dr. Panos Kordomenos; Dr. Jiri E. Kresta; Dr. Shaio-wen Wong; and Dr. Hanziong Xiao. There are also 22 graduate research assistants and some of the teaching faculty of the university's College of Engineering and Science perform polymer research on a part-time basis.



N.J. DeGrazia



K.C. Frisch

Since its founding in 1968, the Institute has served more than 100 corporate clients. Marketing the company to new clients and expanding its research capabilities will be among Dr. DeGrazia's responsibilities. Under the new corporate structure Dr. Frisch will have more time to conduct and direct research, although he will still play an important role in the company's marketing efforts.

The corporation anticipates increasing its work for automotive manufacturers and suppliers, and will continue to pursue research and make contributions in the health care industry.

"We are seeking additional research scientists and hope to double the number of graduate students as our contract work expands," said Dr. DeGrazia. "It will give students more and diversified experiences on real projects where they can clearly see the commercial application of their work," he added.

His plans for the company include upgrading instrumentation and processing lab equipment and renovating laboratories. Through marketing and expanding research capabilities, Dr. DeGrazia projects a growth rate of 30-35% a year.

Founded in 1877 by the Jesuits, the University of Detroit is the largest independent university in Michigan with more than 6,000 students enrolled in its seven schools and colleges.

Spouses Program Set for WCS Symposium

A motorcoach tour of the picturesque Monterey Peninsula will highlight the spouses program of the 1987 Western Coatings Societies' Symposium and Show, to be held February 23-25, at the Monterey Convention Center.

Beginning with a drive through historic Cannery Row, the tour passes the sites made famous by John Steinbeck's novel: the sardine factories, Doc Rickett's Lab, and Wing Chong's General Store. Then, winding along the Pacific Grove coastline and onto the "Seventeen Mile Drive," with its famous coastal scenery, the tour includes three of the famed golf courses included in the annual AT&T National Pro-Am tournament—Pebble Beach, Cypress Point, and Spyglass Hill.

Following lunch at "The Lodge" at Pebble Beach, the tour continues into Carmel-by-the-Sea. Free time is allotted to shop and browse in the boutiques, art galleries, specialty stores, antique shops, courtyards and plazas.

The program will also feature a tour of local wineries, including the Robert Mondavi Winery.

Chairman of the *Spouses Program* is Shirley Lipscomb, of Lipscomb Chemical Co.

Serving as General Chairman for the Symposium and Show is Ted Favata, of T.L.T., Inc. Assisting Mr. Favata are: *Co-Chairman*—Patricia Shaw, of Davlin Paint Co.; *Treasurer*—Barry Adler, of Royell, Inc.; *Advisor*—Bud Harmon, of Borden Chemical Co.; *Exhibits*—Mr. Adler, Bob Minucciani, of Glidden Coatings & Resins, and Mr. Favata; *Entertainment*—Mel Lipscomb, of Lipscomb Chemical Co.; *Publicity*—Patricia Stull, of Pacific Coast Chemical Co.; *Registration*—Tom Dowd, of E.T. Horn Co.; and *Technical Program*—Gordon Rock, of Nuodex/Huls.

For additional information, contact Mr. Favata at T.L.T., Inc., 318 Pendleton Way, Oakland, CA 94621.

NACE Announces Plans for Corrosion/87

The National Association of Corrosion Engineers has scheduled its annual national conference, Corrosion/87 and the 1987 Materials Performance and Corrosion Show for March 9-13, 1987, at the Moscone Convention Center, San Francisco, CA.

The technical program will include over 350 papers on all aspects of the prevention and control of corrosion. Over 200 exhibitors will be in the Corrosion Show, displaying the latest materials, services, and technology for corrosion prevention and control.

Copies of the advance program can be obtained from the NACE Meetings Department, P.O. Box 21830, Houston, TX 77218.

CALL FOR PAPERS

ASTM
Symposium on Mechanisms and Measurement of Water Vapor and Liquid Water through Materials

Philadelphia, PA • September 13-18, 1987

Papers are invited to be submitted for possible presentation at the ASTM Symposium on Mechanisms and Measurement of Water Vapor and Liquid Water through Materials, to be held in Philadelphia, PA, from September 13-18, 1987.

The symposium is co-sponsored by ASTM Committees C-16 on Thermal Insulation; D-1 on Paint and Related Coatings and Materials; D-8 on Roofing, Waterproofing, and Bituminous Materials; C-10 on Packaging; D-20 on Plastics; E-6 on Performance of Building Constructions; and F-2 on Flexible Barrier Materials.

The purpose of the symposium is to bring together papers discussing experiences with existing test methods, proposed new test methods, innovative technology for developing better methods to characterize the water vapor and liquid water transmission of construction materials and building elements in packaging, flexible membranes, coatings, and other materials. Results of the symposium will assist in revising, expanding, or affirming existing standards, and may also lead to the development of new test methods in these fields.

Prospective authors are requested to submit a title, three copies of a 300-500 word abstract, and the ASTM Paper Submittal Form to Theresa Smoot, ASTM Publications Division, 1916 Race St., Philadelphia, PA 19103.

For more information, contact Symposium Chairman Heinz Trechsel, P.O. Box 211, Germantown, MD 20874-0211.

HunterLab Schedules Fall Short Course

Hunter Associates Laboratory, Inc., headquartered in Reston, VA, has released its fall 1986 schedule of educational color and appearance seminars.

"Color and Appearance," a one-day introductory course, is designed to provide a basic background of color science to those people concerned with the measurement of a product's appearance. Included in the seminar are lectures on color theory, gloss, tolerances, sample preparation, and instrument technology. An optional hands-on laboratory will be conducted on the day following the seminar, allowing registrants the opportunity to measure samples on HunterLab instruments.

This seminar will be conducted as follows: October 15-16—Stamford, CT; October 22-23—Dallas; November 5-6—Chicago; November 19-20—Philadelphia; December 8-9—Oakland, CA; and December 11-12—Los Angeles.

"Workshop on the Measurement of Appearance," a 2½ day course, was offered in Reston, VA, on October 1-3.

For additional information, contact the Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990.

DePaul Univ. Celebrates First Year of Graduate Degree Coatings Program

Instituted in the fall of 1985, the Masters Degree Program in Coatings Technology at DePaul University, Chicago, reports great progress being made upon entering its second year of operation.

Program Director Dr. Fred W. Breitbeil III said that 12 students have matriculated and that recent purchases of a Fourier Transform Infrared Spectrophotometer and a Differential Scanning Calorimeter have enhanced the program. "These instruments, along with the important accessories, are essential for any polymer laboratory," he said.

"During the academic year," said Dr. Breitbeil, "students (in the program) had the opportunity to take advanced courses in organic chemistry, inorganic chemistry, chemical kinetics, coatings technology, coatings polymer synthesis and evaluation, and in the physical chemistry of polymers."

In addition, an assistant professor in polymer chemistry has been added to the faculty.

Future possibilities under consideration are: to offer a second laboratory course on coatings formulation and evaluation; to hold an annual coatings technology research symposium, in cooperation with the Chicago Society; to set up a Coatings Technology Program advisory board; and to establish a coatings technology museum and exhibit at the university.

