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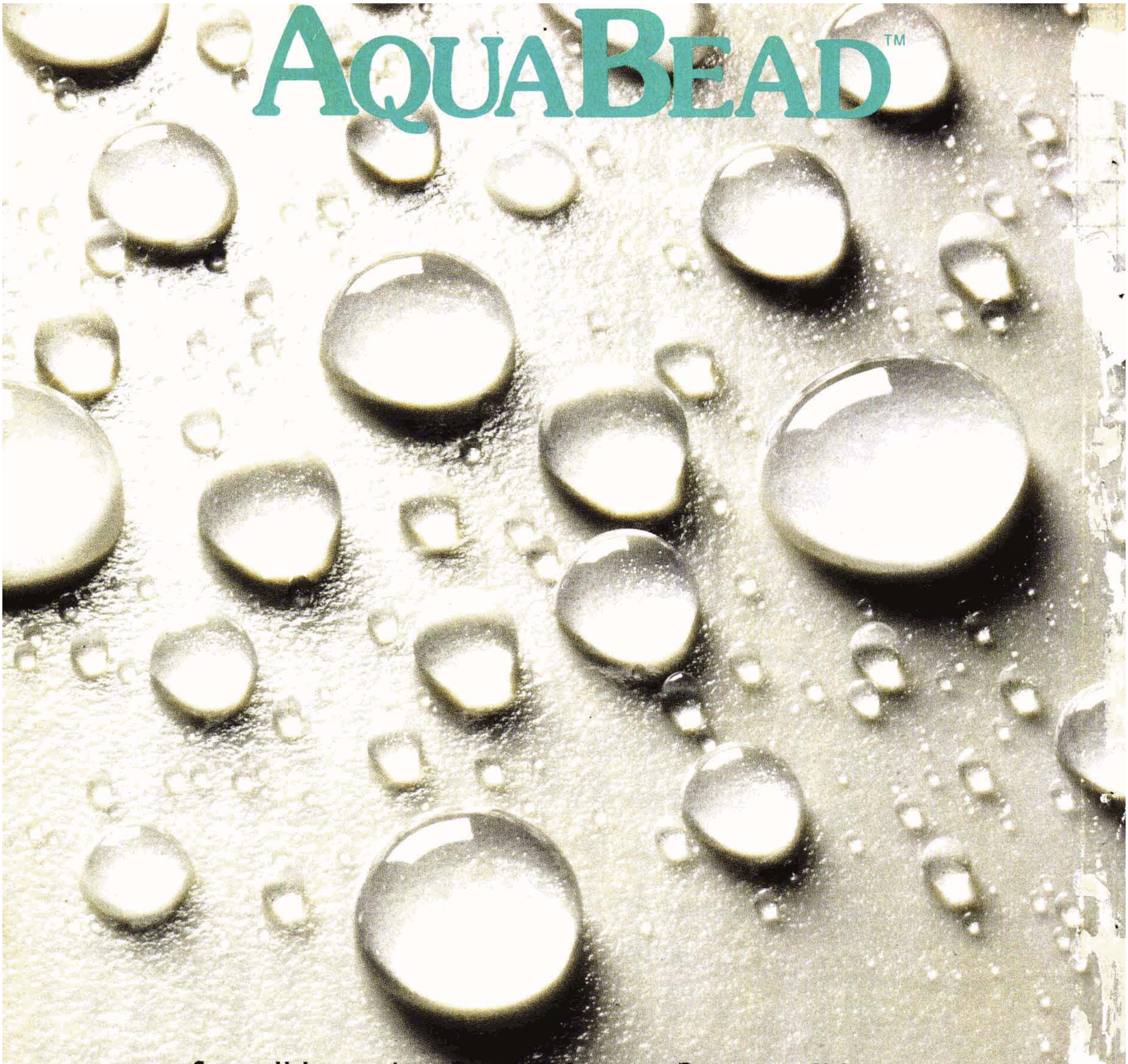
Performance and Compliance: The Challenge Intensifies.

1988 Chicago Convention Wrap-Up.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Federation of Societies for Coatings Technology

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VOLUME 60 NUMBER 767

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Thirteen degrees, 13 new mayor of Clute, Texas.

The group above and their colleagues at Dow have been busy, busy, busy.

They've developed more than a dozen new epoxy resins over the past three years, installed a new 7500 square foot laboratory in Freeport, Texas and added 13 new people to the Dow Resin Products coatings group. (You see seven of the veterans above: Henry, Tom, Chris, John, Lloyd, Dave and Dave.)

They've also lost elections, blown tennis games, and missed qualifying for the Boston Marathon, among other things. (The almost mayor of Clute, Texas is the fellow in the red shirt, Dave Hill. He lost by 61 votes.)

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John Massingill, the chemist in the center of the photo, kept a can coating formulator from losing a one million dollar contract when its customer put on the squeeze. He did so by cutting the viscosity range of a resin in half while retaining all of the original performance characteristics.

epoxy resins, and one almost

In the coming months you will see more of Dave, John and their colleagues at Dow. They will be visiting labs, attending trade shows, and delivering papers at conferences. Wherever you see them, they are there to answer your questions, listen to your needs and respond with products and technical insights.

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Oh, and by the way, if you have any tips on how Dave Hill can win an election, please pass them on. He could use the help.

J1288

To: The Dow Chemical Company, Resin Products Department, P.O. Box 1206, Midland, MI 48641-9940.

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

Comment

Building for the Future

At its recent meeting in Chicago, the Federation Board of Directors voted to acquire a permanent site for its headquarters.

The Board reached its decision after careful consideration and, on the recommendation of the Executive Committee, authorized the purchase of a site in the Philadelphia suburbs to serve as a permanent headquarters for the Federation. Presently, the Federation leases office space in a center city Philadelphia office building and, with lease and maintenance costs increasing, the Board's approval of a facility wholly-owned by the Federation was considered a most prudent decision.

The parameters proposed by the Ad Hoc Building Committee include:

(1) The location be in the Philadelphia suburbs with ease of access to both the airport and center city, and with the potential for likely appreciation of real estate values.

(2) The building be large enough to accommodate present operations and future expansion, with a suggested size of 10,000 sq. ft., and

(3) The maximum total down payment and mortgage commitment be not more than $1.8 million over no more than 20 years.

In all of the factors considered, the greatest significance was attached to maintaining the present, excellent staff and selecting a location which would cause the least amount of disruption to the smooth operation of the Federation.

By approving the acquisition of a permanent headquarters building, the Board has accomplished two things: provide for the future of the Federation—its operation and continued success; and signal to the industry that the Federation is not only here to stay, but also will continue to grow.

Robert F. Ziegler

Robert F. Ziegler
Executive Vice President

Abstracts of Papers in This Issue

MICROGELS—INTRAMOLECULARLY CROSSLINKED MACROMOLECULES: POTENT COMPONENTS OF ORGANIC COATINGS—W.E. Funke

Journal of Coatings Technology, 60, No. 767, 68 (Dec. 1988)

Microgels are polymer particles with sizes in the submicron range. At sufficiently small diameters, microgels exhibit properties characteristic of both particles and normal macromolecules: permanent shape and surface area, respectively, solubility. Such microgels can also be named as intramolecularly crosslinked macromolecules. If properly synthesized, microgels may bear reactive groups at their surface and their interior, which endow them with special properties and make them suitable for subsequent reactions. Due to their special rheological, reinforcing, surface, and carrier properties, reactive microgels are useful components for industrial materials, such as organic coatings, adhesives, additives, or biochemicals.

COATING FORMULATION DEVELOPMENT USING CRITICAL PIGMENT VOLUME CONCENTRATION PREDICTION AND STATISTICAL DESIGN—C.R. Hegedus and A.T. Eng

Journal of Coatings Technology, 60, No. 767, 77 (Dec. 1988)

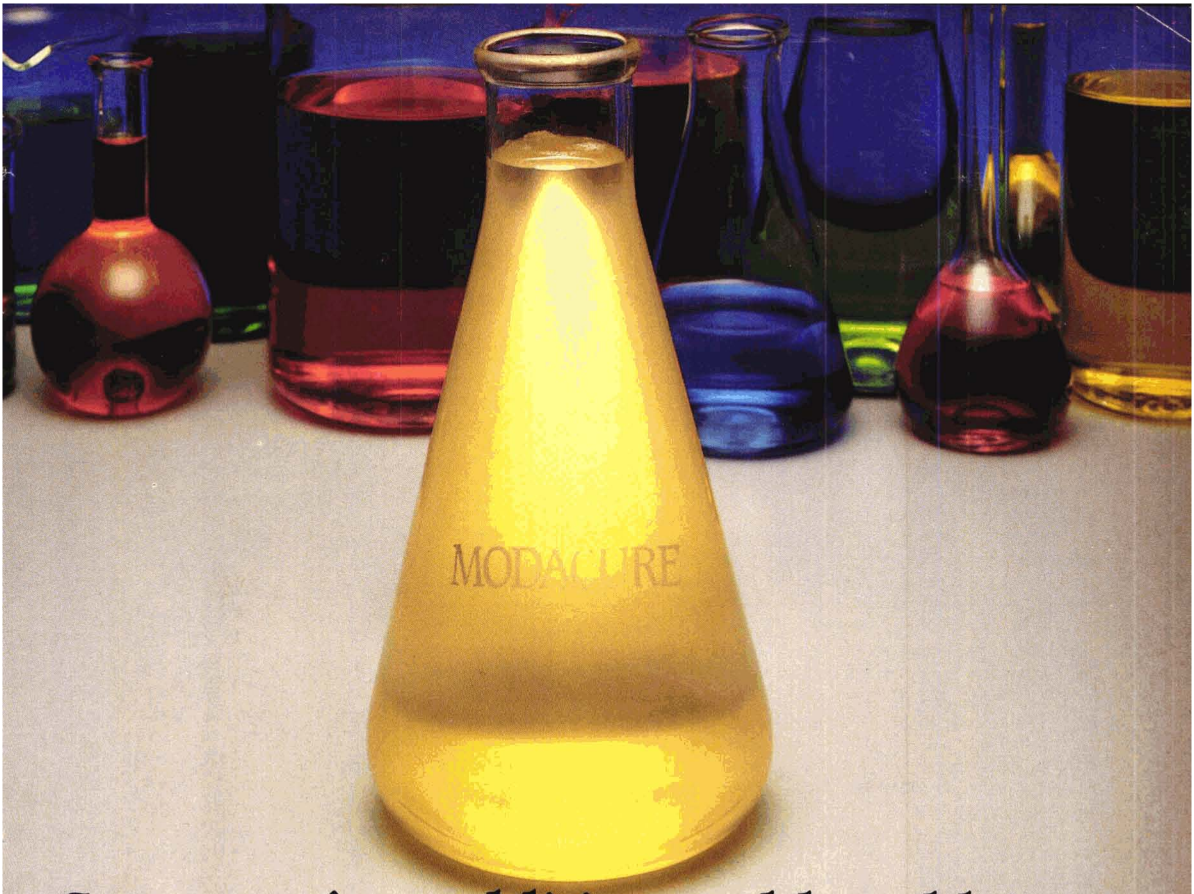
A method has been devised to obtain optimum coating compositions of multi-pigment systems by integrating critical pigment volume concentration (CPVC) predictions with statistical formulation design. Two parameters are used to predict CPVC—pigment packing factor and oil absorption data. Following prediction of CPVC, a statistical formulation design is utilized to "screen" compositions and quickly optimize the coating formulation. In this manner, a coating with the desired properties is quickly and efficiently obtained.

To demonstrate this approach, five binary pigment systems were evaluated in a two component polyurethane resin system. Rutile titanium dioxide was combined separately with diatomaceous silica, antimony oxide, zinc chromate, vesiculated polymer beads, and solid polymer beads, respectively. Each pigment system was systematically formulated with the binder using a statistical design. After application and cure, the coatings were tested and evaluated for gloss and flexibility to experimentally determine the CPVC of the coating systems. The correlation between the predicted and experimental CPVC was either good or fair for the five systems studied. These results indicate that theoretically predicting CPVC along with a statistically designed formulation procedure will yield an optimum pigment system composition and concentration. Although the approach is presented using binary pigment systems, it has been used in other studies for developing multi-pigment coatings.

REMOVAL OF WATER-BORNE PAINT SOLIDS FROM PAINT BOOTH SPRAY WATER—E.W. Fuchs, G.S. Dobby, and R.T. Woodhams

Journal of Coatings Technology, 60, No. 767, 89 (Dec. 1988)

This paper addresses the problem of removing water-based paint solids from automotive spray booth water. By using cationic flotation reagents in a 10 cm diameter flotation column, it has been demonstrated that almost complete removal (>90%) of water-borne paint solids can be attained in less than 10 min retention time. The approach is suitable for current industrial water recovery tanks.



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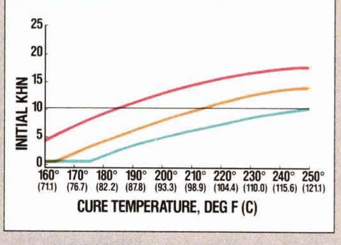

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"Organic Pigments" Monograph Now Offered In Federation Series on Coatings Technology

The Federation of Societies for Coatings Technology has announced the recent publication of "Organic Pigments," the eleventh monograph in its continuing Series on Coatings Technology.

This 40-page publication, contributed by Peter A. Lewis, of Sun Chemical Corp., is designed to provide the coatings formulator with an indication of the classes of organic pigments that are available in today's marketplace. In addition, the monograph provides an insight into the chemistry involved in the manufacture of each pigment type, together with the properties associated with each pigment type as they relate to the usage of the pigment in a coatings application. Dr. Lewis also addresses current concerns surrounding employee health and environmental protection as they relate to each class of pigments. The booklet concludes with some predictions of future trends within the pigment industry and their impact on the coatings industry.

The Series, which will total approximately 35 booklets, will serve as a valuable teaching and training resource for the industry.

The first monograph published in the Series is "Film Formation" by Zeno Wicks, Jr. This 20-page booklet includes discussions on film formation by solvent evaporation from solutions of thermoplastic polymers, from solutions of thermosetting polymers, and by coalescence of polymer particles. Attention is also given to the effect of pigmentation on film formation and testing methods.

"Introduction to Polymers and Resins," by Joseph Prane, is a guide which emphasizes the importance of polymeric materials in the coatings industry. Terminology, classification, types, mechanisms, and structures are among the many topics presented in the 36-page publication.

The subject of radiation curing is explored in the 24-page "Radiation Cured Coatings," written by J.R. Costanza, A.P. Silveri, and J.A. Vona. Emphasis is placed on the technology, equipment, and commercial applications of radiation curing. In addition, material and equipment hazards, storage and handling, personnel protection, and toxicity are presented.

"Solvents," by William Ellis, is a 30-page monograph which contains information on solubility parameters, evaporation rates, solvent molecular structures, as well as terpene and oxygenated solvents. Mr. Ellis also focuses on solvents for specific resin types, solvent identification and analysis, and safety and toxicity.

The fifth monograph in the series is "Coil Coatings," by Joseph Gaske. In addition to terminology and coating types, emphasis is placed on problems in the application and use of coil coatings, the processing of precoated coiled metal, testing, and problems in the manufacture and marketing of coil coatings. The monograph contains 20 pages.

Dr. Wicks also contributed the sixth booklet, "Corrosion Protection by Coatings" to the Series. In this 24-page publication, electrochemical corrosion, corrosion protection by intact coatings, corrosion protection with non-intact film, approaches to formulating corrosion protection coatings, and evaluation and testing procedures are explored.

"Mechanical Properties of Coatings," by Loren W. Hill, is a 28-page monograph which introduces the basic concepts involved with the behavior of polymeric materials which help to systematize mechanical property data. Discussion follows on physical property determinations, as well as descriptions of test methods.

The 64-page publication, "Automotive Coatings," authored by Bruce N. McBane, features such topics as coating systems, original finish undercoats, elements of original finish topcoats, solvents and diluents, and specialty coatings. The author also focuses on application techniques, pigmentation, automotive refinishing, and coating evaluation and quality control.

The proper choice and use of the application tool, or equipment, to apply a paint or coating is the subject of the tenth monograph, "Application of Paints and Coatings." In this 52-page booklet, author Sidney Levinson describes and lists the advantages and limitations involved with the techniques and tools used to coat a product. In addition to brush and spray application methods, details are provided on robotics, dipcoating, eletrodeposition, roll coating, curtain coating, and powder coating.

Development of the Series is under the overall direction of an Advisory Board, whose members assist in selection of authors and review of manuscripts. Dr. Thomas J. Miranda, of Whirlpool Corp., and Dr. Darlene R. Brezinski, of DeSoto, Inc., are Editors of the Series. Members of the Advisory Board, headed by Dr. Miranda, are Dr. Brezinski; Loren Hill, of Monsanto Co.; Joseph Koleske, recently retired from Union Carbide Corp.; Stanley LeSota, of Rohm and Haas Co.; Hugh Lowrey, of Perry & Derrick Co., Inc.; and Percy Pierce, of PPG Industries, Inc.

The Series, which is prepared in an attractive 8½ × 11 inch format, designed to fit in a three-ring binder, sells for $5.00 each. Monographs may be ordered by contacting Meryl Cohen, FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107 (215) 545-1506.

Analytical Techniques to Aid the Coatings Chemist Will Be Discussed at 1989 FSCT Spring Seminar

The availability and practical application of analytical techniques to assist the coatings chemist will be explored at length in a two-day seminar sponsored by the Federation. The seminar, "Modern Analytical Resources: The Coatings Chemist's Ally," will be held May 16-17, 1989 at the Los Angeles Airport Marriott Hotel, Los Angeles, CA.

Presented under the auspices of the Federation's Professional Development Committee, the seminar will focus on paint-related situations, and industry speakers will explain how various analytical techniques (Chromatographic, X-Ray, Spectroscopy, Wet/Electrochemical) can be applied to problem solving in the laboratory.

Programming will be aimed at the typical chemist rather than the analytical specialist, with a minimum of discussion on the instrument and operation—the emphasis will be on answering the question: "What Can the Technique Do for Me?"

An open-forum session will be featured, at which registrants can question speakers on specific problems and applications.

For further information, contact Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 832, Philadelphia, PA 19107.


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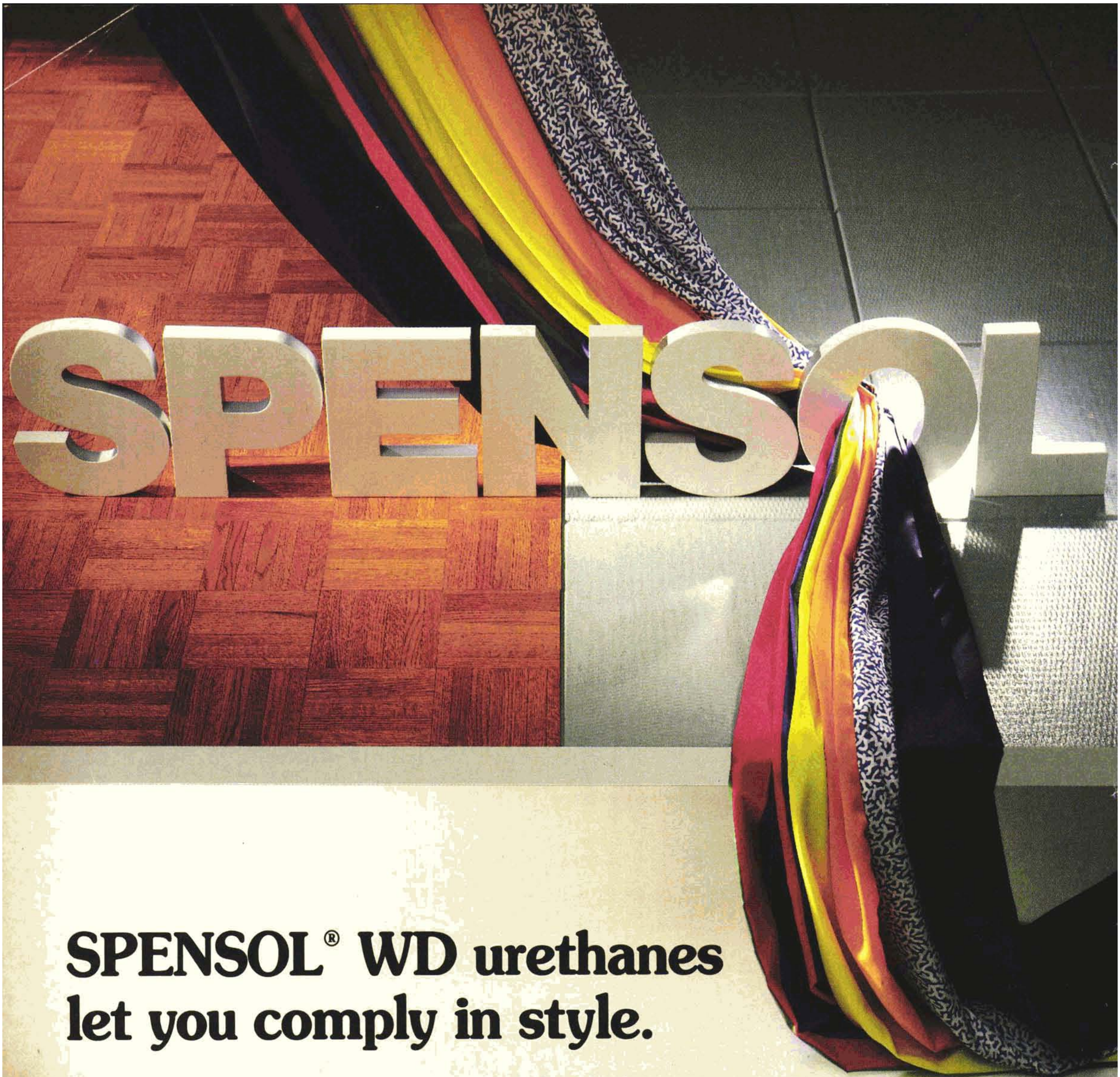

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1988 Chicago Convention Wrap-Up.