Dr. Breitbeil emphasized that the program's success is due in part to the support of the Chicago Society and the time and effort contributed by many of its members. "We are also grateful," he added, "for the supply of instruments and equipment donated by industries and individuals. We hope to repay this generosity in the future with well trained and qualified coatings technologists."

Admission to the program requires admission to the DePaul Graduate School. Candidates should have earned a B.S. degree in chemistry or its equivalent. The 12-course curriculum, which will require about six quarters of effort, includes two advanced courses each in organic chemistry, inorganic chemistry, and physical chemistry; three courses in polymer chemistry, and three courses in coatings technology, one of which is a coatings laboratory.

Taught at the Chemistry Dept. of DePaul, the courses are held on the Lincoln Park Campus and all graduate courses are taught in the evening.

For more information and for application to the Graduate School at DePaul University, write to Dr. Jurgis A. Anaysas or Dr. Fred W. Breitbeil III, at DePaul University, Dept. of Chemistry, 1036 W. Belden Ave., Chicago, IL 60614.

Adhesion Society Offers Student Financial Aid

The Adhesion Society will offer partial financial assistance to graduate students interested in attending its annual technical meeting, to be held in Williamsburg, VA, on February 22-27.

Aid is granted on the basis of the judged quality of abstracts for poster session papers for the meeting. Interested students should write to Dr. Louis H. Sharpe, 28 Red Maple Rd., Sea Pines, Hilton Head Island, SC 29928.

CALL FOR PAPERS
AFP/SME
Finishing '87 Conference and Exposition
September 21-24, 1987 • Cincinnati, OH

The Association for Finishing Processes of the Society of Manufacturing Engineers invites submission of papers for the Finishing '87 Conference and Exposition scheduled for September 21-24, 1987, in Cincinnati, OH.

With its theme, "Start to Finish," the conference will include topics covering design considerations, quality control, environmental compliance, surface preparation, statistical process control, powder coating, and liquid coating. Other subjects will include radiation curing, coil coating, and finishing in the graphic arts, metal furniture, electronics, automotive, major appliance, wood, and plastics industries, and additional related topics. Paper abstracts are due at SME headquarters by October 15, 1986.

The Finishing '87 Advisory Committee will select one paper as the "Best Paper" of the conference and its author will receive special recognition during the conference.

For more information, contact Kathleen Warren, Technical Activities Div., Society Manufacturing Engineers, One SME Dr., P.O. Box 930, Dearborn, MI 48121.

Federation of Societies for Coatings Technology

AUDIO/VISUAL PRESENTATIONS

(All A/V presentations include slides, cassette tapes and scripts)

CAUSES OF DISCOLORATION IN PAINT FILMS

Some of the common causes of paint discoloration, such as mildew, sulfide staining, dirt retention, and staining by cedar or redwood, are illustrated on houses and on painted panels. Chemical tests for distinguishing between these types of stains are shown. A test for distinguishing efflorescence and chalking of paint films is also described. 15 minutes (37 slides) **$40**

THE SETAFLASH TESTER

Produced by the Technical Committee, Birmingham Paint, Varnish and Lacquer Club

The Setaflash Tester offers the capability to quickly ascertain the flash point of a volatile product. This presentation describes the equipment and explains the procedures for determining flash point in two temperature ranges (ambient to 110° C; 0° C to ambient) by both the flash/no-flash method and the definitive method. 54 minutes (134 slides) **$100**

FEDERATION TRAINING SERIES ON TEST METHODS*

Volume II

(3 Lessons) Lessons vary from 7 to 11 minutes (79 slides . . . **$70**

Lessons	***Producing Society***
A Simple Method to Determine Microbiological Activity	Philadelphia
A Salt Spray (Fog) Testing Cabinet	Golden Gate
Wet Film Thickness Gages	Golden Gate

*Volume I not available at this time.

HIGH SPEED DISPERSION

Produced by the Manufacturing Committee, Montreal Society for Coatings Technology

The program covers theoretical and practical techniques used for dispersion in paint plants, showing laboratory test equipment and plant scale manufacturing procedures. 20 minutes (60 slides) **$65**

INTRODUCTION TO RESIN OPERATIONS

Produced by the Manufacturing Committee, Toronto Society for Coatings Technology

This presentation has been developed to assist in the selection and training of resin plant operators, and focuses on basic concepts of manufacture and the role of a resin operator. 12 minutes (58 slides) **$65**

A BATCH OPERATED MINI-MEDIA MILL

Produced by the Manufacturing Committee, New York Society for Coatings Technology

This presentation describes the design and operation of a batch operated mini-media mill, and was developed to assist in the training of plant personnel to operate such equipment. 8½ minutes (51 slides) **$60**

NOW AVAILABLE!

OPERATION OF A VERTICAL SANDMILL—(Produced by the Manufacturing Committee, Kansas City Society for Coatings Technology). This program describes the design and operation of a vertical sandmill, to assist in the training of plant personnel to operate such equipment. 14 minutes (73 slides). **$75**

- ☐ Causes of Discoloration in Paint Films **$40**
- ☐ The Setaflash Tester. **$100**
- ☐ Volume II, Test Methods **$70**
- ☐ High Speed Dispersion **$65**
- ☐ Introduction to Resin Operations **$65**
- ☐ A Batch Operated Mini-Media Mill **$60**
- ☐ Operation of a Vertical Sandmill **$75**

Name ____________________

Company Name ____________________

Address ____________________

City ____________________ State ____________ Zip ________

ORDER FROM: Federation of Societies for Coatings Technology
1315 Walnut Street • Philadelphia, PA 19107

Please make all checks payable in U.S. Funds

Pennsylvania residents, please add 6% sales tax.

Zinc Paint Directory

A comprehensive source of zinc paint producers, listing of products, and an overview of various zinc paint types and characteristics are featured in a new directory. This 40-page guide focuses on zinc-rich and zinc dust/zinc oxide paints. Single copies of "Directory of Zinc Paints" may be obtained free-of-charge by writing: Paint, Zinc Institute Inc., 292 Madison Ave., New York, NY 10017.

Closure Device

A pull tape closure designed for motor oil cans is featured in literature. The publication describes the tab's coating which is comprised of an aluminum pigmented thermosetting material (developed by Valspar Corp.) as the corrosion resistant foundation over which a clear top coat is applied. To learn more about the new pull tab device, contact 3M Corp., John J. Hougnon, Marketing Public Relations, P.O. Box 33600, St. Paul, MN 55133-3600.

Spectrocolorimeter

Publication of a brochure which describes a new color and appearance measurement instrument has been announced. This eight-page, full-color brochure provides pictures showing the instrument's design, as well as a complete list of standard and optional features. Additional information may be obtained from B.F. Krauser, Hunter Associates Laboratory, Inc., 11495 Sunset Hills Rd., Reston, VA 22090-5280.

Acrylic Polymers

A new brochure describing the full line of special-purpose acrylic and urethane polymers for formulating industrial coatings, inks and other graphic arts products, adhesives, floor maintenance finishes, concrete sealers, and cement modifiers is now available. Major product groups featured in the 16-page brochure include solid acrylic resins for solvent coatings; acrylic emulsions for water-borne coatings; water-borne polyurethane dispersions for coatings; alkali-soluble acrylic emulsions for water-borne coatings; and water-borne acrylic dispersion vehicles and water-borne acrylic letdown vehicles for graphic arts. Copies of the guide may be obtained by writing to the Market Development Dept., Polyvinyl Chemicals Inc., 730 Main St., Wilmington, MA 01887.