The 53rd Paint Industries' Show opened as Fran Pawsey performed the traditional ribbon-cutting ceremony. Shown from left to right: FSCT President-Elect James E. Geiger and wife, Lynn; Mrs. Frances Dulog; Mrs. Hilary Bourne and John Bourne, President of OCCA; Mrs. Pawsey; Prof. Dr. Lothar Dulog, President of FATIPEC; FSCT President Deryk R. Pawsey; Treasurer John C. Ballard and wife, Judy; and Executive Vice President Robert F. Ziegler and wife, Elaine

'Windy City' Hosts Most Successful Annual Meeting and Paint Industries' Show

Neither wind, nor rain, nor threat of tornado could stay the men and women from their appointed destination: Chicago, IL, for the Federation's 66th Annual Meeting and 53rd Paint Industries' Show, October 19-21. Despite the unpredictable weather in the appropriately named "Windy City" which forced Chicago's O'Hare Airport to close for several hours early in the week, the 1988 twin bill opened on Wednesday, October 19, to the largest crowd ever—8,414 registrants.

The record-setting attendance topped the previous high of 7475 who registered for the 1984 event in Chicago, and far exceeded the attendance of 7143 in Dallas last year.

Beginning with the stimulating Keynote Address by former broadcast journalist, Douglas Edwards, and culminating with Prof. Dr. Werner Funke's impressive Mattiello Lecture, "Microgels: Intramolecularly Crosslinked Macromolecules—Potent Components of Organic Coatings," attendees were treated to a full complement of technical presentations. Program Chairman Rick Hille and his committee assembled a varied program keyed to the theme of "Performance and Compliance: The Challenge Intensifies." The high level of interest among attendees was reflected in the lively discussions which followed many of the presentations.

In McCormick Place-North, the Federation broke yet another of its records. Exhibit booths featuring the latest in coating products, equipment, and services, occupied over 69,000 square feet of space. The 233 exhibiting firms were pleased by the extremely heavy traffic throughout the hall all three days, while attendees were impressed by the quality of displays and availability of knowledgeable technical personnel in the booths. Although the level of competition for the best booths in the Show was the highest ever, Paint Show judges made the difficult determination and the winners were chosen. These awards and other prestigious awards of the Federation were presented at the Annual Luncheon. There, about 400 attendees were entertained by the political humor of Dick Flavin.

Much of the success of this Show can be credited to the contributions of the Chicago Society members who served on the Host and Spouses' Committees, headed by Rudy Albrecht and Audrey LeNoble. Their efforts ensured that, no matter what Mother Nature provided, Chicago was a welcome host to the most successful Show ever!

1989 Annual Meeting & Paint Show To Be Held Nov. 8-10, in New Orleans

The 67th Annual Meeting and 54th Paint Industries' Show of the Federation of Societies for Coatings Technology is scheduled for November 8-10 at The Rivergate in New Orleans, LA.

Chairman of the Annual Meeting Program Committee is George Pilcher, of Hanna Chemical Coatings Co., Columbus, OH.

Members of the Southern Society, under the direction of Chairman Thad Broome, of J.M. Huber Co., Macon, GA, will serve on the Host Committee.

John Lanning, of Porter Paint Co., Louisville, KY, will head the Paint Show Exhibits Committee.

Howard Jerome, of Mozel Equipment Co., Receives 1988 George Baugh Heckel Award in Chicago

Other Annual Meeting Awards Presented

Howard Jerome, President of Mozel Equipment Co., and a Past-President of the Federation, was honored with the 1988 FSCT George Baugh Heckel Award for his outstanding service to the Federation.

The award was presented during the Federation's Annual Meeting on October 21 in Chicago.

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

After receiving the B.S. Degree in Chemistry from Northeastern University, Boston, MA, in 1950, Mr. Jerome was employed with E&F King Co. as Chief Chemist. He later worked for Celanese Corp., Tennessee Products & Chemicals, Waterlac Finish Co., and Morris Paint Co. In 1974, he joined Spatz Paint Industries, Inc., St. Louis, MO, as Technical Director and Operations Manager. He retired from Spatz as Technical Director and Vice President in June, 1986. Since the fall of 1986, Mr. Jerome has been President of Mozel Equipment Co., a division of Mozel, Inc.

His long and distinguished career with the Federation began in 1950, and includes: 14 years as a member of the Federation's Board of Directors (1964-68, 1975-1983); eight years on the Executive Committee (1968-69, 1978-83); and 11 years as Society Representative to Federation Board (1964-69, 1975-78). In addition, he was a Trustee of the Paint Research Institute (currently the Coatings Industry Education Fund) in 1980. Named an Honorary Member of the New England Society in 1959, he served as President of that Society in 1963-64.

Mr. Jerome moved through the Federation chairs and was Treasurer in 1980, President-Elect in 1981, and President in 1982.

His dedication to the Federation was proven by his service as Chairman on many FSCT Committees, including: Technical Advisory (1960); By-Laws (1976-79); Finance (1983); Nominating (1983); and Annual Meeting Host (1979, 1985). He served on the Planning Committee in 1987-88.

Affiliated with the St. Louis Society since 1970, Mr. Jerome served as Secretary in 1987. As a result of his excellent abilities, he was the recipient of the second place award in the Federation's Trigg competition, also given during the Annual Meeting in Chicago.

He has served the paint industry through membership in the National Association of Corrosion Engineers and the American Chemical Society, and as a Certified Manufacturing Engineer with the Association of Finishing Processes of SME. Mr. Jerome is a Past-President of the St. Louis Paint and Coatings Association.

Howard and Gene Jerome live in St. Louis, MO. They have three children and two grandchildren.

Howard Jerome (left) accepts the 1988 George Baugh Heckel Award from Thomas J. Miranda

Distinguished Service Award

This award was presented to Deryk R. Pawsey, of the Pacific Northwest Society, in grateful recognition of his valuable contributions to the progress of the Federation while serving as President of the Federation in 1987-88. Mr. Pawsey is employed by Rohm and Haas Canada Ltd.

Federation Honorary Membership

Elder C. Larson, Honorary Member of the Houston Society, was elected to Honorary Membership in the Federation at the Board of Directors Meeting, October 18, in Chicago.

Mr. Larson, a member of the Federation for over 30 years, is a Past-President of the Federation (1979-80), a former member of the Executive Committee (1978-81), and spent five years on the Federation Board of Directors (1978-82). He is a Past-President of both the Golden Gate (1971) and Houston (1977) Societies, respectively, and chaired the American Paint Journal Awards (1969-70), Program (1977), and Finance and Nominating (1981) Committees of the Federation. Mr. Larson also served on the Editorial Review Board of the JOURNAL OF COATINGS TECHNOLOGY, and the Publications Committee.

Mr. Larson, a graduate of Washington University, St. Louis, MO, began his 48-year career with Shell Development Co., Houston, TX, working on various aspects of applied research and development. He retired in July 1982 as Senior Research Chemist.

Elder and Margaret Larson reside in the Houston area.

Roon Foundation Awards

These awards, established by the late Leo Roon, and administered by the Coating Industry Education Fund, are for the best technical papers entered in the competition and submitted for presentation at the Federation's Annual Meeting by individuals associated with the organic coatings industry.

James E. Geiger (right) receives the Presidential gavel as it was passed from Deryk Pawsey

FIRST PRIZE ($3,000)—"Phase Behavior of Water-Borne Coatings"—F. Louis Floyd, Pamela Kuschnir, and Richard Eley, The Glidden Co., Strongsville, OH.

SECOND PRIZE ($1,000)—"Film Forming Behavior of Co-Polymer Latexes"—Sarah T. Eckersley and Alfred Rudin, University of Waterloo, Waterloo, Ontario, Canada.

Union Carbide Coatings Technology Award

Established in 1979 by the Union Carbide Corp., the 1988 Award was presented posthumously to Joseph A. Vasta, marking the first time the award was presented to an individual.

The award ($2,000 in cash and a plaque) is given to an individual (or group of individuals) in recognition of an extraordinary contribution to: (1) the advancement of coatings technology, or; (2) the furtherance of research and education in the field of coatings technology.

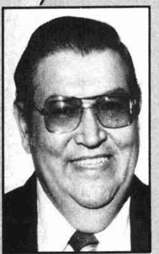
Armin J. Bruning Award

This award, established in 1962 in honor of color science pioneer Armin "Joe" Bruning, was presented to Charles D. Reilly for his "outstanding contributions to the science of color in the field of coatings technology."

Mr. Reilly, retired Research Fellow, Engineering Department, R & D Division, E.I. du Pont de Nemours & Co., Wilmington, DE, has long been active in the field of color. He is a scientist involved with unraveling the mysteries of color, color vision, and, more recently, spatial aspects of appearance. As an industrial scientist, he has always been able to couple the knowledge gained from his basic color research to industrial problem-solving and specialized instrumentation.

Of particular interest has been Mr. Reilly's effect in the finishes, fabrics, textile fibers, plastics, pigments, composites, printing and lithographic products, photo products, pre-press proofing materials, and dyes industries and products.

Union Carbide Coatings Tech Award to Joseph A. Vasta



The Union Carbide Coatings Technology Award was accepted by Mrs. Rita Vasta during the Federation Luncheon, October 21. The award recognizes the contributions made to coatings technology by Joseph A. Vasta.

Active in the Federation for many years, Mr. Vasta served as Chairman of its Educational Committee. Through his efforts, the Committee produced "The Choice," a videotape promoting careers in the coatings industry. Additional contributions included serving as Chairman of the Mattiello Lecture and Roon Awards Committees, as a Trustee of the Coatings Industry Education Fund, and as a member of the Professional Development and Publications Committees. He served on the JCT Editorial Review Board since 1982. Mr. Vasta was a member of the Philadelphia Society.

He began his career at the Georgia Institute of Technology Research Center, where he was involved in the study of superconductivity of rare earth metals, among other projects. In 1952, he joined the Du Pont Marshall R & D Laboratory and was responsible for both research and development assignments. Areas of study included adhesives, ambient room temperature curing, waterborne, and powder coatings.

In 1972, Mr. Vasta was named a Research Fellow of the Fabricated Products Department. He is credited with the technology incorporated in many widely used coatings; for example, Imron™ urethane coatings was one of his inventions. In addition, he was an early pioneer for the introduction of safer solvents and low VOC coatings. In his 35 years at the company, he was responsible for more than 75 U.S. patents and numerous commercial coating products.

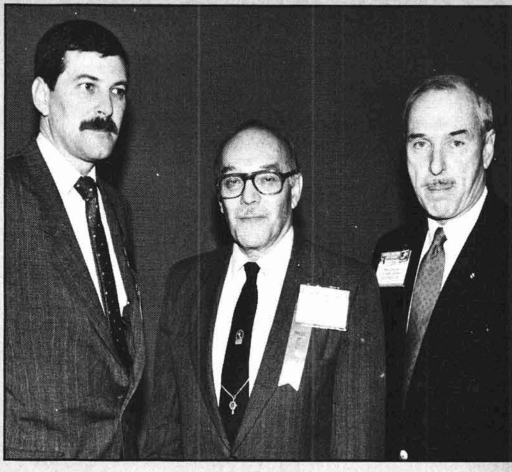
Mr. Vasta served as Chairman of the Gordon Research Conferences and was involved in the Polymer Materials, Science and Engineering groups of the American Chemical Society and that organization's Roy Tess Award.

Before his death in November of 1987, Mr. Vasta was employed with E.I. du Pont de Nemours & Co., Inc., in Wilmington, DE, as Senior Research Fellow in the Fabricated Products Department.

Mr. Vasta received the B.S. Degree in Chemistry from Georgia Institute of Technology in 1950 and M.S. Degree in Chemistry from Drexel University in 1954.

Bill Mainella, of Union Carbide Corp., presents Rita Vasta with the Union Carbide Award

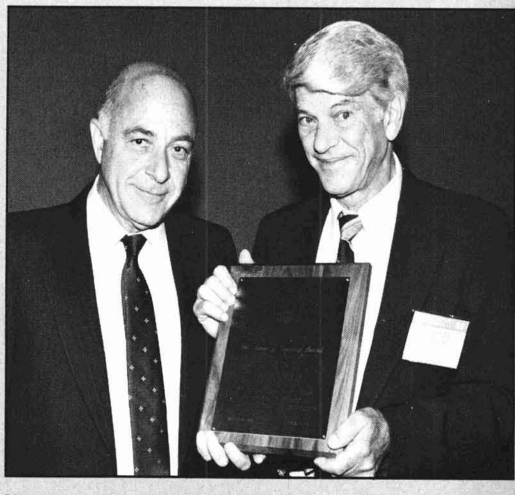
President Pawsey presents a Certificate of Appreciation to Prof. Dr. Werner Funke, who presented the Mattiello Lecture, "Microgels—Intramolecularly Crosslinked Macromolecules: Potent Components of Organic Coatings"



Robert F. Ziegler (left) presents Trigg Awards to Howard Jerome, St. Louis Society, and James F. Calkin, Los Angeles Society

Roon Awards Chairman Gary Gardner (left) presents the 1988 Roon Awards to winners Sarah T. Eckersley, F. Louis Floyd, Pamela Kuschnir, and Richard R. Eley

A.F. Voss/*American Paint & Coatings Journal* Awards are awarded by Chairman Patricia Shaw (center). Representing the winning Societies are Robert D. Athey, Jr. (Golden Gate) and John E. Hall (Montreal). (Missing from photo—representative from Detroit)



Charles D. Reilly (right) accepts the Armin J. Bruning Award for his contributions to the science of color from Ralph Stanziola, Chairman of the Award Committee

Robert Zimmerman accepts the Golden Impeller Award presented by Morehouse Industries representative Dale Morehouse for his outstanding achievement in dispersion technology

Society Speaker Awards Chairman Gerry J. Gough (right) congratulates Robert D. Athey, Jr., Golden Gate Society, and Freidun Anwari, Cleveland Society

Alfred L. Hendry Award

This award of $1,000, sponsored by a grant from the Southern Society of the FSCT, is for the best student paper (graduate or undergraduate) submitted for competition. The 1988 competition was won by Diana Provder, of the Kent State University, Kent, OH, for her paper, "The Concept of Intrinsic Viscosity and Its Practical Significance."

Ernest T. Trigg Awards

These awards are made to the Secretaries of Constituent Societies of the Federation who furnish to the Journal of Coatings Technology the most interesting reports of Society meetings and discussions following the presentation of papers at those meetings.

First Prize ($100)—James Calkin (E.T. Horn Co.), Secretary of the Los Angeles Society.

Second Prize ($50)—Howard Jerome (Mozel Equipment Co.), Secretary of the St. Louis Society.

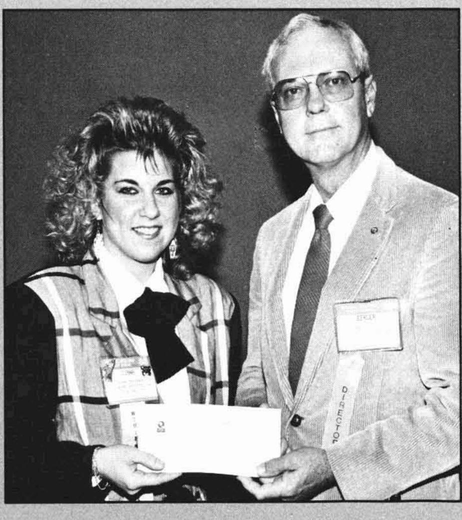
MMA Awards

Established in 1975 by Materials Marketing Associates, these cash awards and plaques are for notable achievements by Constituent Societies of the Federation other than for Society Papers presented at the Federation Annual Meeting. *(Note: MMA has decided not to continue this award after this year.)*

Class A Competition (tie—$175 each) was won by the Chicago Society for its presentation of the seminar "Creative Management with a Personal Touch," and the New York Society for conducting courses in coatings technology at Fairleigh Dickenson University.

Class B Competition ($350) was won by the Pacific Northwest Society for producing the video "Safety in the Paint Industry."

Class C Competition (tie—$175 each) was won by the Pittsburgh Society for conducting the seminar "Hazardous Waste Management," and the St. Louis Society for helping to fund a color computer for the University of Missouri-Rolla.



Diana Provder, winner of the A.L. Hendry Award, is congratulated by Burger G. Justen, of Southern Society

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

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

First Prize ($225)—"Quantifying Pigment Dispersion—II. Iron Oxide Pigments"—Montreal Society (John E. Hall, Chairman, Technical Committee).

Second Prize ($150)—"Poly(Epoxy-Urethane-Acrylic) Interpenetrating Polymer Networks (IPNs) for Primer Applications"—Detrioit Society (Rose A. Ryntz, Chairman, Technical Committee).

Third Prize ($125)—"Room Temperature Cure of Carboxylated Polymers"—Golden Gate Society (Robert D. Athey, Jr., Chairman, Technical Committee).

Society Speakers Awards

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

First Prize ($100)—Robert D. Athey, Jr. (Athey Technologies), Golden Gate Society.

Second Prize ($50)—Freidun Anwari (Coatings Research Group, Inc.), Cleveland Society.

Materials Marketing Associates (MMA) Awards were presented by Awards Chairman Ray Uhlig and MMA Officers Tom Brandt and Skip Lowe to the Chicago, New York, Pacific Northwest, Pittsburgh, and St. Louis Societies. Shown (from left) are: Evans Angelos (Chicago), Irwin H. Young (New York), Valerie Braund (Pacific Northwest), Bob Patterson (Pittsburgh), John Folkerts (St. Louis), Mr. Uhlig, Tom Brandt, and Skip Lowe

Corrosion Committee Publication Award

Presented for the best corrosion-related papers published in the JOURNAL OF COATINGS TECHNOLOGY, the award was won by M.E.R. Shanahan, H. Haidara, and J. Schultz, of Centre de Recherches sur la Physico-Chimie des Surfaces Solides, in France. The title of their work was, "Assessment of Phosphate/Polymer Protective Coatings on Steel, Parts I, II, and III," published in the October 1987 issue of the JCT.

Golden Impeller Award

This award, offered by Morehouse Industries, Inc., for outstanding achievement in dispersion technology, was presented at the Annual Meeting to Robert Zimmerman, of Valspar Corp.

Meeting of Members of the International Coordinating Committee Held During Annual Meeting and Paint Show, October 20

A luncheon meeting for visiting members of the International Committee to Coordinate Activities of Technical Groups in the Coatings Industry (ICCATCI) is sponsored each year by the Federation of Societies for Coatings Technology (FSCT) at its Annual Meeting and Paint Industries' Show.

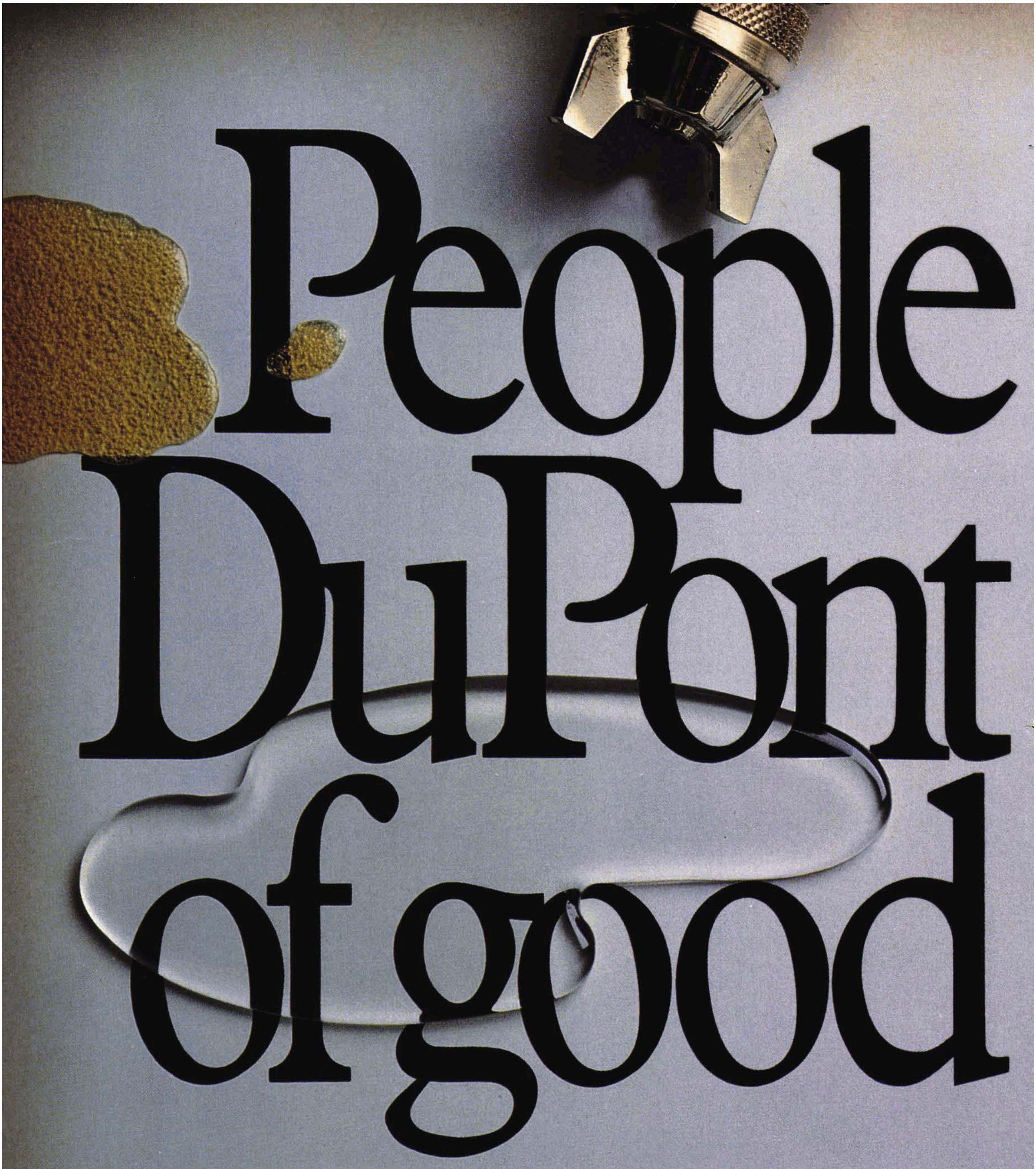
ICCATCI is composed of: FSCT; Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe (FATIPEC); Oil and Colour Chemists' Association—United Kingdom (OCCA); Oil and Colour Chemists' Association Australia (OCCAA); Japan Society of Colour Materials (JSCM); and Federation of Scandinavian Paint and Varnish Technicians (FSPVT).

Present at the meeting held during the FSCT Annual Meeting and Paint Show in Chicago, IL, October 20, 1988, and pictured below, were:

Standing (left to right): Delegate to IUPAC Raymond B. Tennant (FSCT); President-Elect James E. Geiger (FSCT); Birmingham Society President Gerry J. Gough (FSCT); Past-President Carlos E. Dorris (FSCT); Past-President Ted Saultry (OCCAA); Past-President A. Clarke Boyce (FSCT); Past-President Terryl F. Johnson (FSCT); Jose Foster, Panama (guest); President Deryk R. Pawsey (FSCT); and Executive Vice President Robert F. Ziegler (FSCT).

Seated: President Manuel Gutierrez, Mexico Assn. of Paint & Ink Mfgrs.; Annik Chauval, Editor of *Double Liaison* (FATIPEC); President Lothar Dulog (FATIPEC); Past-President William Mirick (FSCT); Past-President Jacques Roire (FATIPEC); Past-President Amleto Poluzzi (FATIPEC); and Past-President Yoshiaki Oyabu (JCSM).

The next meeting of ICCATCI will be held during the OCCA Biennial Conference in Chester, England, June 21-23, 1989.



ELVACITE® acrylic resins, both solid bead and solution. ELVACITE® "G" series resins, designed to permit higher solids at equal viscosity.

ELVACITE® AB dispersants for improved color, stability, and cost effective use of pigment. ELVERON® resins, a group of high-solids, functionalized resins. And the capability to customize polymers to specific technical needs.

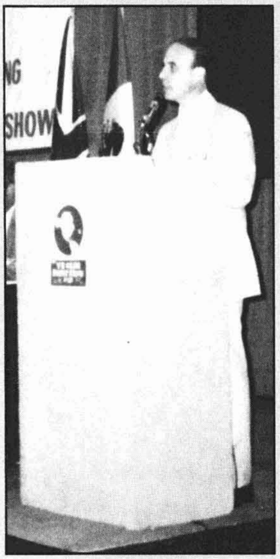
Every day people turn to DuPont Specialty Resins to solve their performance and application problems.

The reasons? DuPont is an innovator in the development of new acrylic polymer technologies. We have the wide range of products, broad-based expertise, the commitment and technical assistance to satisfy your solvent-based coatings needs.

Honored guests in attendance participated as the 66th Annual Meeting Opening Session introduced the technical program theme, "Performance and Compliance: The Challenge Intensifies"

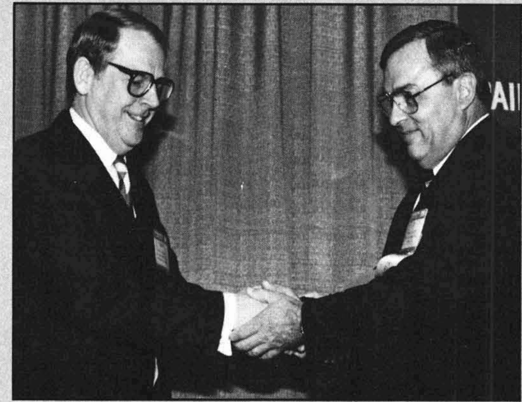
A standing-room-only crowd listened as Keynote Speaker, Douglas Edwards, spoke on "What's Right with America"

Paint Industries' Show Committee Chairman, John A. Lanning, addresses the audience at the Opening Session



ANNUAL MEETING PROGRAM SESSIONS

The FSCT Professional Development Committee held a Symposium on "Advanced Topics in Coatings Research"



After being sworn in as new FSCT President, James Geiger (right) is congratulated by immediate Past-President Deryk Pawsey

FSCT OFFICERS

Past and Present

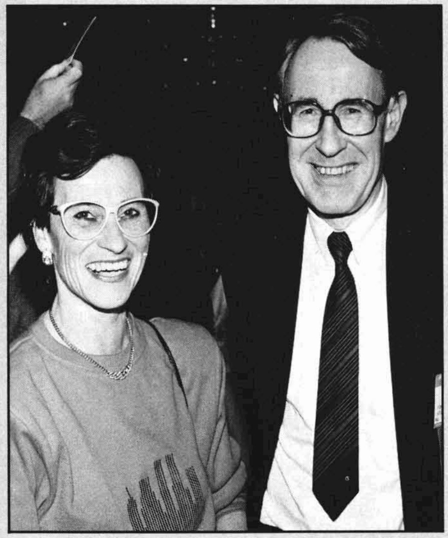
Executive Committee Members for 1988-89 are: (standing, left to right) Norman Hon, Thomas Hill, Richard Hille, and Immediate Past-President Deryk R. Pawsey. Seated: Treasurer Kurt R. Weitz, President James E. Geiger, and President-Elect John C. Ballard

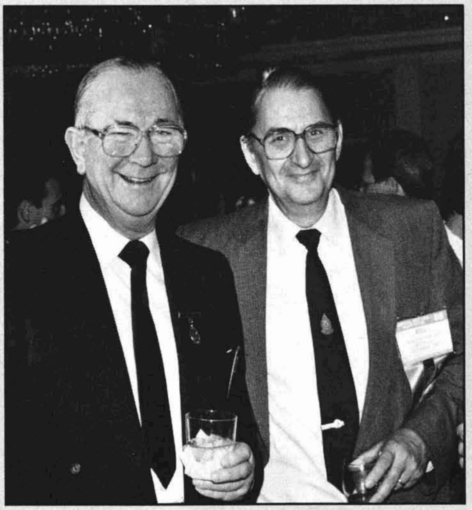
FSCT Past-Presidents in attendance included (standing from left): Michael W. Malaga (1973-74); A. Clarke Boyce (1982-83); Terryl F. Johnson (1983-84); William Mirick (1985-86); Neil S. Estrada (1976-77); Carlos E. Dorris (1986-87); and John J. Oates (1977-78). Seated: Carrolle M. Scholle (1965-66); Milton A. Glaser (1956-57); Eugene H. Ott (1960-61); William H. Ellis (1980-81); Howard Jerome (1981-82); and Deryk R. Pawsey (1987-88)

OVERSEAS

VISITORS

RECEPTION



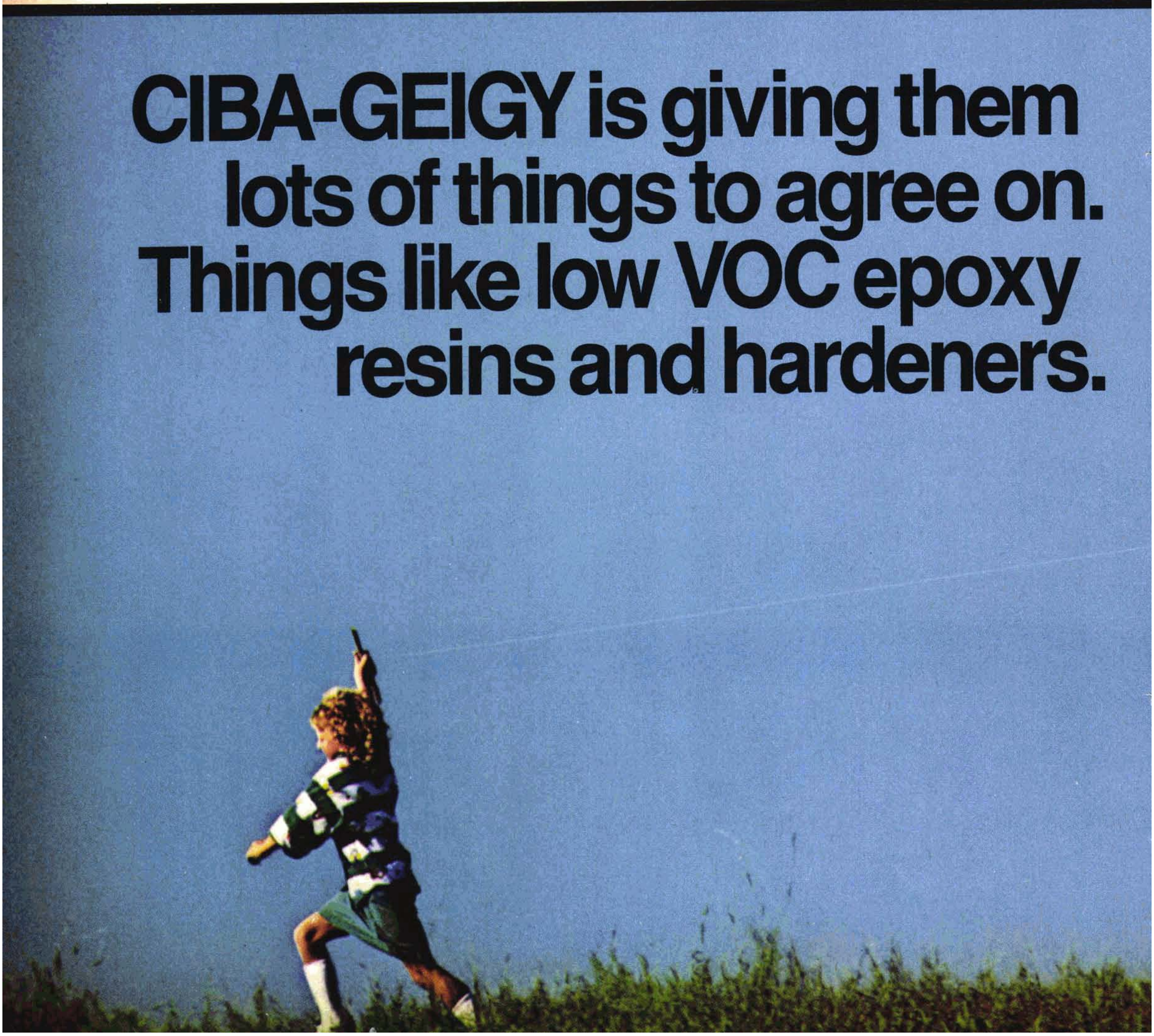


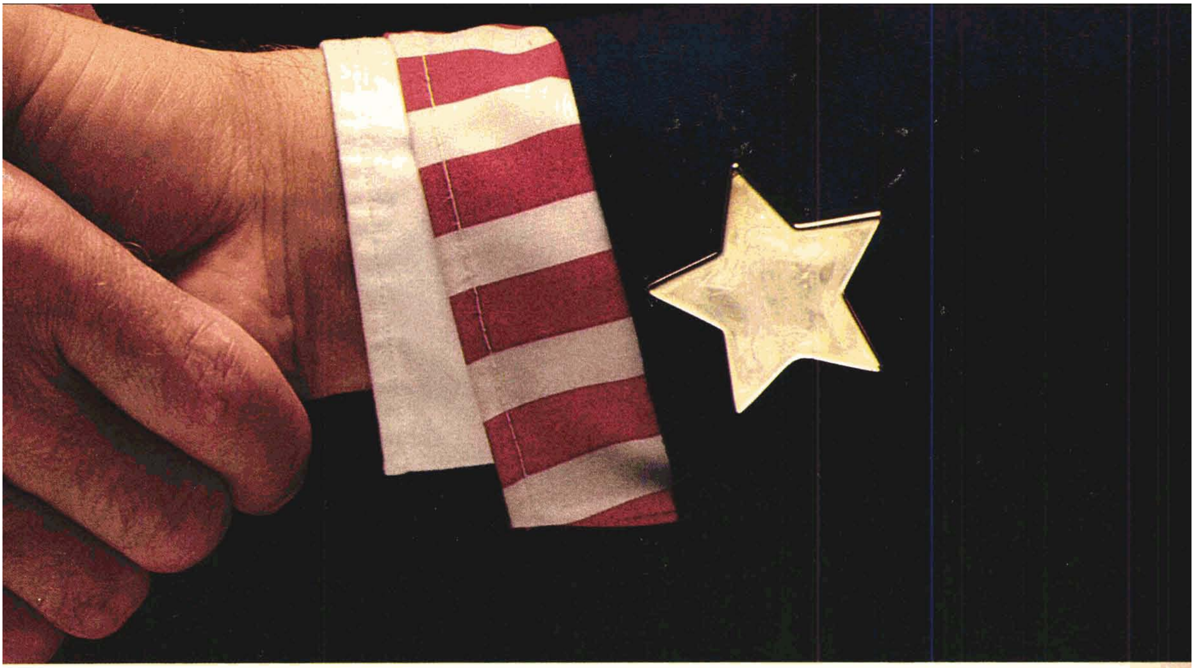
Annual Luncheon Speaker Dick Flavin provided a hilarious insight on this year's Presidential campaign

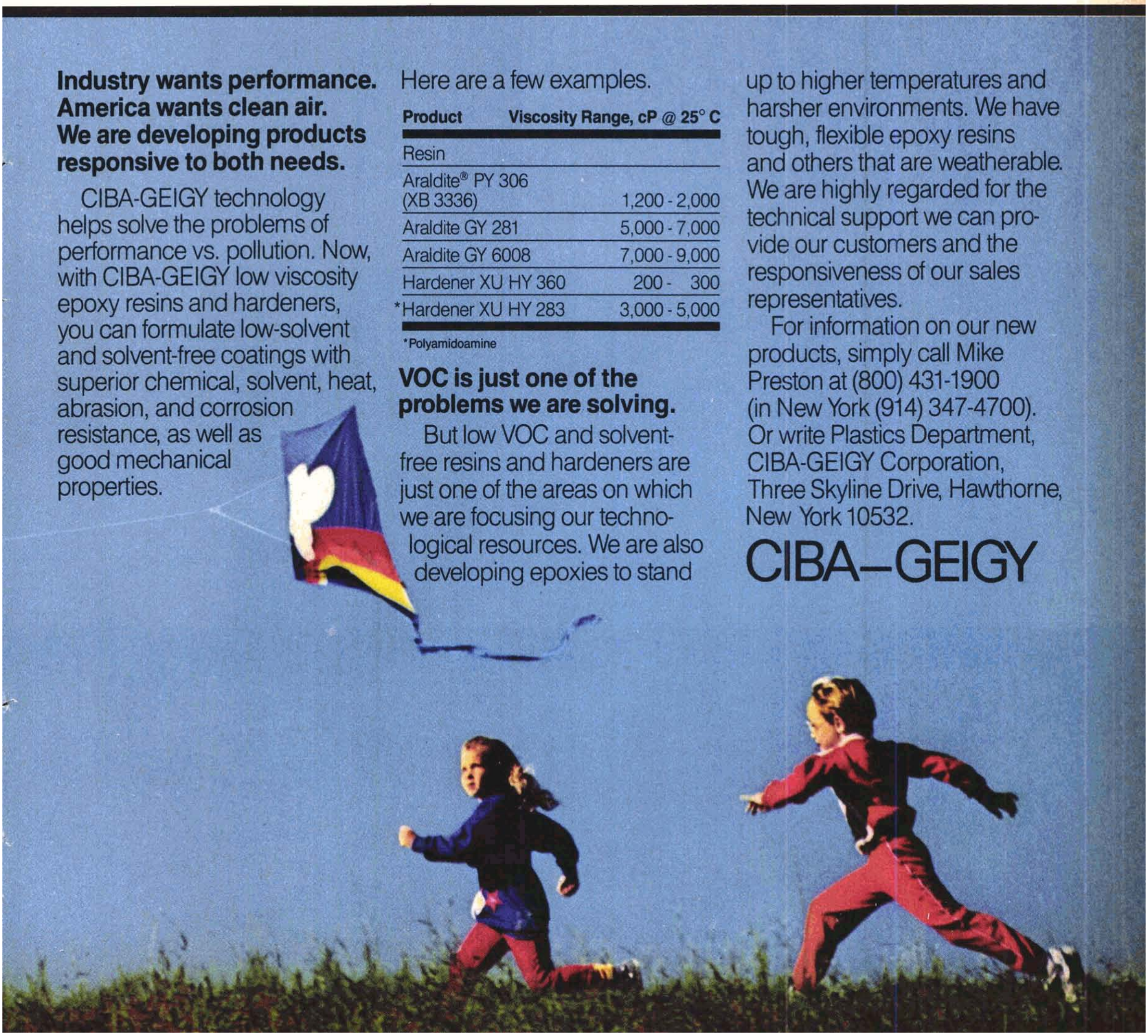
Dick Flavin presents two first-class, round-trip airline tickets, contributed by Delta Air Lines and United Airlines, to Helen Skowronska and Sawako Oyabu, respectively

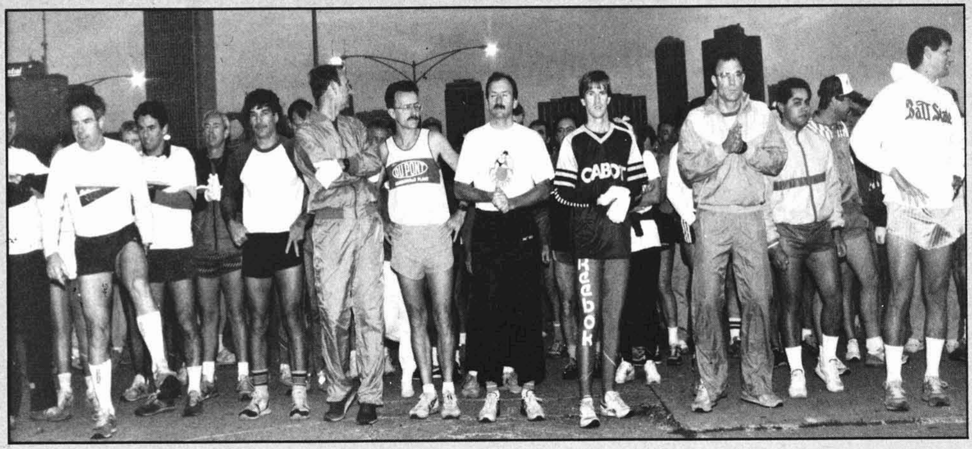
AFTPV Commemorates Contributions of Federation

At the Annual Luncheon on October 19, Jacques Roire, an official of the French Association of Paint, Lacquer, Printing Ink and Adhesives (AFTPV), made a special presentation to the Federation. In acknowledgment of the support and assistance provided to the association by the Federation following World War II, a work of art was commissioned by AFTPV. The sculpture, which graphically commemorates the anniversary of the 40-year bond between the two groups, was presented by Mr. Roire to Federation President Deryk Pawsey. This work will be on permanent display at Federation headquarters.