Primary Coating Formulations

A 108-page booklet contains over 80 formulations of aqueous gloss-paints, primers, stoving enamels, printing inks, and colorants, produced in conjunction with a company's line of coating additives. Free copies of the booklet are available from Servo BV, P.O. Box 1, 7490 AA Delden, Holland.

Chemical Waste Service

A newly published technical bulletin describes the services provided by a company, including the arrangements for collection, transportation, treatment, and disposal of customers' chemical wastes. To obtain copies, request Bulletin 1622 from Ashland Chemical Co., Dept. Waste, P.O. Box 2219, Columbus, OH 43216.

Color-Matching System

Capabilities, merchandising features, and specifications of a recently introduced color-matching system developed for point-of-purchase installation in retail and commercial paint stores is described in a new brochure. The full-color publication is offered by Macbeth, P.O. Box 230, Newburgh, NY 12550-0382.

Safety Management

A new brochure describes a company's process safety management services which aim to help industry control process hazards and reduce the risk of catastrophic accidents. The program includes approaches such as hazard and operability analysis which assesses the safety of equipment; fault free analysis, which estimates the frequency of hazardous materials releases; and consequence analysis, which assesses the effects releases have on employees and the public. To order a copy of the brochure, write to Du Pont Safety Management Services, Barley Mill Plaza 19-1110, Wilmington, DE 19898.

Pycnometer

Information is now available on a pycnometer. Applications include density measurements for metal oxides, refractories, carbon black, activated charcoal, amorphous silica, metal powders, ceramics, graphites, and many more materials. For copies, contact Micromeritics, One Micromeritics Dr., Norcross, GA 30093-1877.

Thermal Analysis

A literature package is available which provides information on enhancing product thermal analysis laboratories. This information package describes computer automation of the major thermal analysis techniques and specifically reviews the use of a robotic system for the total automation of DSC experiments. To receive a copy, write the Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0012.

Detackifier

Recently released literature details a new two-package paint detackifier that denatures high solids coatings and medium and low solids coatings. This compound reportedly detackifies, floats, and conditions the paint sludge for easy removal from spray booths. Complete information may be obtained from Man-Gill Chemical Co., 23000 St. Clair Ave., Cleveland, OH 44117.

Mixing/Agitating System

Literature has been published which describes a new time-saving agitating and mixing system for use with portable paint shipping and storage containers. Complete information on the "Reddy" mixing system can be obtained upon receipt of letterhead request or publication inquiry directed to David LeMaster, Fawcett Co., Inc., 3863 Congress Parkway, Richfield, OH 44286.

Mercury Porosimeters

Five mercury porosimeters are described in a new full-color data sheet. Typical applications for each instrument are outlined. For copies, contact Michael Delancy, Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Caprolactone Polyol

A new caprolactone-based difunctional polyol for high-performance coatings, adhesives, and elastomers has been introduced in literature. The product is available as a liquid at room temperature, designed to facilitate the manufacture of urethane prepolymers, resins and high solids coatings. Additional information on TONE Polyol 0201 can be obtained from Union Carbide Corp., UCAR Coatings Resins, Dept. L4489, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Media Mill

A horizontal small media mill designed for continuous fast-fine grinding and dispersing is described in a new brochure. Operational features, advantages, applications, and grinding media usage are outlined in the publication. For copies, write to Union Process, Inc., 1925 Akron-Peninsula Rd., Akron, OH 44313.

Inorganic Pigments Chart

A new, 36-color inorganic mixed metal oxide pigments color chart is now available. Included are sample masstones and letdowns of a company's line of inorganic pigments. Copies are available from Harry Sarvis, Sales Manager, Color Div., Ferro Corp., 4150 E. 56th St., Cleveland, OH 44105.

Computerized Batching

A unit which combines batching, inventory, and blending to provide a fully automated system is the focus of a new technical data sheet. The system is designed to increase product yield, eliminate human errors, and to reduce waste. Further information is available from S.J. Controls, Inc., P.O. Box 91059, Long Beach, CA 90809.

Polyol

Information has been released concerning a newly developed polyol for non-foam polyurethanes. The polyol is designed for the formulation of casting resins used in the electrical, adhesives, and paint and varnish manufacturing industries. For details, contact Resina Chemie V.O.F. K. Nieboerweg 12, 9607 PH Foxhol, the Netherlands.

Community Outreach Program

A new brochure describes a community outreach consulting and training program which helps manufacturers, importers, distributors, and users of hazardous materials improve emergency response capabilities, community relations, and public image. The brochure discusses the need for and components of programs that improve relations between plants and their immediate communities. For copies, contact Du Pont Safety Management Services, Barley Mill Plaza 19-1110, Wilmington, DE 19898.

Cavity Pump

Progressive cavity pumps which are designed to move a broad range of high viscosity, high solids content materials over long distances and high lifts are described in new literature. For more information, contact Netzsch Incorporated, 119 Pickering Way, Exton, PA 19341-1393.

Compliance Solvent

A specially inhibited grade of 1,1,1-trichloroethane offering fast and cost-effective compliance with the Federal Clean Air Act is highlighted in a new six-page, full-color brochure. In addition to benefits, common applications, and performance information relative to conventional solvents, the publication provides background details on safe handling and conversion requirements. Copies are available from Chemicals and Metals Dept., Dow Chemical Co., 9008 Building, Midland, MI 48640.

Infrared Analyzer

An infrared analyzer which is designed to perform quantitative analysis for laboratory and process control is the subject of technical data. For more information, write to the Sales Dept., Pacific Scientific Co., Gardner/Neotec Div., 2431 Linden Lane, Silver Spring, MD 20910.

High-Shear Mixers

Technical specifications on high intensity, high shear mixers with three interchangeable mixing heads are provided in a recently released six-page brochure. The two-color brochure describes a line of variable speed mixers, including portable models and production size dispersers, and contains a section on selecting the most efficient mixing head. To obtain copies, request bulletin #68610M from Premier Mill Corp., 220 E. 23 St., New York, NY 10010.

Particle Size Analyzer

Literature is available which discusses an automated particle size analyzer capable of readily measuring organic and inorganic materials in the range from 0.02 to 150 μm and printing out test results in several formats. The instrument determines particle concentration during centrifugal or gravitational sedimentation or a combination of the two, and computes size results using the Stokes equation. For copies, contact Dr. David L. Kemper, Shimadzu Scientific Instruments, Inc., 7102 Riverwood Dr., Columbia, MD 21046.

Defoamer Kit

A recently released product bulletin contains information on a defoamer kit and reference guide. Recommended usage levels and the appropriate testing method for establishing efficacy performance are described. For additional information, contact John R. Stinger, Manager, Marketing Communications, Drew Industrial Div., One Drew Plaza, Boonton, NJ 07005.

Industrial Survey Report

The latest findings of a survey profiling Britain's paint industry have been published. The report identifies the 17 major market sectors and itemizes their turnover and main suppliers. It also contains a discussion on the products and technologies of the future. Further details are offered by Jordan & Sons Limited, Jordan House, Brunswick Place, London, N1 6EE, England.