CIBA-GEIGY is giving them
lots of things to agree on.
Things like low VOC epoxy
resins and hardeners.







Second Annual Paint Show 5000

It is an overcast Thursday morning with temperatures above freezing as the wind swirls over Lake Michigan. The site is Grant Park; the famous Buckingham Fountain stands silent. The sun, barely visible from the East, is rising steadily, but not fast enough for the runners entered in the Second Annual Paint Show 5000, sponsored by Troy Chemical Corp. in cooperation with the FSCT.

Traffic on Chicago's Lakeshore Drive at 7:00 a.m. is congested, but the vehicles are oblivious to the over 100 runners gathered to participate in the five kilometer (3.1 mile) run.

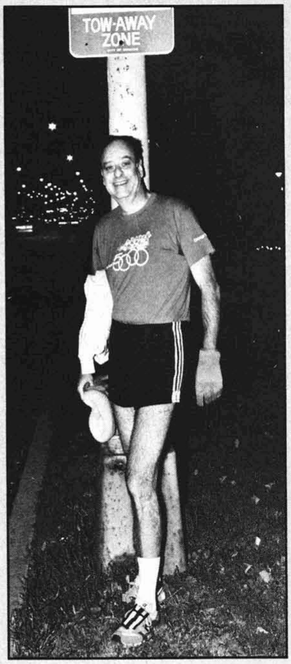
With the command 'runners take your mark,' they finally take heed, gathering at the starting line. As the gun is sounded, the runners jockey for position. They're off. Off into the cool Chicago morning for fun, exercise, and competition.

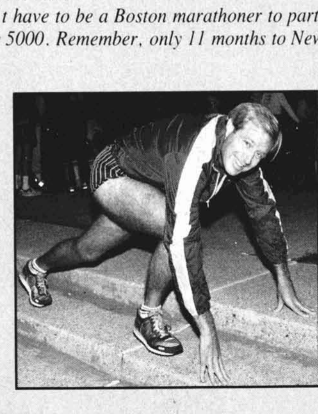
The participants head south on the Lakeshore Drive East. They approach the finish of the first mile in a respectable six minutes. As they round the Adler Planetarium and begin to head north on the Lakeshore Drive, it's clear that a few of the athletes decide to pick up the pace as they steadily break away from the group.

The windy conditions seem to have no effect as the first place finisher Scott Brewer, of Cabot Corp., crosses the finish line in 17:54 seconds. He is followed by Bud Bettler (18:08), of Du Pont Co., and Jaap Vanderklooster (18:18), of Johnson Wax. One minute and 46 seconds later, Lora Jaffin (19:40), of Rohm and Haas Co., is the first women to cross the finish line.

The 5000-meter run has no losers. This year approximately 200 people registered for the race. Proceeds from the $5 registration fees are donated to the Federation's Coatings Industry Education Fund. In addition, all participants receive a handsome T-shirt and memento of the run.

You don't have to be a Boston marathoner to participate in the Paint Show 5000. Remember, only 11 months to New Orleans!





Don't blow your top.

After bacteria gets finished wrecking a can of your best paint by turning it into water, they give it gas pains. When the gas gets painful enough, that can of paint can blow its top all over a customer.

Why risk it when Troysan® 174 is the most economical, effective bactericide you can buy and one of the soundest business decisions you can make.

Troysan 174 is non-metallic and odorless. It's an easy to use, broad spectrum liquid that can be added anywhere along your production line. It starts working soon after it's added to control and eliminate bacteria and odors with no viscosity loss.

Whether you're formulating something brand new, or want to make what you're making now better, call or write our customer service department.

If it has anything to do with paint, the answers come straight from Troy.

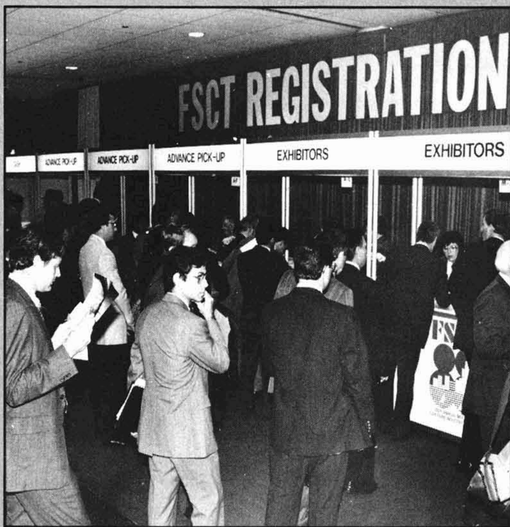
Troy Chemical Corporation,
One Avenue L, Newark,
New Jersey 07105
201-589-2500
TELEX 13 8930

TROY
CHEMICAL

"Women in Coatings" Host Second Annual Meeting

Members of the organization, "Women in Coatings," hosted their second annual meeting in Chicago, on October 18. Over 50 attendees gathered to discuss ongoing activities of the group and to honor those women who have published technical papers in leading journals.

Federation President Deryk Pawsey addressed the group, discussing the role women have played in the coatings industry. Significant contributions to the Federation were made by individuals such as Ruth Johnston-Feller, who received the Bruning Award in 1966, served as Chairman of the Inter-Society Color Council, and presented the Mattiello Memorial Lecture at the FSCT Annual Meeting in 1985. He discussed the accomplishments of Darlene Brezinski, who became, in 1983, the first woman to receive the prestigious George Baugh Heckel Award. Among the other pioneers cited by Mr. Pawsey were Helen Skowronska, who serves as Chairman of the Technical Information Systems Committee and Rita Harper, who became the first female Society President when she presided over the Houston Society in 1975. According to Mr. Pawsey, the role of women in the paint and coatings field has increased dramatically in recent years and continues to build.



An estimated 8,414 registrants passed through the doors of the 1988 Paint Show, surpassing the previous record of 7,475 who attended the last Paint Show held in the "Windy City" in 1984

A tour of the Museum of Science and Industry and an organ recital at Chicago University's Rockefeller Chapel were highlights of an excellent Spouses Program, planned by the Spouses Committee under the direction of Audrey Lenoble

Nine Exhibitors Win Awards In 1988 Paint Industries' Show

AccuRate, Inc.; Hockmeyer Equipment Co.; Kemira, Inc.; Micro Powders, Inc.; Mobay Corp.; NYCO; Pacific Scientific Co., Instrument Div.; Renzmann Inc.; and Union Process, Inc. were recipients of the C. Homer Flynn Paint Show Awards at the 1988 Paint Industries' Show.

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

The prizes (engraved plaques were awarded as follows:

RAW MATERIAL SUPPLIERS:

Single-Booth Exhibit—Kemira, Inc., Bridgewater, NJ (Two years in Show).

Double-Booth Exhibit—Micro Powders, Inc., Scarsdale, NY (Four years).

Three-to-Five Booth Exhibit—NYCO, Willsboro, NY (Nine years).

Six-or-More-Booth Exhibit—Mobay Corp., Pittsburgh, PA (Seven years).

PRODUCTION EQUIPMENT MANUFACTURERS:

Single-Booth Exhibit—Union Process, Inc., Akron, OH (27 years).

Double-Booth Exhibit—Hockmeyer Equipment Co., Harrison, NJ (39 years).

Three-or-More-Booth Exhibit—AccuRate, Inc., Whitewater, WI (Two years).

SERVICE INDUSTRIES — Renzmann Inc., Hauppauge, NY (Two years).

LABORATORY AND TESTING EQUIPMENT MANUFACTURERS—Pacific Scientific Co., Instrument Div., Silver Spring, MD (35 years).

C. Homer Flynn Awards for outstanding exhibits are presented by Paint Show Committee Chairman John A. Lanning. Standing (left to right): Herman Hockmeyer (Hockmeyer Equipment); Steve Culpepper (AccuRate); Dieter Renzmann (Renzmann); Joe Peters (Pacific Scientific); and Mr. Lanning. Seated: Tuula Laiho (Kemira Inc.); Phillis Strauss (Micro Powders); Cheryl Blanchard (NYCO), Joel Braun (Mobay); and John Becker (Union Process)

RAW MATERIALS SUPPLIERS

Kemira, Inc., Bridgewater, NJ

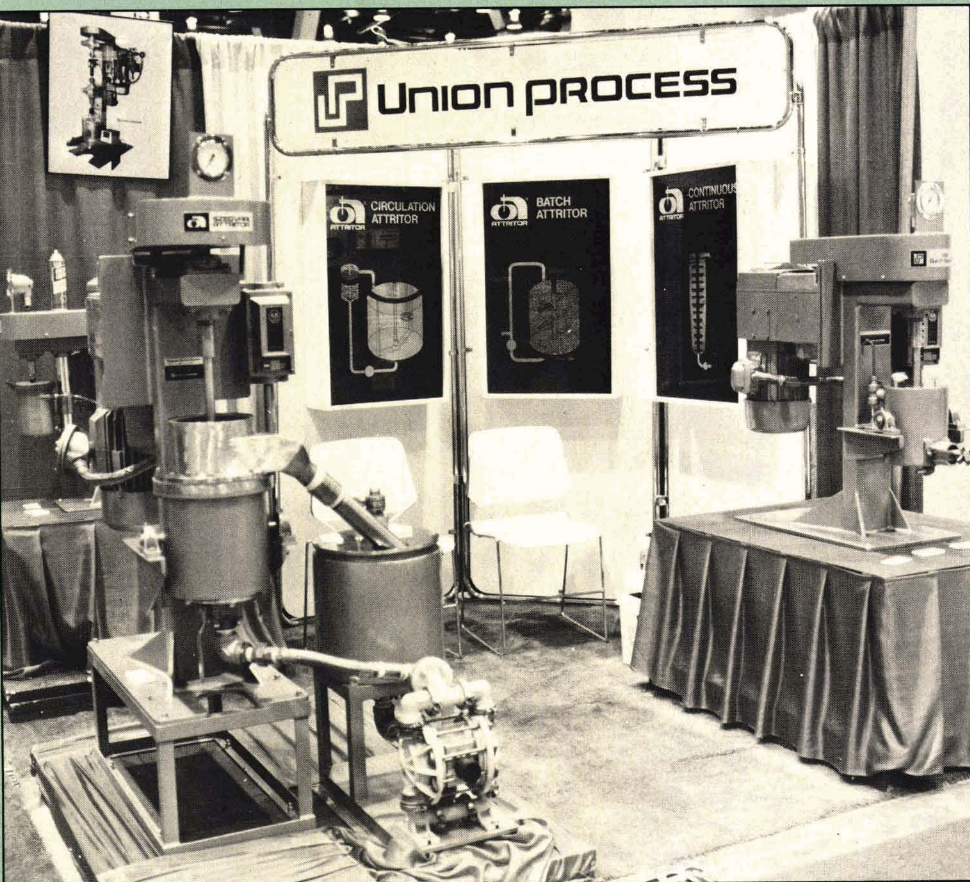
Micro Powders, Inc., Scarsdale, NY

WINNERS

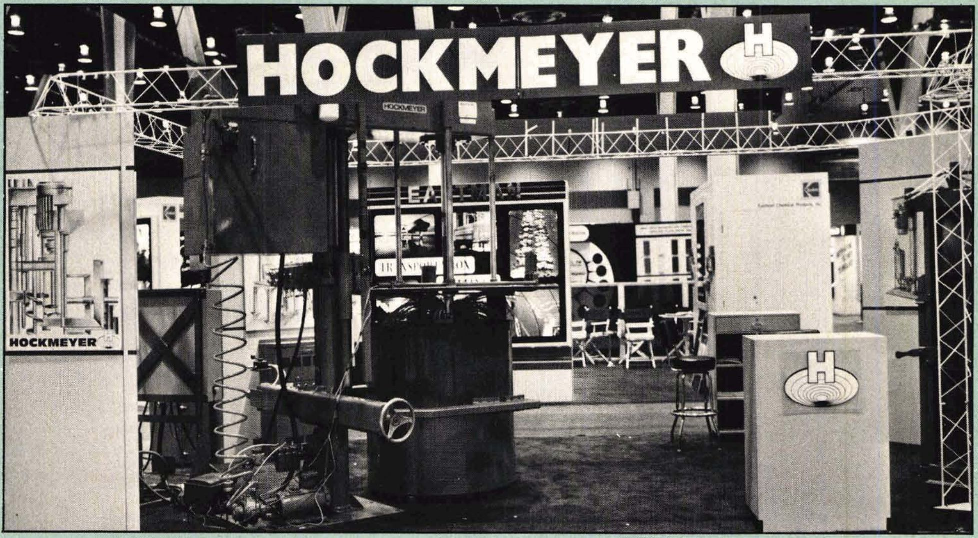
NYCO, Willsboro, NY

Mobay Corp., Pittsburgh, PA

PRODUCTION EQUIPMENT MANUFACTURERS



Union Process, Inc., Akron, OH



Hockmeyer Equipment Co., Harrison, NJ

AccuRate, Inc., Whitewater, WI

SERVICE INDUSTRIES

Renzmann Inc., Hauppauge, NY

EQUIPMENT MANUFACTURERS

Pacific Scientific Co., Instrument Div., Silver Spring, MD

1988 Paint Show Exhibits

The 1988 Paint Industries' Show of the Federation of Societies for Coatings Technology was held at the McCormick Center, Chicago, IL, on October 19-21. The 233 exhibitors took part in the largest-ever Paint Show (69,000).

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

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

ACCURATE, INC.
Whitewater, WI 53190

AccuRate is exhibiting their volumetric screw feeders with flexible vinyl hoppers and dual paddle agitation system, their loss-in-weight feeders with counterbalanced scales for maximum resolution, and their semi-bulk bag discharge system with constant flex agitation.

ACETO CORP.
Flushing, NY 11368

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

ADVANCED COATING TECHNOLOGIES
Hillsdale, MI 49242

Featured is a display of the test panels, specialty substrates, and unique metal section configurations produced by the company. Additional descriptions and examples of testing facilities are provided by ACT Testing Laboratories, Inc.

ADVANCED SOFTWARE DESIGNS
Chesterfield, MO 63006

Demonstrations of the SNAP Manufacturing Control System are given. SNAP is a comprehensive software package for control of manufacturing and accounting functions for coatings manufacturers. The program includes modules for formulation, batch tickets, MSDSs, labeling, SPC analysis, and all accounting functions.

AIR PRODUCTS AND CHEMICALS, INC.
Allentown, PA 18195

Featured is a broad range of emulsion products including Airflex® 742 for elastomeric roof coatings; Airflex 728 for blending with acrylics to reduce costs; and Airflex 562-BP for clear caulk applications. Also highlighted is a broad line of problem-solving coatings additives.

ALCAN-TOYO AMERICA, INC.
Naperville, IL 60540

Featured are new and innovative aluminum pigments, for OEM automotive, paint and industrial coatings, printing inks and graphic arts.

ALPINE AMERICAN CORP.
Natick, MA 01760

Featured is a complete range of size reduction and classification systems for making fine and ultra fine dry powders from coating materials including mineral fillers, pigments and plastic resins for powder coatings systems. The exhibit focuses on exact control over particle top size and minimizing fines in powder coatings.

AMBROSE CO.
Redmond, WA 98052

Ambrose does it again. The first fully-automatic 5 gallon line for metals or plastic. Automatic denesting, filling, lidding, sealing, palletizing, and stretch wrapping. See our new inline high-speed quart/gallon fillers.

AMERICAN CYANAMID CO.
Wayne, NJ 07470

The firm is exhibiting crosslinking agents CYMEL® and BEETLE® as well as polymer additives, such as antioxidants, UV absorbers, and antistatic agents. Processing agents, such as TAC and NMA, and urethane products such as TMXDI® and TMI® are also highlighted.

AMOCO CHEMICAL CO.
Chicago, IL 60601

Featured are isophthalic acid and trimelletic anhydride for use in both water-borne and solvent-borne coatings. Amoco is a leader in providing technical support to coating resins processors.

ANGUS CHEMICAL CO.
Northbrook, IL 60062

Featured is the firm's complete paint and coatings product line, highlighting formulation benefits in the paint can to on the wall. Information is available on dispersants, paint additives, biocides and mildewcides. Experienced technical representatives are on hand.

APPLIED COLOR SYSTEMS, INC.
Princeton, NJ 08543

ACS features its PAINTMAKER System with unique Gloss Compensation Software allowing matches between high-gloss colors and flat bases. Also featured is ACS's Video Color System displaying a wide range of colors for visual color matching and formulation using ACS's 1800 Chroma-Calc System.

AQUALON CO.
Wilmington, DE 19894

Water-soluble cellulose ethers, as thickeners and rheology modifers for latex paints and as thickeners for non-methylene chloride paint removers, are featured.

ARCO CHEMICAL CO.
Newtown Square, PA 19073

Arcosolv® propylene glycol ethers and acetate solvents, Arconate® propylene carbonate and a variety of other solvents and specialty chemicals for paints and coatings are featured.

ARIES SOFTWARE CORP.
Louisville, KY 40222

On display is an IBM Application Solution/400 (AS/400), a new family of multiuser processors. Introduced is the ChemPAC System, the complete software system for formula-based manufacturers and a total solution of integrated, relational data base software.

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

Featured is an extensive line of solvents, exempt solvents and specialty chemicals for the coatings industry. Products are available for local delivery from over 75 locations nationwide. Ashland also offers other unique services like chemical waste disposal and computerized solvent reformulation. Also available is literature on health, safety, and governmental regulations.

ATLAS ELECTRIC DEVICES CO.
Chicago, IL 60613

Displayed is the Ci65 Xenon Arc Weather-Ometer® specified by the automotive industry to simulate the damage to materials caused by sunlight, temperature and rain. The SF Series Corrosive Fog Exposure System, designed to run salt spray and salt fog tests, is also exhibited.

B & P ENVIRONMENTAL RESOURCES
Oakland, NJ 07436

Analytical Lab to identify waste as per Fed. EPA; hazardous waste management services; disposal of "F" wastes by incineration in drum or bulk, liquid or solid, and cleaning and/or removal of storage tanks are highlighted, as well as RCRA analysis, including TCLP and analysis for VOC compliance.

B.A.G. CORP.
Dallas, TX 75218

Super Sack® flexible intermediate bulk containers, used for shipping and storing dry products, are featured. Filling systems and discharge systems are also exhibited.

BASF CORP.
Chemicals Div.
Parsippany, NJ 07054

BASF features a broad range of organic and inorganic pigments designed for applications which include automotive coatings, industrial and transportation finishes, and architectural coatings. Also featured is BASF's growing line of solvents supplied to the coatings industry and BASF's corrosion-inhibiting pigments.

T.J. BELL, INC./ ERICHSEN INSTRUMENTS, INC.
Akron, OH 44310

This internationally recognized manufacturer of testing equipment for the coatings industry is showing: Salt Spray Test Chamber, Glossmeters, Film Applicators, Adhesion Testers, Color Comparison Cabinet, Scrub Resistance Tester, and more.

BEROL CHEMICALS INC.
Westport, CT 06880

Combinations of Bermocoll cellulose ethers and associative thickeners are the focus of "Versatile Thickeners for Rheology Control." Bermodol PUR 2100 polyurethane, Bermocoll EBS with enhanced enzymatic resistance and Bermocoll PR for paint removers are featured. Presented are Inorphil mineral fiber and Bermodol specialty surfactants.

BLACKMER PUMP/DOVER RESOURCES CO.
Grand Rapids, MI 49509

Blackmer Pump is exhibiting its full line of positive displacement, sliding-vane pumps for handling abrasive liquids, solvents and resins. Blackmer's new ML4-inch industrial pump, which is designed for a wide range of services, is also on display.

BOHLIN REOLOGI, INC.
East Brunswick, NJ 08816

Displayed is a complete line of rheological instrumentation for the paint and coatings industries. These laboratory instruments provide measurements of both elasticity and viscosity over a wide range of rate, time, and temperature and offer complete computer control.

BRINKMANN INSTRUMENTS, INC.
Westbury, NY 11590

The firm is showing the Particle Size Analyzer and Grinding Mill.

BROOKFIELD ENGINEERING LABS., INC.
Stoughton, MA 02072

The firm is presenting instrumentation for the measurement and control of viscosity, featuring the new DV GATHER software for use on the Brookfield DV-II Calculating Viscometer. Also featured is the Brookfield Rheoset, a new programmable viscometer with microprocessor speed and Brookfield accuracy and dependability.

BROOKHAVEN INSTRUMENTS CORP.
Holtsville, NY 11742

Particle sizing instruments, featuring the new Shimadzu SALD-1000 Fraunhoffer diffraction instrument and covering size ranges from .005 to 600μ are highlighted.

BTL SPECIALTY RESINS CORP.
Warren, NJ 07060

Thermoset coatings for the 90's including next generation Methylon®, Varcum®, and Polyrez® are featured.

BUCKMAN LABORATORIES, INC.
Memphis, TN 38108

Buckman's coatings additives are presented. Corrosion control is highlighted.

BUHLER-MIAG, INC.
Minneapolis, MN 55440

Buhler, a leading manufacturer of high-quality and high-efficiency dispersing equipment, exhibits its automated and controlled bead mills and three roll mills. Application and sales engineers are available to discuss your specific process needs.