Particle Size Analyzer

Information is now available which details a particle size analyzer for research and quality control applications in the 0.01 to 60 micron particle range. The instrument is particularly suited for samples where the majority of particles are below 1 micron and when high resolution is required. For further information, contact Marco Scientific, 1055 Sunnyvale-Saratoga Rd. #8, Sunnyvale, CA 94087.

Testing Equipment

A company's 750-page limited edition handbook details its line of testing equipment. Complimentary copies can be obtained by contacting The Paul N. Gardner Co., P.O. Box 10688, Pompano Beach, FL 33061-6688.

Solvent Recovery System

A new eight-page brochure details a company's solvent recovery system. Designed to remove volatile organic compounds from industrial airstreams, the system is applicable in printing and labeling, paint spraying and stripping, solvent degreasing, furniture finishing, wire coating operations, and others. For further information, contact The Ceilcote Co., Air Pollution Control Div., 140 Sheldon Rd., Berea, OH 44017.

Mixture Design Software

Mixture design software which enables a user to study three variables at one time is the subject of a product bulletin. With this software, experimental results can be entered into a program and a tri-linear contour plot will be generated on a screen or on paper by using a suitable plotter printer. Further information on Conplot III is available from Tioxide America Inc., 200 Century Plaza, Suite 447, Columbia, MD 21044.

Pigment Powder

Information has been released which describes a very intense, bright white pearl luster pigment. This titanium dioxide coated mica pigment can be incorporated into most plastic resins, or used as a surface coating. Technical information can be obtained by contacting The Mearl Corporation, 41 E. 42nd St., New York, NY 10017.

Grinding Aid

Performance advantages of a new wetting and dispersing agent are outlined in a product bulletin. Designed for paint manufacturers, the cationic pigment grinding aid is offered in an amber liquid. Copies of bulletin #p42-486 are available and sample testing batches can be arranged from Hodag Corp., 7247 N. Central Park Ave., Skokie, IL 60076.

Filter Cartridge

A new filter cartridge with applications for removal of particles over a wide range of sizes has been introduced in a product bulletin. Performance specifications, benefits, and optional attachments are provided. Copies can be obtained from Filterite, 2033 Greenspring Dr., Timonium, MD 21093.

Flammability Tests

A technical bulletin has been published which describes a flammability test designed to predict the flammability hazard of aerosol products in warehouse storage. Important considerations in the test are the heat released during a fire, the time it takes for a can rupture, and the effect of water application on residual liquids. Additional details can be obtained from Sally Robbins, "FREON" Products Div., the Du Pont Co., Wilmington, DE 19898.

Service Directory

The complete directory of a firm's specialty chemical and petroleum products and services has been released in a new edition. Designed as a convenient reference, the directory lists hundreds of product categories and specific products, as well as sales offices and plant addresses. Copies can be obtained by writing to the Marketing Communications Dept., Witco Corp., 520 Madison Ave., New York, NY 10022-4236.

Paint Stripping System

A paint stripping system which is designed to offer high-precision paint removal using plastic media as well as efficient reclamation and reclassification of the media for reuse is described in literature. The system operates within a 20- to 50-pound pressure range and is available in stationary and portable models. For more information, write to Clemco Industries, 1657 Rollins Rd., Burlingame, CA 94010.

Spectrophotometer

A spectrophotometer designed to measure the color of liquids, powders, solids, and pastes is the focus of a new technical bulletin. The instrument employs 45°/0° geometry, correlating to visual observations, and circumferential illumination, which eliminates the need for multiple measurements of directional or textured products. For more information, contact the Sales Department at Pacific Scientific, Gardner/Neotec Div., 2431 Linden Lane, Silver Spring, MD 20910.

Monochromatic Pastes

Water-based monochromatic pastes for polychrome coatings have been introduced in literature. A product bulletin detailing characteristics, chemical physical data, blending, application procedure, storage, and packaging information is available by contacting Mr. F. Halpern, Open Gate Marketing Corp., 681 Fifth Ave., New York, NY 10022.

Viscometers

An updated version of a catalog contains calculating display viscometer models, as well as a full range of viscometers. Information is provided on how to select the right viscometer and accessory for each scientific or individual application. Write to Brookfield Engineering Laboratories, Inc., Dept. NR 52, 240 Cushing St., Stoughton, MA 02072.

Epoxy Hardener

A new low-temperature cure epoxy hardener is featured in literature. The hardener is designed to offer shorter induction time with no loss of gloss and faster cures, and cures at lower temperatures. It has applications in the transportation, pipe, maintenance, marine, tile, or glaze coatings and machinery industries. For a free sample of the epoxy repair packet, write: Diamond Shamrock Process Chemicals Div., 350 Mt. Kemble Ave., CN-1931, Morristown, NJ 07960-1931.

Detackification Additives

A new line of paint spray booth detackification additives are highlighted in a brochure. Included in the new line are nine different chemical products for use in detackifying, floating, sinking, or dispersing oversprayed paint. To learn more about the new additive line, write to Betz Laboratories, Inc., Somerton Rd., Trevose, PA 19047.

Defoamers

A new product/defoamer sample kit for the paint and coatings industry is the subject of a technical bulletin. The kit contains specially developed silicone and non-silicone defoamers for the trade sales, paints and industrial coatings. Kit requests should be directed to John R. Stinger, Manager, Marketing Communications, Drew Industrial Div., One Drew Plaza, Boonton, NJ 07005.

Viscometer

A new seven-page brochure describes the various models of the Stormer rotational shear type viscometer. Copies are available from The Paul N. Gardner Co., Inc., 316 N.E. First St., Pompano Beach, FL 33060.

Color Technology Newsletter

A newsletter featuring articles of interest on color technology has been released. The four-page quarterly publication contains illustrations and photographs, in addition to text. Copies are offered by Applied Color Systems Inc., P.O. Box 5800, Princeton, NJ 08543.

Pigment Suspension Agent

The handling advantages of a new solvent-free pigment suspension agent are outlined in a product bulletin. Manufactured in powder form, the agent is designed for non-aqueous systems. For technical data and samples, contact Troy Chemical Corp., Attn: Manager Marketing Services, One Avenue L, Newark, NJ 07105.

Powder Coating Analyzer

An instrument which is designed to check the standard of powder coatings is the subject of a recently released product bulletin. Copies are available from The Paul N. Gardner Co., Inc., 316 N.E. First St., Pompano Beach, FL 33060.

Pigment

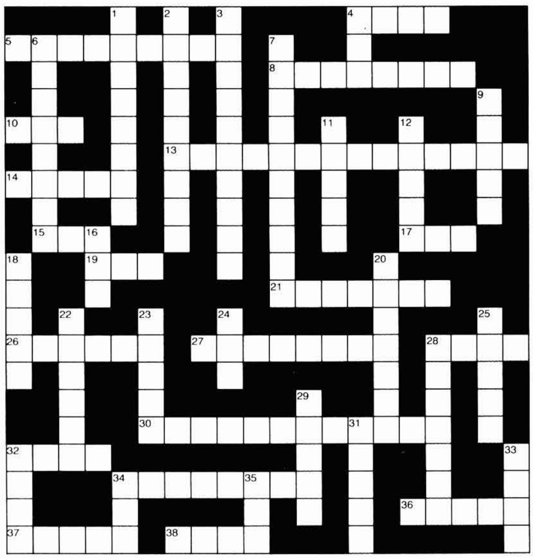
A new quinacridone pigment has recently been introduced in literature. The pigment is designed to provide improved dispersion stability, resulting in improved flow and higher gloss. For more information, contact American Hoechst Corporation, Pigments Dept., 129 Quidnick St., Coventry, RI 02816.

CLASSIFIED ADVERTISING

A complete set of back issues of the *Official* DIGEST and JOURNAL OF COATINGS TECHNOLOGY (from 1953 to the present) can now be obtained. The set is offered at no charge, provided that the interested party covers the cost of shipping. Address inquiries to Mr. Walter O. Bayer, 4205 Green Glade Rd., Phoenix, MD 21131, or telephone (301) 592-8483.

CrossLinks

by Earl Hill



No. 14

Solution to be published in November issue.

ACROSS

4. Natural gum
5. To make
8. Low gloss
10. To cover a tank
13. Chemical reaction
14. Metric measure
15. Type of stain (Abr.)
17. ____ point
19. ____, Value, Chroma
21. Color system
26. Stones
27. Fiber variety
28. Thin metal sheet, e.g.
30. Straight chain aliphatic acid, E____
32. Useful metal
34. Printing press component, e.g.
36. A liquid (syn.)
37. 3-Roll Mill part
38. Lacks tack

DOWN

1. Thread-like corrosion
2. Specialty ink
3. Bright red pigment
4. State of matter
6. Wear away
7. Phenomenon involved in color matching
9. To apply fibers
11. Wood fiber attribute
12. Construction form
16. Fluidity measurement unit (c.g.s.)
18. Fossile gum
20. Brush out thin
22. Volume = 231 cu. in.
23. F____ spray
24. Illumination Commission (Abr.)
25. Small, long paint brush
28. High boiling terpene alcohol
29. To pulverize
31. Positive terminal
32. Z____ potential
33. Old term for viscosity or consistency
34. Power driven blades
35. 2-Amino-2-Methyl-1-Propanol

Book Review

COULOMBIC INTERACTIONS IN MACROMOLECULAR SYSTEMS

Edited by
Adi Eisenberg and Fred E. Bailey

Published by
American Chemical Society
Washington, DC
1986, vii + 272 pages, $59.95

Reviewed by
Dr. Robert F. Brady, Jr.
Naval Research Laboratory
Washington, DC 20375

This useful book contains 21 papers presented at a Symposium of the Macromolecular Secretariat which was held at an American Chemical Society meeting in August, 1984. All of the papers are related to polymers which have multiple ionic groups bound to the polymer backbone, and the papers describe how the effects of electrostatic attraction or repulsion control the properties and behavior of these materials.

Coatings chemists will be especially interested in the first chapter which reviews the structures and applications of the ion-containing polymers, known also as ionomers. The properties and uses of such families of ionomers as Surlyn® or Hycar® are discussed briefly; these materials find their way into specialty paints and coatings, but probably are better known to resin manufacturers than to coatings formulators.

The book is divided into five major categories. A general discussion comprises chapters two through nine. Polymeric membranes are covered in the next four chapters, and rubbers and solutions are addressed in the following three chapters. In addition, three chapters focus on polyelectrolytes and biopolymers and the last two chapters are directed to the subject of colloids. Many of these chapters discuss, at an advanced level, the polymer chemistry of the processes which control the behavior of surfactants, thickeners, flow and leveling aids, and other paint additives.

Chapter 10 will be of interest to coatings chemists. A discussion of the solution processing of prefluorinated ionomers such as Nafion® is included. These solutions can be formulated into protective coatings for reaction vessels and other metallic equipment for which resistance to corrosion and ease of cleaning are desired.

Each chapter contains many references to the literature. The text is complemented by many clear figures and photographs, and contains useful author and subject indexes.

INDUSTRIAL ADHESION PROBLEMS

Edited by
D.M. Brewis
D. Briggs

Published by
John Wiley & Sons
New York, NY
298 Pages

Reviewed by
Paul W. Barnett
Whirlpool Corporation
Benton Harbor, MI

This book is a reference work that covers a range of technologies and materials including case histories of problems and the techniques needed for their examination and solution. It begins with an overview of factors affecting adhesion and the measurement of adhesion. The authors discuss analytical surface techniques used to investigate problems and the thermodynamics involved in adhesion and adhesion problem solving.

A very good discussion on the chemistry and physics of metal-polymer interfaces is offered in Chapter Four. It explores corrosion protection, adhesive joints, metalization of plastics, semiconductors applications, and decorative coatings. Well-researched chapters on the topics of mineral-organic composites and adhesion problems with paint and powder coatings, packaging and aircraft industries are found in the last half of the book.

The book is an excellent guide and reference for evaluating adhesives and coatings and also for obtaining problem-solving techniques. The question of durability is thoroughly addressed in every application. It is highly recommended reading material.

Letters to the Editor

Recollections:
Submarines, the CAT Test, and a Perfect Score

To the Editor:

I read with great interest the Birmingham Club's paper on "Correlation of Results from CAT Scores," in the August 1986 issue. May I add a few of my personal recollections and experiences to the CAT story?

As I recall it, Dr. F. L. Dimmick's original efforts in conjunction with the Inter-Society Color Council were motivated by the need to *see* small differences of color, not to determine an individual's ability to accurately perform color matching tests. This application came later and was an important development. Problems had arisen on U.S. submarines where wires, conduits, etc., were color coded for identification. Under the rather poor lighting conditions which existed, errors had been made or barely avoided because submarine personnel could not discriminate properly between many different colored wires, conduits, etc., involved. As I recall the story, these wires were sometimes simply different shades of the same color.

My company (now the Midland Division of The Dexter Corporation) purchased what I recall to be the 1953 edition of the CAT test. And, in the fall of 1953 we gave this test to all company personnel involved with matching colors. One of our lab staff members made a score of 109. I believe this was a perfect score for the 1953 edition. After I reported this result, together with all our scores, to Dr. Dimmick, in accordance with his request, he expressed amazement that anyone had achieved a perfect score. At a subsequent meeting which we both attended and were discussing this matter, Dr. Dimmick asked me to subject the same individual to the same CAT test again—perhaps under a slightly different lighting. This was done, and the then young laboratorian, John A. Szwedo, once more scored a perfect 109. When informed of this Dr. Dimmick was again amazed, no one else having achieved a perfect score—even once, at least up to that time.

As a result of his unique ability to discriminate small differences in color, Mr. Szwedo was assigned to the Quality Control Laboratory. To our delight we found that he had the additional ability to make accurate and mature "go/no go" color judgments in batches of high quality industrial coatings. Mr. Szwedo was later promoted to Manager of the Q.C. laboratories where he contributed substantially to Midland's reputation for consistently fine color matching.

He is currently a Senior Research Chemist at Midland. It would be interesting to learn how he would score if he took the CAT Test today—a third of a century later!

Milton A. Glaser
Midland Div., Dexter Corp.
Waukegan, IL

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact FSCT, 1315 Walnut St., Philadelphia, PA 19107 (215-545-1506).

1986

(Nov. 5-7)—64th Annual Meeting and 51st Paint Industries' Show. World Congress Center, Atlanta, GA.

1987

(March)—Seminar on Statistical Process Control. Sponsored by FSCT Professional Development Committee. Scheduled by region: March 2-3—Marriott Hotel, Chicago O'Hare Airport, Chicago, IL; March 9-10—Atlanta Marriott (downtown), Atlanta, GA; March 16-17—Marriott, Philadelphia Airport, Philadelphia, PA; and March 30-31—Marriott, Torrance, CA.