BULK LIFT INTERNATIONAL, INC.
Carpentersville, IL 60110

Bulk Lift features its full line of flexible bulk containers (FIBC's) holding from 1000# to 8000# of product. Information on Bulk Lift's PVC reusable bags is also available.

BURGESS PIGMENT CO.
Sandersville, GA 31082

Expansion now for the 90's—Major expansion commitments are presented with emphasis on those functional kaolins especially designed to extend TiO_2 in both gloss and flat systems, water- and solvent-based.

BYK-CHEMIE USA
Wallingford, CT 06492-7661

Highlighted are the wetting and dispersing additives of the Disperbyk 160 family, Anti Terra 204, and Anti Terra 207. Also featured are the defoamers of the BYK 052 family and BYK 020. Uses of levelling agents BYK 306, BYK 310, BYK 336 and BYK 361 are exhibited. Instruments displayed include a wide range of color and gloss meters, the Bykotrack/Gradient Oven combination, high-speed dispersers and the Dynometer.

CB MILLS DIV.
Chicago Boiler Co.
Buffalo Grove, IL 60015

Exhibit includes horizontal and vertical small media mills used in the paint industry. Production and laboratory units are displayed. Additionally, an innovative solvent recovery system that provides a safe distillation system is highlighted.

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

Featured is Cab-O-Sil® fumed silica—offering paint and coatings formulators a unique product which controls viscosity, prevents sagging and anti-settling in heavy pigments. Cabot's featured hydrophobic fumed silica grades improve coatings' water and corrosion characteristics and provide numerous benefits in epoxy and urethane systems.

CALGON CORP.
Pittsburgh, PA 15230

Featured are TEKTAMER 38 A.D., BIOCHEK 240 and other preservatives for use in paints, emulsions and pigment slurries. These preservatives have an excellent toxicological profile, together with a high degree of efficacy. Representatives are available to help with your specific biocide problem.

CARDOLITE CORP.
Newark, NJ 07105

Cardolite presents its unique line of epoxy products. Featured are phenalkamine curing agents, reactive diluents, flexibilizers and epoxy novolac resins. Other products highlighted include flexibilizers for phenolic resins and several specialty chemicals.

CARGILL, INC.
Minneapolis, MN 55440

This year Cargill is the whole show—you'll discover 31 new products at our exhibit—fourteen new high-solids resins, eleven new water-reducible resins, two new power resins, and four new curing agents for powder coatings. You can see samples on a broad array of substrates and meet with Cargill's team of experts. If you don't want to miss the show—don't miss Cargill.

CASCHEM, INC.
Bayonne, NJ

The exhibit features the firm's Caspol® polyol product line for high-solids, high-performance urethane coatings. Caspol 1842 modifier polyol is introduced;with the advent of Caspol 1842, extremely low VOC's are now possible.

CATALYST RESOURCES, INC.
Houston, TX 77018

Aztec® high-purity initiators, including alkyl peroxyesters, diacyl peroxides, dialkyl peroxides, perexyketals, alkyl hydroperoxides, blends and custom formulations, are highlighted.

CDF CORP.
Marshfield, MA 02050

CDF Corp., "The Liner People," is displaying its line of heavy gauge polyethylene liners for drums, pails, and tanks. CDF's seamless vacuum-formed liners keep containers like new and ready for either reuse or easy disposal.

CHEMICAL AND ENGINEERING NEWS
American Chemical Society
Washington, DC 20036

The display features *Chemical And Engineering News*, a chemical newsweekly and the official publication of the American Chemical Society. C&EN's coverage includes all aspects of business, science, technology, and government. On display is C&EN's sixth annual Paint Coatings Product Report, ACS's annual chemical guide, Chemcyclopedia, and the new *Today's Chemist*.

CHEMICAL WEEK
New York, NY 10020

This exhibit, representing McGraw-Hill, features copies of current issues of *Chemical Week*, *Industrial Chemist*, *Chemical Week Buyer's Guide*, and the special *Chemical Week Coatings '88* report issue. Representatives are available to answer questions about the magazines, advertising and circulation.

CHEMOLIMPEX
Hungarian Trading Co. for Chemicals
Budapest, Hungary H-1805

Presented are inorganic pigments, anti-corrosive pigments, chrom oxide green, and dimethylamino-propyl-amine (DMAPA) for the lacquer and varnish, plastics and rubber, and resins industries.

CIBA-GEIGY CORP.
Hawthorne, NY 10532

CIBA-GEIGY Corp. features a spectrum of resins, additives and pigments for coatings. Hardener XU HY 360 is a very low viscosity (200-400 cP @ 25°C) hardener for low VOC industrial coatings. Tinuvin® 1130 is a new liquid light stabilizer compatible with high-solids and water-borne coating systems. CIBA-GEIGY Pigments offers a full range of high-performance colorants and the customer services to go with them.

CLAWSON TANK CO.
Clarkston, MI 48016

Jumbo™ portable shipping containers for both liquid and dry materials, built to D.O.T. specifications in stainless steel, carbon steel, and polyethylene. New finish available on stainless steel containers called Sta-Brite™. Stop by the booth and see the difference.

CL INDUSTRIES
Georgetown, IL 61846

CL Industries is a new manufacturer of Epoxy Novolac Resins and Custom Advanced Epoxy Solutions. Low viscosity novolacs offer easy handling and low VOC without sacrificing properties. High and low molecular weight solid solutions are offered with narrow EEW ranges in a wide variety of solvents.

COATINGS MAGAZINE
Oakville, Ontario, Canada L6K 3G5

Copies of *Coatings Magazine*, Canada's premier paint magazine are available. The booth will serve as a gathering spot for Canadians at the Paint Show.

COLLOIDS, INC.
Marietta, GA 30061

The company's product line including dispersants, defoamers, surfactants, thickeners and resins is featured. The firm's commitment remains pure quality.

COLOR CORP. OF AMERICA
Rockford, IL 61108

Color Corporation of America is celebrating it's 40th anniversary as a supplier of quality colorants and color systems. Two new dispersion lines and a new trade sales color system are featured.

COLORGEN, INC.
Billerica, MA 01821

Featured is a spectrophotometer and a computer system for use in quality control, color analysis, and color-match prediction in paints, inks, and automotive coatings.

COLUMBIAN CHEMICALS CO.
Atlanta, GA 30339

Columbian Chemicals features its new "Ultra" high purity Raven blacks for color and conductive applications and improved Mapico synthetic iron oxides with enhanced wettability for improved rheology. Come to Columbian's booth to see how these products can help you.

CONTRAVES INDUSTRIAL PRODUCTS
Cincinnati, OH 45222

Featured are laboratory viscometers, both constant shear and constant stress systems for R&D and QA. Process viscometers for continuous in-line measurement and control of viscosity are also shown.

COOK RESINS & ADDITIVES
Kansas City, MO 64141-6389

Various resin product brochures are available on additives, high solids, water reducibles, and acrylics. A product summary catalogue is introduced. The booth is staffed by Cook research, sales and agency people. Display panels are presented for some new products.

COSAN CHEMICAL CORP.
Carlstadt, NJ 07072

The exhibit features Cosan's newest developments in specialty chemicals, including DRYMAX™, a revolutionary organic through-drier for high-solids and conventional coatings. Personnel are available to discuss the firm's complete line of bactericides, fungicides, specialty chemicals, driers and catalysts.

COULTER SCIENTIFIC INSTRUMENTS
Hialeah, FL 33012-0145

See the latest Coulter Scientific Instruments' particular characterization technology: the N4 series automated submicron (.003μm to 3μm) particle size analyzers; Multisizer broad-range (0.4μm to 1200μm) particle size distribution analyzer; and Delsea 440 for zeta potential/electrophoretic mobility analysis (particle size range – 10nm to 30μm).

CPI PURCHASING MAGAZINE
Newton, MA 02158

CPI Purchasing Magazine is written for buyers and managers with purchasing responsibility in the chemical/process industries. It reaches 35,000 qualified buyers and managers, more than any other publication serving the CPI. It covers 20,000 plants/buying locations that account for over 80% of the buying power for chemicals, equipment, supplies and transportation.

CRAY VALLEY PRODUCTS, INC.
Stuyvesant, NY 12173

A new thixotropic additive is featured as part of the CRAYVALLAC range. The LANCOWAX range of micronized waxes is exhibited and some novel resins for wood care products are shown.

CROSFIELD CHEMICALS, INC.
Joliet, IL 60435

Featured is the Crosfield HP200 Series – a new generation of high efficiency, rapid dispersion silica flatting agents. Also highlighted are Crosfield silicas designed specifically for the flatting of specialty coatings such as radiation curables, high-solids systems and powder coatings.

CUNO, INC.
Process Filtration Products
Meriden, CT 06450

Cuno Process Filtration Products features Betapure®, a rigid depth filter cartridge for the highest quality coatings. Also on display are CUNO's industry standard Micro-Klean®III and MicroWynd filters, and various filter housings.

CUSTOM METALCRAFT, INC.
Springfield, MO 65808

Custom Metalcraft displays portable bins, tanks, tumbler, tilt, and processing vessels.

CYPRUS INDUSTRIAL MINERALS CO.
Englewood, CO 80155

MAXIMIX-6, a 6 grind; and CYPRUFIL, a 325 mesh grind extender series engineered for solvent- or water-reduced high-solids, low VOC compliance coatings are featured. STELLAR talcs, a new family of high brightness, unique viscosity talcs will help you meet the new demands being placed on the paint and coatings industry. Barytes in paint and coatings grinds are also presented.

D/L LABORATORIES
New York, NY 10003

The booth theme is diversity. Featured are services provided to the coatings, caulk, sealants and plastic industries, including formulation, testing, evaluation, surveys, preparation of specifications and manuals, personnel training and legal assistance.

DANIEL PRODUCTS CO.
Jersey City, NJ 07304

Presented are new dry powder colorants and additives for low VOC coatings: Tint-Ayd PC Colorants for stir-in use in UV, EB, powder- and high-solids and conventional systems; Disperse-Ayd 9100 Powdered Dispersing Resin for preparing high-solids pigment dispersions; and Slip-Ayd SL 600 micronized powder wax blend for exceptional mar resistance and slip in industrial coatings.

DATACOLOR
Charlotte, NC 28217

Featured is our latest in automotive Metallics Color Measurement Systems. Demonstrations show the GK-111 Multi-Angle Color Measurement System and the MMK Production Line Quality Control System. Metallic color tolerances and pass/fail decisions are readily determined and easily communicated between supplier/customer. Also shown is the complete line of our Pigmenta Color Matching and Batch Correction System using our 3890 Dual Beam Spectrophotometer. Bring your color problems and metallic samples for evaluation.

DATALOGIX FORMULA SYSTEMS, INC.
Valhalla, NY 10595

Datalogix Formula Systems, Inc. is a leading supplier of integrated business and manufacturing software for the paint industry. Datalogix' CIMPRO includes all phases of production, inventory control, costing, regulatory compliance, and accounting/business functions. A computer-aided formulation module is designed for paint manufacturers.

DAY-GLO COLOR CORP.
Cleveland, OH 44103

Day-Glo® Color Corp. features their specialty chemicals, pigments, and dispersions for the coatings industry. The Day-Glo® colorants and fluorescent pigments are displayed. Also highlighted is the Nalco® coatings additives product line.

DEGUSSA CORP.
Ridgefield Park, NJ 07660

Featured are flatting agents for solvent- and water-based, clear and pigmented coatings: OK412 for a variety of applications; TS100 for highest efficiency; and HK188 for cost efficiency. Also shown is Aerosil 200® for thixotropy and anti-settling; Aerosil R972® for corrosion resistance, anti-settling and anti-sag; channel-type Color Black FW200 for automotive coatings and Printex XE2 carbon black for conductivity.

UNIVERSITY OF DETROIT
Detroit, MI 48221

The U of D exhibit offers information concerning undergraduate and graduate programs in coatings and polymer science. Special courses in coating technology and contracted research opportunities in polymers and coatings are highlighted.

DISTI ENVIRONMENTAL SYSTEMS, INC.
Kenilworth, NJ 07033

The exhibit features the Universal Tank Cleaner and various sized solvent recovery units. Highlighted is the new Disti D-15 with vacuum, which is a small, low-cost, solvent recovery unit. Also shown is the Disti Universal Tank Washer to wash round and square tanks (Tote Tanks).

DOW CHEMICAL USA
Midland, MI 48674

Featured are D.E.R.™ epoxy resins, D.E.N.™ epoxy novolacs, bisphenols, hydroxyalkyl acrylate monomers, DOWANOL™ glycol ethers and acetates, acetone, vinyl toluene and styrene monomer for automotive, marine and maintenance, can and coil, powder coating, appliance and architectural applications. Dow will also introduce RAP 213 styrene butadiene latex for primer/sealers and stains.

DOW CORNING CORP.
Midland, MI 48686

Technical and sales representatives are available to help formulators and manufacturers learn more about the company's complete line of silicone paint additives, resins and intermediates. New technology is highlighted

DRAISWERKE, INC.
Allendale, NJ 07401

DRAIS introduces Perl Mill Model PM-DCP, a revolutionary design for greater efficiency than conventional media mills. It has 4 times the cooling surface of others and uses grinding media from 0.2 to 2.0 mm. Also exhibited are the TEX, STS and DDA Mills along with the Turbulent Mixer/Reactor for vacuum drying of pigments and flushing processes.

DREW INDUSTRIAL DIV.
Boonton, NJ 07005

The booth highlights recent developments in foam control additives for trade sales paints and industrial coatings. A QUALITY PLUS™ Program that has contributed to improving product quality and efforts devoted to meeting paint industry government compliance are also featured.

DSA CONSULTING, INC.
Mission, KS 66222

Featured is a computer software system now being extensively used by paint companies in both Europe and the USA. These companies are using the system to formulate coatings to customers' specifications. The programs control and define color, gloss, dispersion and viscosity. Personnel demonstrate the software system and answer questions.

DSET LABORATORIES, INC.
Phoenix, AZ 85029

The company and its subsidiary, Everglades Testing Laboratory, are displaying a complete line of equipment and services for materials testing and evaluation. The EMMAQUA® Test Method, Suntest CPS, and Specialty Environmental Test Services are featured.

DU PONT CO.
Wilmington, DE 19898

Du Pont Coatings Resource Network features environmental, business operation, engineering and technological problem solving, plus consistently high quality materials for coatings: resins, solvents, titanium dioxide, surfactants, and a variety of additives for special coating properties.

ECC AMERICA
Atlanta, GA 30342

Featured is Southern Clay Products line of specialty thixotropes including the Claytone family of organoclays and the Flowtone series of castor rheological additives. In addition, ECC America Calcium Products features the newly acquired Atomite, Snowflake and Duramite extender pigments.

EAGLE ZINC CO.
New York, NY 10112

Eagle Zinc manufactures American Process zinc oxide for the paint industry, grades 414W and 417W. Meadowbrook Company manufactures quality zinc dust for the paint industry.

EASTERN MICHIGAN UNIVERSITY
Ypsilanti, MI 48197

EMU bestows B.S. and M.S. degrees in Polymer & Coating Technology. Information can be obtained regarding academic and research activities. Research is focused in the "Coatings Research Institute" in the form of industrial contract activity and student's degree-oriented investigations. The staff invites inquiries and is available for consultation.

EASTMAN CHEMICAL PRODUCTS, INC.
Kingsport, TN 37662

Eastman exhibits the following: acetoacetyls (AAEM, MAA, EAA), Ektapro® EEP Solvent, cellulose esters for coatings, Texanol® ester alcohol, TMPD® glycol for high-solids coatings and CHDA acid for high-polyester polymers.

EBONEX CORP.
Melvindale, MI 48122

Exhibit features specialty bone blacks, and items produced using cosmic black pigment.

EIGER MACHINERY, INC.
Bensenville, IL 60106

Displayed are the highly efficient laboratory and production horizontal bead mills, along with the new Eiger Mixer/Dispenser (EMD). In addition, representatives from the Eiger Process Systems Group are available to discuss Eiger's plant engineering capabilities.

ELCOMETER, INC.
Troy, MI 48083

A complete line of precision instruments for measuring and analyzing coating thickness, gloss, adhesion, surface preparation, climatic condition, porosity, ferrite detection and ultrasonic wall thickness is featured. Models range from the simple mechanical to the sophisticated SPC compatible coating thickness computer.

ELEKTRO-PHYSIK USA, INC.
Arlington Heights, IL 60005

The latest in nondestructive coating thickness testing instruments are displayed. The Minitest portable digital instruments are available for demo and hands-on use. Also featured is the Mikrotest series.

ELMAR INDUSTRIES, INC.
Depew, NY 14043-0245

Elmar Industries displays the Model RPE-514 GI, 14 station gallon filler with 4' long infeed conveyor and random discharge to a conveyor or lid dropper. This machine has the capability to fill one gallon cans of latex paint at speeds of 160 containers per minute. Latex- or solvent-based stains can be filled at speeds up to 80 containers per minute.

EM INDUSTRIES, INC.
Hawthorne, NY 10523

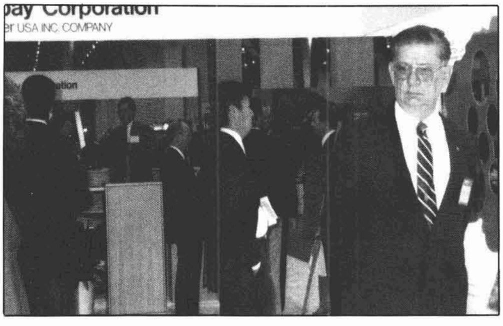
EM Industries Pigment Division manufactures a synthetic, inorganic, lustre pigment. These pigments consist of platelets of mica coated with titanium dioxide, iron oxide, or a combination of both. Affair lustre pigments can be formulated into a wide variety of colors. Gold, silver, copper and aluminum effects can also be simulated.

ENGELHARD CORP.
Cleveland, OH

Engelhard now offers the complete line of Harshaw colors for architectural, OEM and special purpose coatings. See our spectrum of inorganic and organic dry colors and aqueous, resin and universal dispersions. Our Gallery One™ paint tinting and merchandising system is also on display.

ENGELHARD CORP.
Iselin, NJ 08830

The booth combines specialty extender pigments and Attagel® products with Harshaw Color Pigments. Displays include TiO_2 extension examples using Satintone® and ASP® products. Engelhard also offers Harshaw environmental test chambers for salt-fog, humidity and multi-gas tests. Harshaw chambers are available in a variety of sizes, including custom-designed walk-in models. Digital indicator/controllers on all units offer ease of operation and increased accuracy.



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

The patented X-ENTRI Small Media Mill is displayed. It features lower energy consumption, higher thru-puts than conventional vertical or horizontal mills. The time proven SWMill is displayed, along with all types of grinding media.

ERDCO ENGINEERING CORP.
Evanston, IL 60204

The Rapid Flash Point Tester is featured with a broad range of process instrumentation including flowmeters, batch controllers, flow switches and solvent vapor monitors.

EXPANCEL, NOBEL INDUSTRIES SWEDEN
Marietta, GA 30062

Introducing EXPANCEL® for formulations of quality paint with low density, high-solid content and improved ease of application. The EXPANCEL® product program of thermoplastic hollow microspheres is presented, with emphasis on features in paint such as ultra low density and resiliency.

EXXON CORP.
Houston, TX 77001

The exhibit features Exxate® solvents for high-solids and water-borne coatings, urethane systems and paint strippers. High purity hydrocarbon solvents include ISOPAR® isoparaffins with low surface tensions, NORPAR® normal paraffins with selective solvency, EXXSOL® dearomatized aliphatics, and a broad range of light and heavy aromatics. SPARC (Solubility Parameter Calculator) computer model is also featured for reformulation and technical service.

FAWCETT CO., INC.
Richfield, OH 44286

Displayed is the firm's complete line of air-driven and electric-driven mixers and accessories to fit all your mixing and stirring applications. Also shown is a new portable paint tank agitator for your production mixing applications.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
Philadelphia, PA 19107

Featured is a display of Federation publications and educational and training aids including the *new* FSCT Series on Coatings Technology, the *Journal of Coatings Technology*, "An Infrared Spectroscopy Atlas for the Coatings Industry," "Paint/Coatings Dictionary," and FSCT slide/tape training programs. Information on upcoming Federation-sponsored Seminars is available. The 1989 Paint Industries' Show floor plan is on display and applications for exhibit space are available.

FILTER SPECIALISTS INC.
Michigan City, IN 46360

Highlighted are liquid filtration products for the paint and chemical industries. F.S.I. sales personnel are on hand to discuss applications and problems. Filter bags, cartridges and equipment are on display.

FREEMAN CHEMICAL CORP.
Port Washington, WI 53074-0996

Emphasis is on providing the paint formulator a choice of solutions for today's pressing environmental issues, most notably the need for lower VOC. High solids, water-borne and plural component resins are featured.