(Apr. 29-May 2)—Combined Federation Spring Week and Pacific Northwest Society Symposium. The Westin Hotel, Seattle, WA. FSCT Society Officers Meeting on April 29; FSCT Board of Directors Meeting on April 30; Seminar on May 1-2. Concludes with a dinner dance on May 2.

(Oct. 5-7)—65th Annual Meeting and 52nd Paint Industries' Show. Convention Center, Dallas, TX.

SPECIAL SOCIETY MEETINGS

1987

(Feb. 23-25)—Southern Society 14th Annual Water-Borne and Higher-Solids Coatings Symposium. New Orleans, LA. (Dr. Gordon L. Nelson, Chairman, Department of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Feb. 23-25)—Western Coatings Societies' Symposium and Show, Monterey Convention Center, Monterey, CA. (Barry Adler, Royell, Inc., 1150 Hamilton Ct., Menlo Park, CA 94025).

(Apr. 1-3)—Southern Society. Annual Meeting. Dutch Inn, Lake Buena Vista, FL. (C. Lewis Davis, 802 Black Duck Dr., Port Orange, FL 32019).

(Apr. 7-8)—Chicago Society's Symco '87 "Risky Business: Technology of Our Times." Knickers, Des Plaines, IL. (William Fotis, The Enterprise Cos., 1191 S. Wheeling Rd., Wheeling, IL 60090).

(Apr. 29-May 2)—Combined Federation Spring Week and Pacific Northwest Society Symposium. The Westin Hotel, Seattle, WA. April 29—FSCT Society Officers Meeting; April 30—FSCT Board of Directors Meeting; PNW Golf; PNW Evening Activities; May 1—Seminar; May 2—Seminar continued; PNW Sports Competition; Dinner Dance.

(June 12-13)—Joint meeting of St. Louis and Kansas City Societies. Holiday Inn, Lake of Ozarks. (A.E. Zanardi, Thermal Science, Inc., 2200 Cassens Dr., Fenton, MO 63026).

1988

(Apr. 13-15)—Southern Society. Annual Meeting. Charleston, SC. (Scott McKenzie, Southern Coatings Co., P.O. Box 160, Sumter, SC 29150).

(Apr. 28-30)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C., Canada. (Yvon Poitras, General Paint Corp., 950 Raymur Ave., Vancouver, B.C., Canada V6A 3L5).

1989

(Mar. 13-15)—Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim, CA. (Andy Ellis, NL Industries, Inc., 200 N. Berry St., Brea, CA 92621).

OTHER ORGANIZATIONS

1986

(Oct. 15-16)—Color and Appearance Seminar sponsored by HunterLab. Stamford, CT. (Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990).

(Oct. 15-16)—"Industrial Paint Application Technology" Course. Sponsored by Kent State University, Kent, OH. (Dr. Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(Oct. 15-17)—"Principles of High Performance Composites" course sponsored by State University of New York, Lake Mohonk Mountain House, New Paltz, NY. (Dr. A.V. Patsis, Chemistry Dept., State University of New York, New Paltz, NY 12561).

(Oct. 16)—Near-Infrared Technology Seminar sponsored by Gardner/Neotech Div. of Pacific Scientific, Houston, TX. (Michael Lams, Gardner/Neotech Div., Pacific Scientific, 2431 Linden Ln., Silver Spring, MD 20910).

(Oct. 20-23)—"Introduction to Coatings Technology" Course. Sponsored by Kent State University. Kent, OH. (Dr. Carl J. Knauss, Kent State University, Chemistry Dept., Kent, OH 44242).

(Oct. 21-23)—"Shop Painting Practices" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Oct. 22-23)—Color and Appearance Seminar sponsored by HunterLab. Dallas, TX. (Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990).

(Oct. 27-28)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Dalton, GA. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Oct. 27-31)—"Modern Instrumentation for the Polymer & Coatings Industry" Short Course. Univ. of Missouri-Rolla, Rolla, MO. (Prof. James O. Stoffer, Dept. of Chemistry, Univ. of Missouri-Rolla, Rolla, MO 65401).

(Oct. 28-30)—"Managing Safety: Techniques that Work for the Safety Pro" seminar sponsored by Du Pont Co., Wilmington, DE. (Du Pont Co., Professional Development Seminars, P.O. Box 4500, Greenville, DE 19807).

(Nov. 3-4)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Atlanta, GA. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Nov. 3-5)—Paint Research Association. Sixth International Conference, Sheraton Hotel, Brussels, Belgium. (D. Dasgupta, PRA, 8 Waldegrave Rd., Teddington, Middlesex TW11 8LD, England).

(Nov. 3-5)—Annual Meeting of National Paint and Coatings Association. Hilton Hotel, Atlanta, GA. (Karen Bradley, NPCA, 1500 Rhode Island Ave., Washington, D.C. 20005).

(Nov. 5-6)—Ninth Resins and Pigments Exhibition. Brussels, Belgium. (Exhibition Director, Queensway House, 2 Queensway, Redhill, Surrey RH1 1QS, England).

(Nov. 5-6)—Color and Appearance Seminar sponsored by HunterLab. Chicago, IL. (Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990).

(Nov. 10-12)—ASTM Committee D-33 on Protective Coating and Lining Work for Power Generating Facilities. Radisson Plaza, Nashville, TN. (Anne McKlindon, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Nov. 11-12)—"Coatings Problem Solving Forum" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Nov. 11-13)—"Process Hazards Management" seminar sponsored by Du Pont Co., Wilmington, DE. (Du Pont Co., Professional Development Seminars, P.O. Box 4500, Greenville, DE 19807).

(Nov. 18-20)—"Maintenance Painting Practices" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Nov. 18-20)—Color Science Workshop sponsored by Clemson University, Clemson, SC. (Fredrick T. Simon, Office of Professional Development, Clemson University, P.O. Drawer 912, Clemson, SC 29633-0912).

(Nov. 19-20)—Color and Appearance Seminar sponsored by HunterLab. Philadelphia, PA. (Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990).

(Nov. 21-23)—39th Annual Show and Convention of National Decorating Products Association. Cervantes Convention Center, St. Louis, MO. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132).

(Dec. 3-5)—Industrial Color Technology Seminar sponsored by Applied Color Systems, Inc. Orlando, FL. (Ms. Bobbie Deel, ACS, 2848 M Carolina Center, I-85 S., Charlotte, NC 28208).

(Dec. 8-9)—Color and Appearance Seminar sponsored by HunterLab. Oakland, CA. (Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990).

(Dec. 9)—Near-Infrared Technology Seminar sponsored by Gardner/Neotech Div. of Pacific Scientific, San Francisco, CA. (Michael Lams, Gardner/Neotech Div., Pacific Scientific, 2431 Linden Ln., Silver Spring, MD 20910).

(Dec. 11)—Near-Infrared Technology Seminar sponsored by Gardner/Neotech Div. of Pacific Scientific, Los Angeles, CA. (Michael Lams, Gardner/Neotech Div., Pacific Scientific, 2431 Linden Ln., Silver Spring, MD 20910).