H.B. FULLER CO.
St. Paul, MN 55126

Our paint chemists are present in the booth to answer questions about our Fulatex® vinyl acrylic and all-acrylic latexes. These materials include PD-0110, PD-0124, and PD-0442 and are designed for the trade sale and contractor house paint manufacturer.

GAF CHEMICALS CORP.
Wayne, NJ 07470

Highlighted in this exhibit are specialty chemicals for the coatings industry. Featured are V-PYROL®, ALIPAL®, BLANCO®, GAFAC®, GANEX®, IGEPAL®, NEKAL®, Thickener LN, M-PYROL®, THF®, BLO®, and Butanediol.

PAUL N. GARDNER CO., INC.
Pompano Beach, FL 33060

Highlighted are new EZ Viscosity Cups that exceed ASTM D4212, qualify under MIL STD 45662, calibration traceable to N.B.S. New conversion tables relating efflux time to viscosity in centistokes for EZ Cups and Gardner Ford Cups, and many new instruments developed by the Gardner Company are featured.

GEORGIA KAOLIN CO., INC.
Union, NJ 07083

The company presents its complete line of kaolin clay and specialty fillers and extenders for the coatings industry. Particular emphasis is given to titanium dioxide extender pigments a well as fillers meeting Hegman grind specifications.

GOODYEAR CHEMICAL DIV.
Akron, OH 44316

Featured are the firm's new Plioway resin, soluble in aromatic-free solvents, and Pliolite WR-D, a water-reducible dispersion. The firm also exhibits recent developments in the water-borne industrial coatings area. Technical and sales personnel are on hand.

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

The Grace booth features Syloid® silicas, high quality flatting pigments for the coating industry. Staff is on hand to help you select the silica flatting agent designed for your specifications. Also highlighted is Shieldex®, a nontoxic, anti-corrosion pigment.

HALOX PIGMENTS
A Div. Hammond Lead Products, Inc.
Hammond, IN 46320

The exhibit features HALOX Pigments' SQP (Service-Quality-Performance) approach to solving corrosion and tannin stain problems with their complete line of nontoxic inhibitors.. Formulating versatility and effective cost performance highlight the benefits of Halox Proven Performance.

HENKEL CORP.
Gulph Mills, PA 19406

Two Henkel divisions share the exhibit and the featured technology includes new application data for rheology modifiers, plus emphasis on high-solids systems for epoxies, urethanes and radiation-cured systems. There is also special emphasis on how mercaptan epoxy curatives will improve coating properties. Ask for more information!

HEUBACH, INC.
Newark, NJ 07114

Exhibited are the firm's new Phthalo Blue Pigment Blue 15.1 and low-soluble lead and chromium Krolor® LS yellows and oranges for coating applications. HeucoTech (Heubach Color Technology) is showing its expanded line of Heucophos® zinc phosphates and new high-solids color dispersions for coatings — Aquis® II.

HI-TEK POLYMERS, INC.
Jeffersontown, KY 40299

Hi-Tek Polymers, Inc. (formerly Interez) is a major supplier of epoxies, acrylics and other coating resins for bake and ambient-cure. Particular emphasis is being placed on high-solids and water-borne products to meet VOC requirements.

HILTON DAVIS CO.
Cincinnati, OH 45237

Theme of this expanded exhibit is "We Have A New Line On Color." Featured are new services, including 1-800-HDCOLOR, and several new pigments recently introduced; comparative low VOC data and color formulary. Technical literature and assistance highlight our entire line of colors. Meet the management and technical team. Daily drawings for "Pocket Color TVs."

HITOX CORP. OF AMERICA
Corpus Christi, TX 78403-2544

The exhibit focuses on HITOX buff-colored TiO_2, a 95% rutile alternative to white TiO_2; OSO Iron Oxides and BARTEX barium sulfates. Experienced technical personnel are on hand to assist you in incorporating HITOX Corporation products into your coatings formulation.

HOCKMEYER EQUIPMENT CORP.
Harrison, NJ 07029

The exhibit features the firm's CMX100 portable tank washing system and single shaft, high-speed disperser. Also highlighted is a dual shaft mixer, a hydraulic press, a baler, various dispersing blades as well as frequency inverter disperser drives.

HOECHST CELANESE CORP.
Coventry, RI 02816

The Pigments Department of Hoechst Celanese is represented by key technical, marketing and sales people to answer questions and provide information on new product ideas. Hoechst Celanese Chemicals Department is also represented.

HORIBA INSTRUMENTS, INC.
Irvine, CA 92714

Horiba exhibits the CAPA line of particle size analyzers. This line is displayed with a new computer package to enhance graphics and data processing. Also a new, automated, helium pycnometer is shown.

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

This major supplier of titanium dioxide extenders, flatting agents and functional fillers, is represented by the Chemical, Clay and Calcium Carbonate Divisions. J.M. Huber manufactures high quality precipitated silicas and silicates, kaolin clays, micas, and coarse and fine particle size calcium carbonates.

HULS AMERICA, INC.
Piscataway, NJ 08855-0365

Featured are industrial and trade sales color systems, high-solids colorant dispersions, aliphatic isocyanates (IPDI/TMDI), aliphatic epoxy hardeners (IPD/TMD), powder coating crosslinkers, and a comprehensive line of additives, including driers, thickening agents, fungicides, preservatives, and special resins.

HUNGARIAN ALUMINIUM CORP.
Budapest, Hungary H-1387

Aluminum pastes featuring leafing and non-leafing qualities for paints, roof-coating, industrial coating,—for gas—concrete, with different solvents and water-based quality in various grades. Producer: Köbánya Light Metal Works, Kecskemét Factory.

HUNTER ASSOCIATES LABORATORY, INC.
Reston, VA 22090

HunterLab manufactures color and appearance measurement instrumentation for quality control, research and development, and other applications for the paint and coatings industry. Our applications specialist is available to answer questions and demonstrate the instruments on any types of samples.

ICI AMERICAS, INC.
Wilmington, DE 19897

Featured are SOLSPERSE® hyperdispersants; pigments for paints; nitrocelluose grades including isopropanol, plasticizer, water wet; LUMIFLON® fluorpolymer resins for high-performance coatings; PROXEL® antimicrobials for preservation of paints and coatings; standard surfactants and HYPERMER® polymeric surfactants; ATRUST® rust converter treatment for poorly-prepared rusted steel.

ICI RESINS U.S.
formerly Polyvinyl Chemicals
Wilmington, MA 01887

The exhibit has a problem/solution format in which specific coatings problems are addressed. Several new water-based NeoCryl, NeoRez and Haloflex resins are featured with emphasis on low VOC/high-solids formulating. Our technical experts are available to match our solutions with your problems. Tap into the expanded world of ICI Resins U.S.

IDEAL MFG. & SALES CORP.
Madison, WI 53704

On display is an SA 150A automatic/semi-automatic volumetric filler which handles container sizes of one Imperial gallon to ½ pint. Also on display is Ideal's new PRISM I, an electronic weight filler for one gallon to ½ pint containers.

ILLINOIS MINERALS CO.
Cairo, IL 62914

Illinois Minerals' booth describes mining and plant procedures along with scanning electron photographs of various silicas. Also featured are descriptions of semi-bulk bag loading.

INDUSMIN, INC.
Columbus, OH 43235

Indusmin, Inc. manufactures micronized nepheline syenite and feldspar products for use as inert fillers for the coatings industry.

INDUSTRIAL FINISHING MAGAZINE
Wheaton, IL 60188

Current issues of *Industrial Finishing Magazine* are being distributed free to attendees and subscription qualification forms are available. Business and editorial staff members are present.

ITASCO DIVISION, I.W.I. IND.
Summit, IL 60501

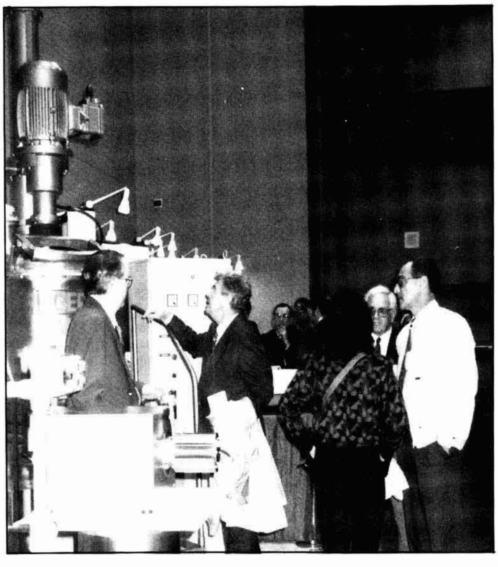
Itasco exhibits its new D.O.T. bulk liquid and bulk powder portable shipping tanks and tank accessory parts and materials.

ITT MARLOW PUMPS
Midland Park, NJ 07432

Oil-less air-operated diaphragm pumps and centrifugal types for tough fluid handling applications are presented.

J & L INSTRUMENTS CORP.
Norristown, PA 19403

Featured is the Irvine-Park Falling Needle Viscometer/Density Meter, which can accurately measure the viscous properties of Newtonian and non-Newtonian fluids without instrument calibration. The density, thermal expansion coefficient, and sedimentation rate can be measured. Testing time can be reduced substantially with the disposable kits especially made for paints and coatings.



FSCT 88

66th ANNUAL MEETING
53rd PAINT INDUSTRIES' SHOW
McCORMICK PLACE • CHICAGO, IL
OCTOBER 19, 20, 21 1988

S.C. JOHNSON & SON, INC.
Johnson Wax
Racine, WI 53403

Johnson Wax features the Joncryl line of rheology-contorlled acrylic emulsions and solvent-borne acrylic polyols for VOC compliant industrial coatings. The acrylic emulsions offer many benefits including solution-like flow, application properties, appearance and manufacturing ease. The solvent-borne acrylics are high-solids or 100% N.V. flakes. These acrylic polyols have utility in either urethane or baking enamels, and are often used to enhance a coating's application properties.

KEMIRA, INC.
Bridgewater, NJ 08807

Kemira, Inc. features a complete line of pearlescent pigments for paint and coatings. Heat-stable and chemical-resistant, these highly refractive pigments provide the particular silver or gold effect that's just right for your formulation. Technical service representatives are available to discuss which FLONAC® will meet your specific need.

KENRICH PETROCHEMICALS, INC.
Bayonne, NJ 07002

Presented are Ken-React Titanates, Zirconates and Aluminate Coupling Agents; Kenplast® G and ES-2 nonreactive and reactive diluents; and Kencure® MPP, MPPJ and MPPM (methane sulfonyl pyrophosphates) for low temperature bake cures. NACE and Water-borne Technical Papers are available.

KENT STATE UNIVERSITY
Kent, OH 44242

The Department of Chemistry activities relative to the coatings group are presented. Coatings research performed by undergraduate and graduate students is outlined and details on the B.S. and Ph.D. programs related to coatings are offered. Materials are available describing the department's analytical instrumentation facility, cooperative education, coatings continuing education programs and coatings publications.

KING INDUSTRIES, INC.
Norwalk, CT 06852

King is introducing two new product lines, K-FLEX® polyurethane diols and K-SPERSE dispersing agents, to its full line of specialty products for coatings and inks. New product literature is available on King's Nacure and K-Cure catalysts, K-FLEX polyester polyols, NACORR corrosion and Dislon additives.

KRAFT CHEMICAL CO.
Melrose Park, IL 60160

For quick, efficient service of your chemical and raw material needs, stop by booth #865. Kraft Chemical Company represents major suppliers to the midwest paint and coatings industry from their suburban Chicago office and warehouse.

KTA-TATOR, INC.
Pittsburgh, PA 15275

KTA-Tator, Inc. features the KTA Envirotest, an innovative cycling apparatus designed to accelerate the weathering of coating and lining materials. The company's consulting, failure analysis, laboratory, inspection and inspector training services and instrument sales are also highlighted. Brochures available

LABELETTE CO.
Forest Park, IL 60130

LEEDS & NORTHRUP
A Unit of General Signal
North Wales, PA 19454

Presented are Microtrac particle size analyzers using forward scattered light measuring range of 0.12 to 700 microns; Data Management Systems software for PC compatibles, logs data and runs statistical analyses; and Automatic Surface Area Analyzer uses BET method measuring range of 0.15 to 4000 meters per square gram.

LIQUID CONTROLS CORP.
North Chicago, IL 60064

Liquid Controls is exhibiting meters and accessories specially designed for the paint industry. For Absolute Accountability™ visit us and ask about The Colors of Money: "Green (anodized aluminum)," "Copper (brass)," "Silver (stainless steel)," and "Gold (yellow-all ferrous)."

LogiCom, Inc.
Moline, IL 61265

CLaM, the Coatings Lab and Manufacturing software system, is presented for hands-on evaluation. Comprehensive lab, MSDS, production, inventory, sales, pricing, accounts receivable, accounts payable, general ledger, and more in a true relational data base system.

THE LUBRIZOL CORP.
Wickliffe, OH 44092

The Lubrizol display (Booth 163) features a wide variety of paint and ink additive products which include rheology control agents, pigment dispersants, corrosion inhibitors, adhesion promoters, copolymerizable latex surfactants and antisettling agents. Examples of typical application performance are presented.

3M/INDUSTRIAL CHEMICAL PRODUCTS DIV.
St. Paul, MN 55144-1000

Fluorad™ coating additives, featuring a range of wetting agents, flow control agents, and fluorochemical surfactants are highlighted. These materials are designed for high-solids and 100% epoxy systems. UV curing additives are also available.

MACBETH
A Div. of Kollmorgen Instrument Corp.
Newburgh, NY 12550

Macbeth introduces a mini-size, portable, color-matching booth evaluating samples under different light sources and automatic calibration unit for its Eagle-Eye remote on-line color control system. It also shows its P.O.P-Eye computerized paint matching system, 1500/PLUS color measurement system, lab-size SpectraLight color-matching booth, and Munsell Color physical standards and companion products.

MAGNESIUM ELEKTRON INC.
Flemington, NJ 08822

Information on the company's range of zirconium chemical crosslinkers for the coatings industry is available. Improvements in adhesion, heat resistance, and water/solvent resistance are experienced as a result of their use. Also featured is a new line of specialty corrosion-resistant pigments.

MALVERN INSTRUMENTS INC.
Southborough, MA 01772

Featured are particle size analysers for dry powders, slurries, suspensions and emulsions in large or small volumes, aqueous and nonaqueous media and sprays. Total instrument range is 0.001 to 1800 microns. Zeta potential and molecular weight instrumentation are included. Instruments feature user friendly full color software for control and data manipulation.

MANCHEM, INC.
Princeton, NJ 08540

Manchem features its range of ALUSEC® crosslinkers for high-solids coatings, designed to meet today's low VOC requirements. Also, MANALOX® 403/60WS, a tried and true ingredient for water repellents, is displayed. Other products include EASISPERSE® Iron Blues and a range of precipitated calcium carbonates. Technical personnel are on hand.

MANVILLE CORP.
Filtration & Minerals Div.
Lompoc, CA 93438-0519

Learn how our efficient Celite flatting agents and extender pigments can help improve your formulation's performance and costs. Visit us and learn about our TiO_2 extender and precipitated silica products, ZERLITE at work.

MCWHORTER, INC.
Rockford, IL 61108

THE MEARL CORP.
New York, NY 10017

The firm is exhibiting a complete line of pearlescent luster pigments, both in regular and exterior grades for unique, optical effects in all coating applications.

MICRO POWDERS, INC.
Scarsdale, NY 10583

Micro Powders exhibits its complete line of functional micronized wax additives for all types of paints and coatings. New Polyfluo 120 is featured as well as the latest developments in stir-in waxes for exterior water- and solvent-based stains. Technical and sales representatives are on hand.

MICROMERITICS INSTRUMENT CORP.
Norcross, GA 30093-1877

The company is exhibiting automatic and manual instruments for materials characterization including surface area analysis by the B.E.T. method, pycnometers, and particle size analyzers.

MID-STATES ENGR. & MFG., INC.
Milton, IA 52570

Bulk liquid and dry storage containers in mild steel and stainless steel are featured. They are available in capacities of 178 to 644 gallons. DOT certification is available.

MILLER PAINT EQUIPMENT, INC.
Addison, IL 60101

Featured are Miller Accutinter computerized dispensers, Gyromixer high-speed mixers, Tintmaster colorant dispensers, and Dualmixer shakers.

MILTON ROY/DIANO COLOR PRODUCTS
Rochester, NY 14625

Shown to the paint industry for the first time is the newest member of the DIANO Color Products family: the Color Mate HDS color analyzer. Also on display is the original Color Mate and the Color Graph spectrophotometer. Accurate enough for research, reliable enough for production, DIANO Color Products are *still* the least expensive true double-beam systems you can buy.

MINERAL PIGMENTS CORP., DAVIS COLORS
Beltsville, MD 20705

Mineral Pigments Corp. and Davis Colors, both subsidiaries of Rockwood Industries, offer a complete line of synthetic, natural and easy dispersing iron oxides. They also have umbers, siennas, Van Dyke Brown, chrome yellow and corrosion inhibiting pigments.

MiniFIBERS, INC.
Johnson City, TN 37615

Information on synthetic fibers and their suggested end use is available. Experienced technical personnel are on hand with samples of current applications. Sales representatives also staff the exhibit.

MINOLTA CORP.
Ramsey, NJ 07446

Minolta displays its tristimulus color difference meters. These meters are able to measure color difference of a customer's product to ensure that a customer's products are all the same color according to their own specifications.

UNIVERSITY OF MISSOURI–ROLLA
Rolla, MO 65401

The University of Missouri–Rolla display includes the Coatings and Polymer Science Program outlining basic composition, paint formulation, physical testing, estimating, maintenance coatings, polymer chemistry, and basic coatings for business. Research and educational programs at UMR are also presented. Resumés of students are available.

MITECH CORP.
Twinsburg, OH 44087

Mitech exhibits the "Carri-Med Controlled Stress Rheometer" which does creep, flow, and dynamic measurements with automatic analysis for simple and complex fluids. Also introduced is the innovative "Thermosafe" induction drum heater which melts solids and heats liquids with no danger.

MIXING EQUIPMENT CO.
Avon, NY 14414

Featured is the LIGHTNIN® Quik-Connect™ modular mixer, designed specifically for use with TOTE® tanks, JUMBO™ bins and other portable, shipping/mixing/discharge containers. LIGHTNIN® Mix-perser™—high shear mixing with better circulation at lower power levels than conventional dispersers.

MOBAY CORP.
Pittsburgh, PA 15205-9741

The Mobay exhibit features applications for coatings systems based on the company's line of polyurethane resins and additives, particularly transportation and wood finishes; a full line of organic pigments for automotive and trade sales paints; quality synthetic iron oxide pigments and mixed metal oxide pigments for a broad range of coatings systems.

MODERN PAINT AND COATINGS
Atlanta, GA 30328

Complimentary copies of the October paint show issue are being distributed at the booth. The Paint Red Book, the only directory in the paint and coatings field, is on dsplay, as well as Adhesives Age Directory and Rubber Red Book. These directories are aso published by Communication Channels, Inc.

MOREHOUSE INDUSTRIES, INC.
Fullerton, CA 92633

Presented is the new Low Profile 25hp disperser, with jackshaft, for maximum power delivery. Also featured is the new 5hp disperser, solvent recovery display and full pressure media mill.

MOZEL INCORPORATED
St. Louis, MO 63110-2390

Messages may be left or received during regular show hours. Messages will be posted on the Mozel display located on the mezzanine floor. The telephone number is **(312)-808-2950**.

MYERS ENGINEERING
Bell, CA 90201

Displayed are representative samples of the company's disperser line. Factory personnel are on hand to answer your technical and application questions.

NETZSCH INCORPORATED
Exton, PA 19341

Netzsch is exhibiting the Molinex Model LME20 (20 liters) and the Molinex LME50 (50 liters), featuring the new "Made in the U.S.A." concept.

NEUPAK, INC.
Minnetonka, MN 55345

Neupak is showing its new patented pump system which allows paint to be pressure fed to filling machines, eliminating the need for costly tanks and level controls. These pumps are shown on twin head and semi-auto machines. Also shown is a 5 gallon filling by weight machine.

NEVILLE CHEMICAL CO.
Pittsburgh, PA 15226-1496

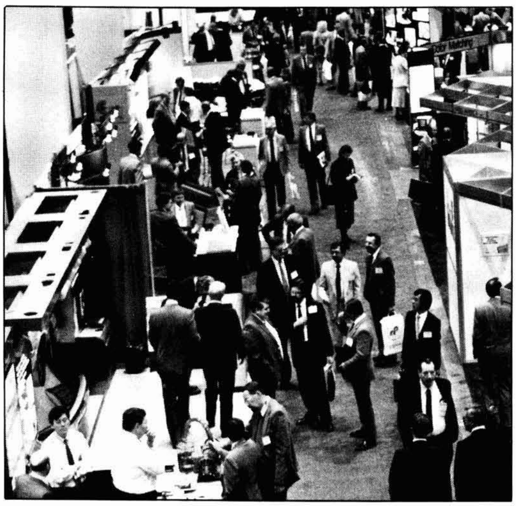
The company's wide range of petroleum hydrocarbon resins, Cumar coumarone indene resins and Syntase ultraviolet light absorbers are featured. Technical information on use in coatings and coatings systems is available. Technical representatives staff the exhibit.

NEW WAY PACKAGING MACHINERY, INC.
Hanover, PA 17331

New Way Packaging Machinery, Inc. is celebrating its 60th year in business by showing its EP Roll-Through Labeler with timing mechanism for gallon paint cans. The NEW WAY Model EP is the standard paint can labeler for the coatings industry and NEW WAY is proud of 60 years of service to this industry. In addition, NEW WAY is displaying models of its line of disposal equipment for hard-to-handle wastes.

NL CHEMICALS, INC.
Hightstown, NJ 08520

Resin products featured include SPENSOL® water-reducible urethanes, SPENLITE® and SPENKEL® solvent-borne urethanes, AROLON® acrylics, KELSOL® water-reducible alkyds and polyesters, AROFLINT® polyester epoxy systems, and AROPLAZ® high-solids alkyds and polyesters. Rheological additives include RHEOLATE™ 255 and 278 urethane associative thickeners and THIXATROL® SR. NALZIN® 2, a nonlead, nonchrome, anti-corrosive pigment is also presented.



NORTH DAKOTA STATE UNIVERSITY
Fargo, ND 58105

Educational and research activites are featured, 1989 short courses are described. Booth is staffed by alumni and faculty.

NUFLEX, INC.
Linden, NJ 07036

Nuflex, Inc., the only U.S. manufacturer of composite hose, features light, flexible products which handle higher temperatures and pressures than their rubber and metal counterparts. They feature excellent chemical resistance and are extremely durable.

NYCO®
Willsboro, NY 12996

Featured is 10 WOLLASTOKUP®, fine particle-sized wollastonite, chemically modified for dispersion, wet adhesion and long-term resistance to corrosion and blistering in high performance coatings.

ORB INDUSTRIES, INC.
Upland, PA 19015

ORB Industries, Inc., a manufacturer of aerosols and chemical specialties for industry, is featuring their touch-up paint services. Exact custom color matches in aerosol and bulk or your own coating filled into aerosols.

ORTECH INTERNATIONAL
Mississauga, Ontario, Canada L5K 1B3

Independent technical consulting and contract R&D. Business and technical viewpoints can be applied simultaneously to client's needs in areas including process and product development, materials selection, formulation, evaluation and specifications testing for industry and government.

PACIFIC ANCHOR CORP.
Los Angeles, CA 90040

Featured are the company's new products for high-solids epoxy coatings including new lines of cycloaliphatic amines and polyamides.

PACIFIC MICRO SOFTWARE ENGINEERING
Bell, CA 90201

Pacific Micro demonstrates BatchMaster PLUS+, the complete software package to manage your manufacturing and business operation. The modular package improves productivity by handling inventory, production, costing, OSHA compliance, formula analysis, accounting, and much more. BatchMaster PLUS+ runs on IBM-compatible PC's and local area networks.

PACIFIC SCIENTIFIC
Instrument Div.
Silver Spring, MD 20910

Color and appearance instruments featured include: the Color Machine with Gloss™, that simultaneously measures colors and gloss, Spectrogard II spectrophotometers, Glossgard gloss meters and Gardner physical test equipment.

PACKAGING SERVICE CO., INC.
Pearland, TX 77588

Since 1971, Packaging Service Company has been the full service source for packaged solvent products. For whatever your reasons, use our facility to produce quarts, gallons, five gallons, and drums of solvents blended, packaged, labeled, and shipped according to your instructions.

PFIZER PIGMENTS INC.
Easton, PA 18042

Participating in their 36th Paint Industries Show, Pfizer Pigments features a tradition of technical leadership with a focus on Pferrisperse® iron oxide slurry and Pferritan heat stable pigments. Information on pigment grade products and distributor locations is provided. Phil Pfizer, our Robot, along with other company personnel, is on hand to review this information.

PHILLIPS 66 CO.
Bartlesville, OK 74004

Phillips 66 hydrocarbon propellants, solvents and chemical intermediates are highlighted.

PICO CHEMICAL CORP.
Tinley Park, IL 60477

Specialized "Workhorse" production and maintenance chemicals, and paint and coatings cleaners/removers for mixing tanks, reactors, shipping and storage container interiors and floor maintenance, are featured.

PIONEER PACKAGING MACHINERY, INC.
Greenville, SC 29609

The five gallon pail labeler is once again on display with its improved label magazine. Also a one gallon, quart and pint labeler is introduced for flexible wet-glue paper labeling. Machine is able to orient "ears" as well as handle "F style" cans.

POLY-RESYN, INC.
West Dundee, IL 60118

The company features a complete line of rheological additives for solvent-based paints. Included is a new pourable anti-settling agent. Also, a complete line of castor thickeners are the newest addition to the product line.

PPG INDUSTRIES, INC.
Pittsburgh, PA 15272

PPG introduces two new precipitated silica products: An anti-corrosion pigment designed as a replacement for strontium chromate, zinc chromate and other toxic materials; and a new flatting agent for high-solids coatings. Also featured are Lo-Vel® flatting agents and T-600, a highly efficient, low-cost thickener.

PQ CORP.
Valley Forge, PA 19482

PQ features a broad line of hollow microspheres for use as versatile, low-density fillers or extenders for coatings, sealants and adhesives. They are offered in a variety of grades and include surface-modified and metal-coated types.

PREMIER MILL CORP.
Reading, PA 19606

Premier Mill Corp. introduces their Ultra-Shear™ in-line homogenizer at this year's Paint Show. In addition, they display samples of their Supermills, Extra-High Performance Supermills, and Prem-A-Mix disperser/mixers, along with their complete line of laboratory mixers and mills.

PROGRESSIVE RECOVERY, INC.
Columbia, IL 62236

Progressive Recovery, Inc. has developed an extensive line of liquid solvent recovery equipment to convert solvent-laden, hazardous waste into a reuseable product. The PRI recovery system reclaims solvent from contaminated solvents, waste inks, pigments, resins, and other solvent solutions. It is an efficient, low-cost distillation process.

THE Q-PANEL CO.
Cleveland, OH 44145

On display is the QUV Weathering Tester, and the new UVA-340 lamp. The UVA-340 allows improved correlation between natural and laboratory exposures.

RAABE CORP.
Milwaukee, WI 53223

These formulators of exact matching touch-up paints feature custom filling of aerosol, bulk, and brush-in-cap touch-up containers.

RED DEVIL, INC.
Union, NJ 07083

Featured are the 5600 AUTO SPERSE® paint mixer for faster, safer, quieter mixing; the 5400 versatile paint mixer which blends paint thoroughly every time; the 1000 Series manual colorant dispenser; and the 5050™ high-speed mixer, the best mixer made for volume paint dealers. Visit Red Devil for a complete line of paint mixing and tinting equipment.

REICHHOLD CHEMICALS, INC.
White Plains, NY 10603

On display are a full line of coating resins, including ultraviolet-cured resins, alkyds, and fluorocarbons; a broad range of latexes, including acrylics and vinyl acrylics; specialty coating resins, featuring epoxies, self-healing polyurethanes, and non-isocyanate-curing acrylics, and pigment dispersions. Included are new products since the merger with Dainippon Ink and Chemicals, Inc. The firm is also represented by Polychrome Chemicals, Reichhold Ltd., Cellomer, and RBH Dispersions personnel.

RENZMANN INCORPORATED
Hauppauge, NY 11788

Featured are Renzmann Washing Machines ideal for mixing tubs, paint cans, pails, 55 gallon drums, etc. and Renzmann Distillation Units ranging in capacity from 3 gallons to 280 gallons. Renzmann Distillation Systems enable you to recover as much as 98% of your dirty solvent while reducing the amount of hazardous waste you generate.

REYNOLDS INDUSTRIES, INC.
Fort Mill, SC 29715

Information and displays of mixing and dispersion equipment, involving the application of hydrostatic and hydraulic drives, are featured.

RHONE-POULENC INC.
Monmouth Junction, NJ 08856

Rhone-Poulenc features an international marketing and technical team to help you on discussions regarding Tolonate® polyisocyanate resins for high-solids PU coatings; Rhodorsil® resins for high-temperature coatings; Rhodopol® biopolymer for water-based, high-build texture paints; and why rare earths for epoxy, latex, and PU coatings.

ROHM AND HAAS CO.
Philadelphia, PA 19105

Rohm and Haas Co., a Philadelphia-based manufacturer of polymers, resins and additives, features a cross section of products used for Trades Sales, Industrial, and Marine and Maintenance applications. The company is also presenting a revolutionary new advance in acrylic latex technology.

ROSEDALE PRODUCTS INC.
Ann Arbor, MI 48106

Rosedale is exhibiting bag type filters and basket strainers. They also manufacture a vibrating basket-type paint filter, activated carbon retaining baskets and a wide range of wire mesh and perforated metal products.

RUSSELL FINEX, INC.
Mt. Vernon, NY 10550

The Russell Finex 22" vibratory high-speed strainer is the latest in our range of equipment and used throughout the coatings industry. Its high-speed frequency and variable weight changing ability make it one of the most efficient strainers ever marketed.

SANDOZ CHEMICALS CORP.
Charlotte, NC

The Sandoz exhibit features the firm's range of Sandorin and Graphtol pigments, including the newly introduced Sandorin Brown RL, Orange 5RLT and Graphtol Fast Orange 5GL. Also, two new additives — Sanduvor 3052 and Sanduvor 3054 are displayed.

SANYO-KOKUSAKU PULP CO., LTD.
Tokyo, Japan,100

Sanyo-Kokusaku Pulp Co., Ltd., Chemical Division, is showing chlorinated polyolefines for plastic paints and universal primer for plastic moldings and plastic films, i.e., bumper, packaging film etc. Also shown are adhesives for plastic moldings, i.e., PP molding parts of automobile and concrete surface coatings.

SCHOLD MACHINE CO.
St. Petersburg, FL 33716

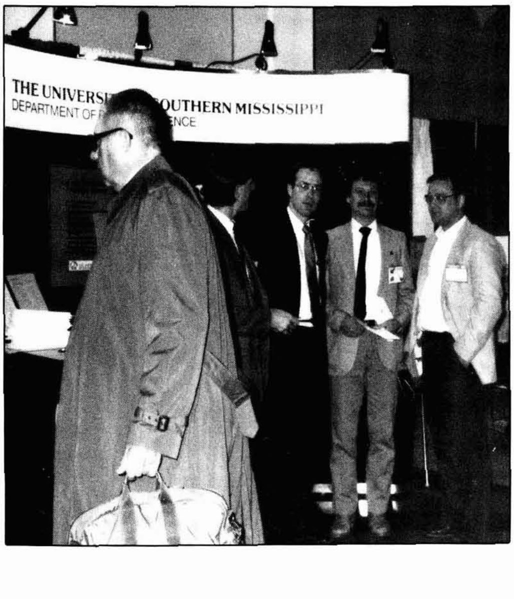
Featured is the 60 gal. patented high speed/production media mill including 100hp easy start drive. Equipment shown includes the VRS 300 10hp rotor stator, post mounted disperser with hydraulic rise; the VMD 500 30hp wide speed range disperser; and the VLS 300 10hp variable low-speed disperser with high torque option. Also displayed is a cutaway model of the Schold "patented" media mill seal and rotary screen assembly.

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

Featured is the Air-Pallet® system for clean, dust-free filling, shipping and discharge of powders. On display is the Air-Pallet filling unit with filling head adapter to accommodate all FIBC's; Air-Pallet containers in industrial and food grade types; equipment for gravity, pneumatic and slurry discharge, including special adapter/mixer; and new Air-Cone® fluidized hopper for free flow of powder products.

SERAC, INC.
Addison, IL 60101

Highlighted is the Model #R8/720-NWIII 8 head rotary paint filler for pints to gallons using Serac's exclusive net-weight system. Other features include stainless steel construction and clean in place (C.I.P.).



SHAMROCK TECHNOLOGIES, INC.
Newark, NJ 07114

Meet the tribolobists—specialists in the control of friction and wear! The company provides a wide range of stir-in powder products, primarily utilizing polyethylene and PTFE in grinds to suit your application needs. Products are designed to provide wear, mar, scuff, and abrasion resistance.

SHEEN INSTRUMENTS CORP.
Tampa, FL 33614

Among the instruments featured are the recently introduced 155 Glossmeter, which measures quality of finish; the new SE 1000, which measures coating thicknesses; and the just introduced IA 8100, a digital melting point testing apparatus for resins and glues. This year, Sheen, of Middlesex, England, began distributing its precision instruments from Tampa, FL.

SHELL CHEMICAL CO.
Houston, TX 77001

Shell features its EPON® and EPONOL® epoxy resins, KRATON® thermoplastic rubbers, and it's full line of oxygenated and hydrocarbon solvents. Two new KRATON rubber products are introduced for modification of waxes and epoxy resins to increase flexibility and toughness.

SHEREX POLYMERS, INC.
Dublin, OH 43017

Sherex Polymers, Inc., a subsidiary of Sherex Chemical Co. introduces four product lines. The booth highlights reactive epoxy diluents, epoxy curing agents, PVC adhesion promoters and a line of products based on m-xylene diamine and its derivatives marketed for Mitsubishi Gas Chemical Inc.

SHERWIN-WILLIAMS CHEMICALS
Coffeyville, KS 67337

MOLY-WHITE® corrosion-inhibiting pigments are featured. New studies in current formulations demonstrate the cost/performance advantage of these white environmentally safe products. New low cost molybdate pigments and new fine particle size products are now available.

SILBERLINE MANUFACTURING CO., INC.
Hometown, PA 18252

New aluminum pigments are featured for aqueous, high-solids, and powder coatings. Stop and discuss your requirements with our technical representatives.

SONOCO FIBER DRUM INC.
Marietta, GA 30067

Sonoco, a full-line fibre drum producer features Leverpak, Stapak and Fibrepak drums for dry products and, for liquids, the Liquipak style, which incorporates a variety of plastic and foil linings. Also exhibited are Wastepaks for hazardous waste and Unipaks for hot helt adhesives.

SOUTH FLORIDA TEST SERVICE, INC.
Miami, FL 33178

Technical consultants from South Florida Test Service discuss a wide range of natural and accelerated weathering test programs which will provide service life predictions for coatings and other materials.

UNIVERSITY OF SOUTHERN MISSISSIPPI
Dept. of Polymer Science
Hattiesburg, MS 39406

Highlighted are USM's areas of coatings education and research, and service to the coatings industry. Information concerning the February 1989 Water-Borne and Higher-Solids Coatings Symposium is available, as well as information about B.S., M.S., and PhD. degree programs in Polymer Science.

SPARTAN COLOR CORP.
Houston, TX 77087

For small batch manufacture and tinting, the widely compatible Spartacryl-PM industrial color concentrates in PM acetate are featured. They are excellent for both volumetric and digital weight-dispersing systems. Also featured are masstone and tint level displays of the broad palette of colors available in the Spartacryl-PM color system.

STONE CONTAINER CORP.
Schaumburg, IL 60173

Stone Container Corp. is the nation's leading manufacturer of corrugated and bag packaging. Stone exhibits their complete line of corrugated boxes, multiwall, consumer, semi-bulk bags, load restraint systems and bag packaging systems.

SUB-TROPICAL TESTING SERVICE
Miami, FL 33156

Natural and accelerated weathering techniques are demonstrated with information on exposure and evaluation methods. There is a presentation featuring equipment, instrumentation, and services for testing. Technical personnel are available to discuss specialized test programs.

SUN CHEMICAL CORP.
Cincinnati, OH 45232

Visitors to Sun's booth can look forward to receiving technical data and advice from the Sun personnel on hand at the booth in addition to taking with them complete brochures showing Sun's range of Sunfast® performance pigments for the coatings industry.

SYLVACHEM CORP.
Subsidiary of Arizona Chemical Co.
Panama City, FL 32401

Sylvachem manufactures epoxy curing agents for the coatings, adhesives and structural industries. Sylvachem introduces their new line of low viscosity polyamides and specialty amidoamines for high-solids, corrosion-resistant and chemical-resistant coatings.

TAMMSCO, INC./UNIMIN CORP.
New Canaan, CT 06840

Tammsco crystalline and microcrystalline silica products are featured. Unimin introduces the Silica Source™ program and exhibits Snow White™ mica.

TEGO CHEMIE SERVICE USA
Hopewell, VA 23860

Featured are the firm's new Airex series of deaerators for use in high-solids and solventless epoxies, high-solids alkyds and OEM coatings. Also highlighted is a new series of Tego® Glide mar and slip products. In addition, Silikophen® P40/W, a phenyl methyl polysiloxane resin emulsion for water-based, high-temperature applications is introduced.

TEXACO CHEMICAL CO.
Bellaire, TX 77401

Featured are solvents and chemical intermediates for the coatings industry including Texacar™ carbonates, Texsolve™ aliphatic solvents, Jeffamine® polyetheramines and many other organic intermediates.

THIELE ENGINEERING CO.
Minneapolis, MN 55435

Highlighted is the Two-head Top Fill Paint Machine with automatic lid placer and press as well as the Thiele new double-acting pump.

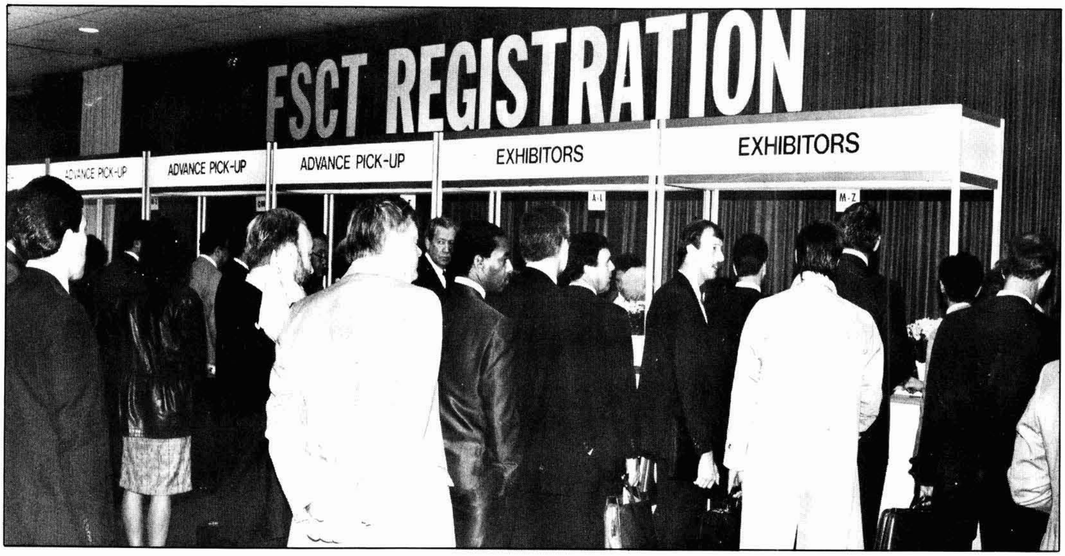
TOKHEIM CORP.
Fort Wayne, IN 46801

TROY CHEMICAL CORP.
Newark, NJ 07105

Troy promotes both specialty additives and a full product line of biocides. New graphic panels depict these products. This is the largest and most elaborate trade show booth in Troy's history. Technical presentations, laboratory demonstrations and meeting facilities are among the features of the exhibit.

U.S. SILICA CO.
Berkeley Springs, WV 25411

The exhibit presents MIN-U-SIL® (micronized silica), SIL-CO-SIL® (custom ground silica) SNOW•TEX® 45 (calcined kaolin clay), and MIN-U-GEL® (colloidal attapulgite clay). Products are used as functional fillers to enhance paint film properties, extenders for TiO_2 and rheological control agents.



UNION CARBIDE CORP.
Danbury, CT 06817-0001

The exhibit features the expanded line of UCAR® solvents for new and conventional coatings applications; UCAR® resins and intermediates for superior high-performance coatings; and UCAR® acrylics and latexes for trade paints, industrial finishes, and weather-barrier coatings. The Captain's 23rd Putting Contest is being held.

UNION PROCESS INC.
Akron, OH 44313

Featured is a complete line of fine grinding and dispersing equipment. Included are Attritors in batch, continuous and circulation systems, with new and improved features, as well as the Rotomill (a horizontal small media mill) and the HSF Batch Bead Mill.

UNITED CATALYSTS INC.
Rheological Div.
Louisville, KY 40201

United Catalysts highlights its high-performance organoclay thixotropes, with special emphasis on the very easy to disperse Tixogel EZ 100. Also featured are custom-designed organoclays for the unsaturated polyester industry—Tixogel PL and PLS, and the newly introduced 100% solids anti-settling agent Tixogel YPA-1.

UNITED STATES TESTING CO., INC.
Hoboken, NJ 07030

This independent testing company has complete paint testing and analysis services. Navlap approved environmental exposures are also available.