ORDER FORM

Quantity					Price	Total
Journal of Coatings Technology:						
		U.S. and Canada	**Europe (Air Mail)**	**Other Countries**		
_____	1 Yr.	$27	$50	$37		
_____	2 Yrs.	51	97	71		
_____	3 Yrs.	73	142	103		_____

New Federation Series on Coatings Technology ($5.00 ea.)

_____ "Film Formation"—Z.W. Wicks, Jr. (7M86001) _____
_____ "Radiation Cured Coatings"—J.R. Costanza, A.P. Silveri, and J.A. Vona (7M86002) _____
_____ "Introduction to Polymers and Resins"—J. Prane (7M86003) _____
_____ "Solvents"—W.H. Ellis (7M86004) _____

Audio/Visual Presentations (Slide/tape except where noted)

Quantity		Price	Total
_____	Causes of Discoloration in Paint Films	($40)	_____
_____	The Setaflash Tester	($100)	_____
_____	High Speed Dispersion	($65)	_____
_____	Introduction to Resin Operation	($65)	_____
_____	A Batch Operated Mini-Media Mill	($60)	_____
_____	Operation of a Vertical Sand Mill	($75)	_____
_____	Laboratory Test Procedures (*VHS format*)	($50)	_____
_____	Federation Training Series on Test Methods	($70)	_____
_____	**Paint/Coatings Dictionary**	(Mbr.–$30; Non-Mbr.–$50)	_____
_____	**Infrared Spectroscopy Atlas**	(Mbr.–$75; Non-Mbr.–$100)	_____
_____	**Color-matching Aptitude Test Set**	($400)	_____

Pictorial Standards of Coatings Defects

_____ Complete Manual ($80) _____
Individual Standards ($2 ea., plus $2 per photo as noted) _____

_____ Adhesion *(1)* _____ Blistering *(4)* _____ Chalking *(1)*
_____ Checking *(1)* _____ Cracking *(1)* _____ Erosion *(1)*
_____ Fillform Corrosion *(3)* _____ Flaking *(2)*
_____ Mildew *(3)* _____ Print *(1)* _____ Rust *(4)*
_____ Traffic Paint Abrasion *(2)* _____ Traffic Paint Chipping *(2)*

_____ Record Sheets (pad of 100 sheets) ($2.50) _____

_____ **Glossary of Color Terms** ($6.00) _____

Subtotal .... _____

Pa. Residents please add 6% Sales Tax .... _____

Total .... _____

ALL INFORMATION BELOW MUST BE COMPLETED

YOUR COMPANY:
Check the one block which applies most specifically to the company or organization with which *you* are affiliated.

- ☐ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants, etc.
- ☐ Manufacturers of Raw Materials
- ☐ Manufacturers of Equipment and Containers
- ☐ Sales Agent for Raw Materials and Equipment
- ☐ Government Agency
- ☐ Research/Testing/Consulting
- ☐ Educational Institution/Library
- ☐ Paint Consumer
- ☐ Other _____ *(please specify)*

YOUR POSITION:
Check the one block which best describes *your* position in your company or organization.

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

Signed _____ Date _____

Name _____

Title _____

Company _____

Address _____

City & State _____

Country _____ Mail Code _____

Make checks payable to:
Federation of Societies for Coatings Technology
Postage and handling charges will be added to all orders requiring billing.

☐ FSCT Member ☐ Non-Member

All checks must be payable on a U.S. Bank

Federation of Societies for Coatings Technology
1315 Walnut St. • Philadelphia, PA 19107 • 215/545-1506

(Dec. 11-12)—Color and Appearance Seminar sponsored by HunterLab. Los Angeles, CA. (Seminar Coordinator, HunterLab, 11495 Sunset Hills Rd., Reston, VA 22090-9990).

1987

(Jan. 19-22)—Annual Meeting, Technical Symposium and Coatings Technology Exposition of Steel Structures Painting Council. Fairmont Hotel, New Orleans, LA. (James G. Busse, SSPC, 4400 Fifth Avenue, Pittsburgh, PA 15213).

(Feb. 4-6)—"Formula" Forum on Chemical Specialties sponsored by the Societe Francaise de Chimie, Nice. (Societe Francaise de Chimie, Departement Congres, 250 rue Saint Jacques 75005 Paris, France).

(Feb. 8-11)—Inter-Society Color Council. Williamsburg Conference on "Geometric Aspects of Appearance." The Lodge, Colonial Williamsburg, VA. (Dr. D.H. Alman, Du Pont Co., P.O. Box 2802, Troy, MI 48007).

(Feb. 17-19)—"Coatings Failure Analysis" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Mar. 3-5)—"Coating Inspection of Industrial Facilities" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Mar. 9-13)—CORROSION/87. National Association of Corrosion Engineers. Moscone Center, San Francisco, CA. (NACE, P.O. Box 218340, Houston, TX 77218).

(Mar. 17-19)—Powder Coatings '87. G-MEX Exhibition Center, Manchester, England. (Mervyn W.K. Little, Specialist Exhibitions Ltd., Grantleigh House, 14-32 High St., Croydon, Surrey CRO 1YA, England).

(Mar. 20-25)—The International Paint Industry & Anti-Corrosion Technology Exhibition, Beijing, People's Republic of China. (Sino Trade Promotions, 15A Wing Cheong Commercial Bldg., 19-25 Jervois St., Central, Hong Kong).

(Mar. 26-29)—Colour 87—the International Exhibition for Painting Techniques and Colour Application. Cologne, Germany. (Koln Messe, Postbox 210760, D-5000 Cologne 21, Germany).

(Apr. 5-10)—ACS, Div. of Polymeric Materials: Science & Engineering, Anaheim, CA. (T. Davidson, Ethican, Inc., Route 22, Somersville, NJ 08876).

(Apr. 7-9)—"Bridge and Highway Structures Coatings Inspection" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Apr. 21-23)—"Coatings Specifiers" course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (William Corbett, KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(May 18-21)—Surface Coating '87. Chemical Coaters Association. Milwaukee, WI. (CCA, Box 241, Wheaton, IL 60189).

(May 31-June 5)—Sixth International Meeting on Radiation Processing. Skyline and Holiday Inn Hotels, Ottawa, Ont., Canada. (Mrs. E. Golding, International Meeting on Radiation Processing, P.O. Box 13533, Kanata, Ont., Canada K2K 1X6).

(June 17-19)—"Chemically Modified Surfaces" Conference co-sponsored by Colorado State University and Dow Corning Corp. Holiday Inn, Fort Collins, CO. (Ward T. Collins, Mail Stop C41C00, Dow Corning Corp., Midland, MI 48686-0994).

(June 17-20)—Oil and Colour Chemists' Association Biennial Conference. Eastbourne, England. (Mr. R.H. Hamblin, Director & Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF, England).

(July 13-16)—SUR/FIN '87 Chicago—International Conference & Exhibit of Electroplating and Surface Finishing. McCormick Place, Chicago, IL. (AESF, 12644 Research Parkway, Orlando, FL 32826).

(Aug. 23-28)—"Copolymerization" Symposium. Sponsored by the Polymer Div. of the Royal Australian Chemical Institute and the Div. of Polymer Chemistry of the ACS. Sydney, Australia. (Prof. D. Tyrell, Polymer Science & Engineering, Univ. of Massachusetts, Amherst, MA 01003).

(Sept. 13-18)—"Mechanisms and Measurement of Water Vapor and Liquid Water through Materials" Symposium co-sponsored by ASTM Committees C-16, D-1, D-8, D-10, D-20, and F-2. Philadelphia, PA. (ASTM, 1916 Race St., Philadelphia, PA 19103).

(Sept. 15-18)—XVIIth Congress of AFTPV (French Association of Paint and Varnish Technicians) and Eurocoat. Nice, France. (J. Roire, 5, Rue Etex, 75018 Paris, France).

(Sept. 20-23)—Canadian Paint and Coatings Association. 75th Annual Convention. Four Seasons Hotel, Vancouver, B.C. (CPCA, 515 St. Catherine St. W., Montreal, Que., H3B 1B4 Canada).

(Nov. 7-11)—10th International Congress on Metallic Corrosion sponsored by Central Electrochemical Research Institute on behalf of International Corrosion Council. Madras, India. (Dr. V.I. Vasu, Chairman, ICMC Organizing Committee, Director CERI, Karaikudi 623006, Tamil Nadu, India).

1988

(June 15-16)—Surfex '88. Oil and Colour Chemists' Association. Harrogate International Conference Center, Yorkshire, England. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF England).

(Oct. 18-21)—12th World Congress on Metal Finishing, INTERFINISH 88. Palais des Congres, Paris, France. (SEPIC INTERFINISH, 17 rue d'Uzes, 75002 Paris, France).

Advertisers Index

'Humbug' from Hillman

This last summer brought a burst of poetry to Humbug's Nest. For October's portion, I have chosen an original ode written by Michael O'Connell and sent to me by Henry Siy, of Frazee's, in California. Michael is Frazee's shader so he knows whereof he pens. Shakespeare it ain't but "it's paint."

Roses It Ain't
(A Paintmakers' Song)

It's worse than kids, it's damn near alive.
For it's elusive perfection, we feverishly strive.
It's a perverse souffle that'll flop on a whim,
A mad witches' brew where fierce demons swim.

We make it, unrivaled, like masterful cooks,
Following runes in the chemists' books.
(Ah, the chemists, those wiley wizards!
They've sniffed enough solvent to melt lizzards' gizzards!)

We mix the components, the pigments, the smells,
The remnants of forests turned liquid in wells;
Colors from essence of dinosaur bones,
Man-made plant plasmas, pulverized stones.

We scramble this ooze in huge mobile urns;
Loud, looming mix masters cause it to churn,
To whirl and gurgle, to bubble and spurt,
To leap from its vortex and fresco our shirts.

Then it's let down and tinted just right,
Sluiced into cans and out of our sight.
It's numbered and labeled, then off it goes
To the paint rollered armies of condo Van Goghs.

We like it. Hell, we love it. We nurse every drop.
It gets in our eyes and we still never stop.
Now I don't mean to sound like a saint,
'Cause roses it ain't. It's paint.

Speaking of poetry, here's more truth than—from Howard Jerome:

- Authority tends to assign jobs to those least able to do them.
- To err is human. To blame it on someone else is even more human.
- If you leave the room, you're elected.
- He who shouts the loudest has the floor.
- A meeting is where minutes are kept and hours are lost.
- Authorization for a project will be granted only when none of the authorizers can be blamed if the project fails and all the authorizers can claim credit if it succeeds.
- Far away talent always seems better than home developed talent.

Here's more from Maureen Lein and the National Safety Council:

From fourth graders in Edmonton, WA, these well-thought-out answers to a first aid quiz:

- For head colds: Use an agonizer to spray the nose until it drops in the throat.
- For nose bleed: Put the nose lower than the body.
- For snakebite: Bleed the wound and rape the victim in a blanket for shock.
- For fractures: To see if the limb is broken, wiggle it gently back and forth.
- For fainting: Rub the person's chest, or if it's a lady, rub her arm above the hand.
- For asphyxiation: Apply artificial respiration until the victim's dead.

Earl Hill was impressed by the "Menu of Thoughts" from the Newburg Inn, Easton, PA, that appeared in the December 1984 *Chemtech.* I figure that enough time has passed so that those of you who read it either forgot the "Menu" or don't remember where you read it.

- A good boss is someone who accepts a little more blame and a little less credit.
- Optimists are the people who take the cold water thrown on their proposition, heat it with enthusiasm, make steam, and push ahead.
- Education is what you get from reading the small print. Experience is what you get from not reading it.
- Temper is what gets most of us into trouble. Pride is what keeps us there.

Walter Mass, known to many of our readers as a technical writer of note, found inspiration in the "art of writing" among the following quotes:

"Why do people always expect authors to answer questions?" —S. L. Perlman

"Mostly, we authors must repeat ourselves, that's the truth!" —F. Scott Fitzgerald

"The greatest misfortune that ever befell man was the invention of printing." —Benjamin Disraeli

"Tis pleasure sure, to see one's name in print." —Lord Byron

"Sir, no man but a blockhead ever wrote except for money." —Samuel Johnson

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361

Coatings Product Selection Guide

Shamrock

	S-379	S-394	S-395	Neptune 1	S-381	S-400	S-232	S-Nauba 5021	Versa-Flow 266	Versa-Flow 5022	SST-Series	Texture Series
For one of these COATING SYSTEMS...												
Coil and Metal Deco — *Water*	☘	☘	☘	☘	☘	☘	☘			☘	☘	☘
Coil and Metal Deco — *Solvent*	☘	☘	☘		☘	☘	☘	☘	☘		☘	☘
Air Dry	☘	☘	☘	☘	☘	☘	☘	☘	☘			☘
Wood Lacquers		☘	☘		☘	☘	☘	☘	☘		☘	
Powder Coatings	☘				☘						☘	☘
Flexible Packaging		☘			☘		☘	☘	☘	☘	☘	
Automotive Topcoats					☘		☘	☘	☘	☘		
U.V. Clears			☘					☘	☘	☘		
Rigid Packaging		☘	☘			☘	☘	☘	☘	☘	☘	
Architectural Paint					☘					☘		
Where you want one of these desired PERFORMANCE CHARACTERISTICS...												
Block Resistance		☘	☘	☘			☘	☘	☘	☘	☘	
Slip*	☘			☘	☘	☘	☘	☘	☘	☘		
Mar Resistance	☘	☘		☘	☘	☘	☘	☘	☘	☘	☘	
Abrasion** Resistance			☘					☘			☘	
Flow Control									☘	☘		
Textured Appearance												☘
Gloss Reduction					☘							☘
Select from these PRODUCTS... (Available with average particle size from 5 to 20 microns)												
Material	PE	PE	PE	PE (Water)	Modified PE	Modified PE	Melt Blend	Carnauba Wax	Liquid PE (Solvent)	Liquid PE (Water)	PTFE	PP
Product Name or No.	S-379	S-394	S-395	Neptune 1	S-381	S-400	S-232	S-Nauba 5021	Versa-Flow 266	Versa-Flow 5022	SST-Series	Texture Series

* We have specific recommendations for dealing with Altek, horizontal, or slide angle COF.

** We have specific recommendations for Taber, falling sand or can slide resistance.

or,

let us develop a custom product for special performance requirements.

Ask for the *Coatings Laboratory*

Shamrock, Foot of Pacific Street, Newark, N.J. 07114/telex 138691/Fax: 201-242-8074/Phone (201) 242-2999