UNIVERSAL COLOR DISPERSIONS (UCD)
Lansing, IL 60438

UCDs are colorant systems for manufacturing and/or tinting industry paints. These dispersions are unique in their "universality"—their compatibility with many different types of paint systems. UCD's Super-V line, Solvent Free (SF) line and their Q-line are among the product lines displayed as well as acrylic resin product lines.

UNOCAL CHEMICAL DIV.
UNOCAL Corp.
Schaumburg, IL 60196

UNOCAL Polymers introduces 76 RES 3083, a high performance latex binder for architectural coatings. UNOCAL Chemicals' distribution offers precision blending and state-of-the-art quality assurance for its line of chemicals.

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

Vanderbilt features the use of NYTAL, VANTALC, ACTIV 8 and VAN GEL in updated coatings formulas. Research and technical sales people are on hand to help answer customer's questions.

VELSICOL CHEMICAL CORP.
Rosemont, IL 60018

VIKING PUMP, INC.
Cedar Falls, IA 50613

Viking exhibits a variety of positive displacement Rotary Pumps for handling abrasive liquids. Featured is series 4625 abrasive liquid pump that is four times more efficient than air-operated diaphragm pumps. Catalog and technical data along with cut-away models are available.

VISCOTEK CORP.
Porter, TX 77365

Viscotek offers a solution viscometer and software and detectors for size exclusion chromatography. Also represented is the PHYSICA line of rotational viscometers/rheometers from Q.C. applications to R&D, including controlled stress, oscillation, and thixotropic analysis.

VORTI-SIV
Div. of MM Industries, Inc.
Salem, OH 44460

Shown is the all stainless steel Vorti-Siv Pilot Plant Model RBF-15 (15" screen diameter) high-speed (3500 RPM) sieving and straining machine. This model is widely used for small batch coating production and for reclaiming grinding mill media. Also, displayed is a totally enclosed inline production Vorti-Siv Model RBF-2 (22" screen diameter). This unit utilizes special inlets, gaskets and clamp system to effectively sieve liquids and solids completely inline.

WACKER SILICONES
Adrian, MI 49221

Wacker features a complete line of silanes and ethylsilicates, silicone intermediates, silicone resins, silicone paint additives and silicone masonry water repellents as well as hydrophobic fumed silica for thixotropy and anti-settling of pigments and fillers and hydrophobic grades of fumed silica for corrosion-resistant coatings and printing inks.

WARREN RUPP, INC.
Mansfield, OH 44901

Visitors can see operating displays demonstrating the SandPIPER pump's ability to pump almost pipe-size solids with no damage to the pump and its ease in handling heavily viscous material. Zero-leakage—a feature sought after by paint manufacturers—is an engineered-in, inherent benefit of SandPIPER pumps.

WILDEN PUMP & ENGINEERING CO.
Grand Terrace, CA 92324

On display are working, cutaway models of Wilden's complete line of air-operated double-diaphragm pumps designed to handle very thin material applications to very thick and very abrasive products.

WITCO CORP.
New York, NY 10022-4236

Witco's Organics Div. features Witcobond® aqueous urethane dispersions and its surfactants used in latex manufacture, paint formulation and foam control. The Sonneborn Div. shows its SACI® rust preventive concentrates. The Humko Chemical Div. exhibits its Kemamide® amides and Kemester® esters used as specialty additives and Industrene® fatty acids, Kemstrene® refined glycerine and Hystrene® dimer acids in paint resins manufacture.

ZEELAN INDUSTRIES, INC.
St. Paul, MN 55101-1578

This exhibit features Zeelan's line of ceramic microspheres including fine particle size, high-strength ZEEOSPHERES® and new, white-colored, low density Z-LIGHT SPHERES™ and their use in roof coatings, texture finishes, caulks, sealants, spackles, and high build maintenance coatings.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Seven Industry Statesmen Honored at NPCA Annual Meeting

During the National Paint and Coatings Association's annual meeting held in Chicago, IL, on October 17-19, seven individuals received the association's Industry Stateman Award. The awards, given in recognition of a career of distinguished service to the paint and coatings industry, were presented at the NPCA luncheon on October 17. Those honored were:

Orley H. Anderson, recently retired from the position of Vice President and Corporate Director of the O'Brien Corp., South San Francisco, CA, after 32 years with the firm. Mr. Anderson had served on NPCA's Trade Sales Steering Committee for 12 years, and had been the committee's Vice Chairman and Chairman. A resident of Redwood City, he is active with the National Decorating Products Association, and was the recipient of an outstanding service award from the San Francisco Sales and Marketing Executives Association.

Stanley P. Eysmann joined Cellofilm Corp., Wood Ridge, NJ, after graduating from Lehigh University in 1938 and rose to the position of President in 1961. When the company was acquired by the Polychrome Corp., he remained as President of Polychrome Chemicals Corp. and was a Vice President and Director of the parent company until his retirement. Founder of a resin company, Cellomer Corp., Mr. Eysmann was a regional Vice President of NPCA, and served on its Industrial Coatings Industry, Membership Steering, and Industry Suppliers Committees. He also served two terms as President of the Metropolitan New York PCA.

Harry E. Gilbert recently retired from the position of Group Director, Environmental and Safety Affairs at PPG Industries, Pittsburgh, PA. Mr. Gilbert joined PPG as a Formulating Chemist in 1950 and advanced through numerous technical positions in the company's industrial coatings and consumer products departments before being named Director of Environmental and Safety Affairs in 1978. He served on several NPCA committees, including the Scientific Committee, and several task forces including Fire Retardant Coatings and Hazard Response.

Richard L. Gustafson will retire this year following a 28-year career with Seymour of Sycamore, Inc., Sycamore, IL. He holds the position of Executive Vice President. Mr. Gustafson's service to the company encompassed a wide variety of positions, including manufacturing and production, inventory control, personnel management, transportation, and hazardous waste disposal. He served for 15 years on NPCA's Transportation and Distribution Committee, several of those years as Vice Chairman or Chairman. In 1981, Mr. Gustafson served on the association's Water Quality/Waste Management Task Force.

John E. (Jack) Lynch is a Board Member and Vice President/Operations at Benjamin Moore & Co., Montvale, NJ. When he retires next year, he will have completed 42 years with the company, previously serving in the positions of Chief Chemist and Technical Director. In addition, he served on NPCA's Scientific Committee from 1972 to 1978, was its Vice Chairman in 1978-79, and Chairman in 1980. He was a member of the association's Fire Retardant Coatings Committee and Toxic Substances Task Force, and is a 40-year member of the Metropolitan New York PCA. Mr. Lynch is also a member of the New York Society for Coatings Technology.

Bruce Ocko was General Manager of the Truesdale Co., Brighton, MA, until his death in May. He had been with Truesdale for six years, and had previously been employed with the Monsanto Co. and Polyvinyl Chemical. This posthumous award recognized his contributions to the NPCA, including his service as a member of the NPCA Board of Directors from 1975 to 1977, and active participation on the association's Industrial Coatings Industry Committee and Industry Suppliers Committee, for which he had served as Vice Chairman and Chairman during the 1970s. Mr. Ocko was a member of the New England Society for Coatings Technology.

Richard D. Radford retired this year following nine years of service with the Valspar Corp., Minneapolis, MN. He most recently served as Vice President of the firm. From 1976 to 1979, he was President of Conchemco, Inc., Kansas City, MO, which he had joined as Vice President and Technical Director in 1960. Mr. Radford served as Chairman of the association's Scientific Committee in 1971-72, and was a member of the Board of Directors and Budget and Finance Committee for four years. He has been a member of the Kansas City PCA and the Kansas City Society for Coatings Technology for over 20 years.

General Electric to Build Manufacturing Plant in Spain

Over the next 15 years, General Electric Co., Waterford, NY, has plans to invest $1.7 billion in a new plastics and silicones plant to be built at the port city of Cartegena, on the southeast coast of Spain.

The plant will be managed from its European headquarters in The Netherlands. It will be the first basic silicones investment in Europe and will become part of the proposed GE/Union Carbide joint venture company, GE Carbide Silicones, Inc. The plant, to be constructed on a 1,750-acre site, initially will produce silicone polymers, which are used in a variety of industrial applications.

This move, one of the largest single investments ever made in Spain by an outside company, is designed to meet the increasing demand for silicones and engineering thermoplastics in Europe.

GE Plastics' other manufacturing sites in Europe are in The Netherlands, Austria, Ireland, Scotland, France, and Italy.

RPM, Inc. Announces Purchase Of Chemical Specialties Corp.

RPM, Inc., Medina, OH, has acquired Chemical Specialties Manufacturing Corp., Baltimore, MD, for an undisclosed amount.

RPM is a manufacturer of specialized protective coatings products. Chemical Specialties, whose annual sales are approximately $7 million, produces specialty coatings, cleaners, and additives for the professional carpet, textile, and floor-care markets. The company will continue to operate under the leadership of its founders, Robert R. Hughes, President, and Daniel F. Savanuck, Vice Chairman.

Witco Expands Plant Capacity At Houston's Organic Plant

Witco Corporation, New York, NY, has announced its planned expenditure of over $3.5 million for additional capacity at its Organic Division's Houston, TX, plant. The expansion will approximately double the plant's capacity for the production of certain specialty surfactants. Expected completion of the project is in the first quarter of 1990.

Battelle Study to Focus on Chemical Industry's R&D Expenditures

Profiles of research and development expenditures and professional staff levels for segments of the chemical industry are the focus of a multiclient program now entering its second year at Battelle.

A number of major international chemical companies are participating in the program. They find the study's results useful in R&D planning and budgeting, assessing R&D effectiveness and productivity, and obtaining a clearer picture of chemical industry R&D expenditure levels and trends.

Under a strict confidentiality agreement, participants provide 1983-1988 R&D and sales data to Battelle for specific business segments, such as petrochemicals, intermediate chemicals, commodity chemicals, engineering resins, elastomers, specialty chemicals, and fabricated products. All data are handled as highly proprietary and are not referenced directly in the final analyses. Battelle compares the R&D expenditures with sales and staff levels and prepares trend curves for each.

The chemical industry program helps managers assess their R&D programs by learning how their company's R&D effort compares to that of other companies in the same business lines. Profiles being developed by business segments include:

(1) R&D expenditures as a percent of sales or as a percent of earnings by individual lines of business;

(2) R&D expenditures per R&D professional in various lines of business;

(3) sales per R&D professional for each business line;

(4) distribution of R&D expenditures between process and product research;

(5) environmental and toxicology R&D and testing as a percent of total R&D;

(6) percent of technical service done by R&D for each business sector;

(7) average number of technicians for each professional; and

(8) distribution of elements of research expenditures.

These profiles are proving to be a very valuable tool for participating companies to: evaluate their company's R&D relative to that of the aggregate of its principal competition; to make comparative assessments of the distribution of R&D and technical service dollars among various lines of business; to measure performance and activity levels, for use in R&D reevaluation decisions; and to help analyze productivity of R&D dollars and personnel levels.

Participation in the chemical industry R&D profile program is available for $5,000 per company. For more information, contact: Peter R. Taussig, Battelle, 505 King Ave., Columbus, OH 43201-2693.

Occidental Chemical Corp. Signs Agreement with Tokyo Firm

Occidental Chemical Corp., Dallas, TX, has entered into a joint venture agreement with Marubeni Corp., Tokyo, Japan, to construct and operate a vinyl chloride monomer (VCM) plant on the Texas Gulf Coast. The plant is scheduled to begin operations during the fourth quarter of 1990, with construction to begin in the second quarter of 1989. The plant's expected capacity will be in excess of one billion pounds per year.

Under terms of the agreement, Occidental and Marubeni will equally own and manage the facility. Occidental will operate the plant on behalf of the joint venture and will supply the chlorine and ethylene required to produce VCM.

Occidental Chemical Corp., a subsidiary of Occidental Petroleum, produces electrochemicals, detergent and specialty products, plastics and resins, and agricultural products.

Marubeni Corp. is a general trading corporation, with more than 10,000 employees and sales of about $100 billion through its organization of 150 overseas and 42 domestic offices.

ASTM Institute for Standards Research Appoints Five to Board of Trustees

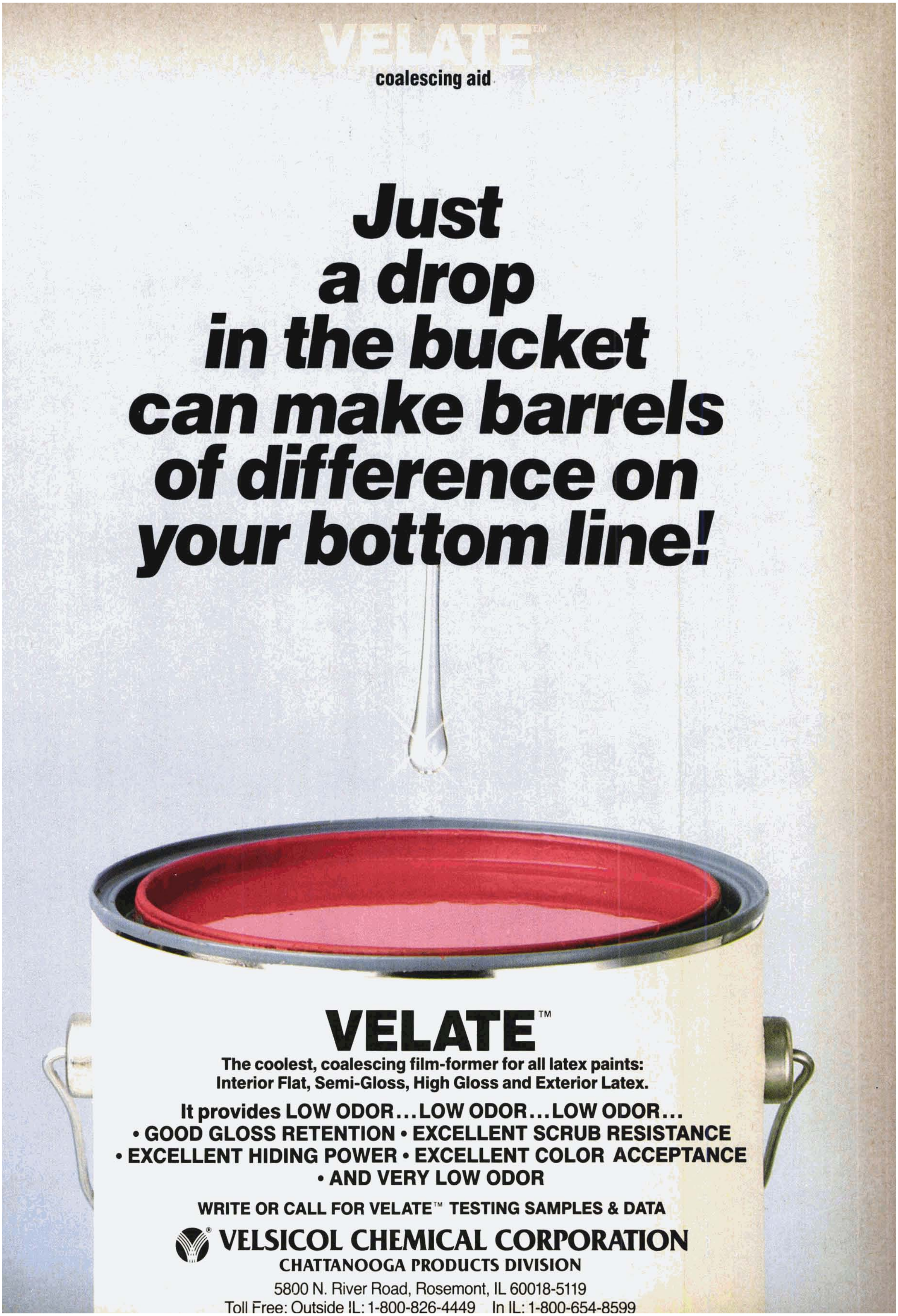
Five trustees have been appointed to the Board of ASTM's newly formed subsidiary, the Institute for Standards Research, Inc. (ISR). ISR is a subsidiary corporation, established by ASTM to accelerate the development of technical information in support of ASTM standards-writing committees. It will serve as the intermediary between ASTM committees and the public or private agencies that supply research and technical service.

F. Karl Willenbrock, Executive Director for the American Society for Engineering Education, Washington, D.C., will serve as Chairman of the Board for ISR. A. Ivan Johnson, President of A. Ivan Johnson, Inc., has been appointed Vice-Chairman of the Board. The three other Trustees are Robert E. Philleo, Consulting Engineer, Annadale, VA; Derek E. Till, Consultant for Arthur D. Little, Inc., Concord, MA; and Adolph O. Schaefer, Emeritus Executive Director for the Materials Properties Council, Inc., Blue Bell, PA.

Virginia Tech Seeks Products To Improve Wood Pallets

The Department of Wood Science and Forest Products at Virginia Tech and the USDA Forest Service are assisting the wood pallet and container industries with the U.S. and Canada to identify products or treatments which, when applied to wood, will improve any of the following performance characteristics of wood pallets and containers: fire and flame retardance, washability or easiness of decontamination, and resistance to mildew and biodeterioration.

The potential market for successful products or treatments would be more than $100 million. Information on products or technologies which may improve all or some of the above characteristics should be forwarded to Nian-hua Ou or Marshall S. White, Sardo Pallet and Container Research Laboratory, Dept. of Wood Science and Forest Products, Virginia Tech, Blacksburg, VA 24061-0503.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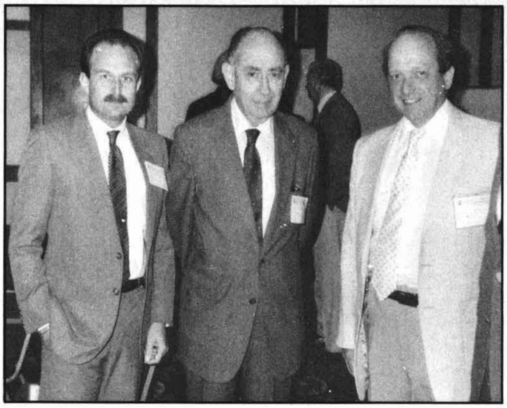

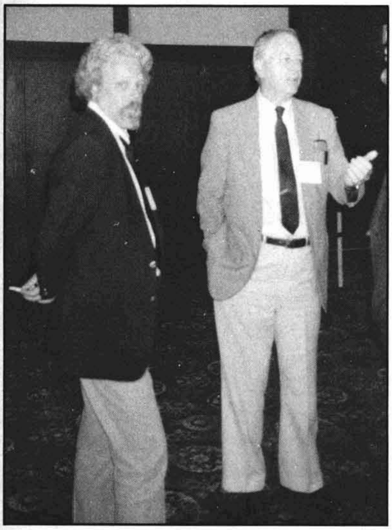

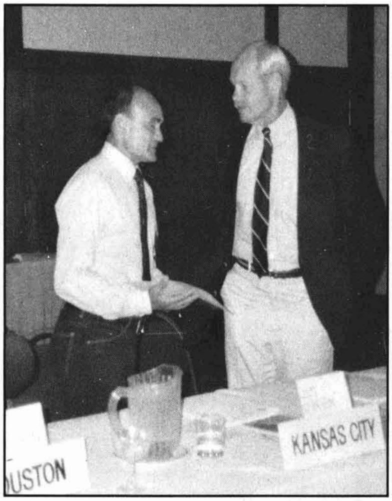
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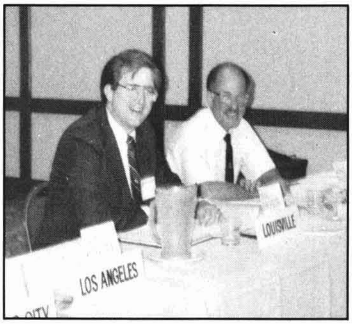
LOUISVILLE
LOS ANGELES

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

Representatives of Society Educational Committees met recently with members of the Federation Educational Steering Committee in Cleveland to review their programs. Topics of discussion included the A.L. Hendry Award competition; promoting career opportunities in coatings through use of the videotape, "The Choice"; scholarships; and Society-sponsored educational activities.

The meeting was chaired by Sidney Lauren, of New England Society, Chairman of the FSCT Educational Steering Committee. In addition, the following Steering Committee members were in attendance: Don Boyd (Pittsburgh); Ted Fuhs (Chicago); John Gordon (Los Angeles); Dave Kittredge (Los Angeles); Carl Knauss (Cleveland); John Oates (New York); and Joseph Vona (New York).

Society Educational Committee representatives included: Al Holder (Baltimore); Jim Flanagan (CDIC); Charles Beck (Cleveland); Dan Melnyk (Detroit); Tim Specht (Golden Gate); Art McDermott (Houston); Jim O'Brien (Kansas City); Paul Baukema (Louisville); Horace Philipp (Montreal); Rudy Deanin (New England); Jeff Kaye (New York); Al Yokubonis (Northwestern); John Mitchell (Pacific Northwest); Wayne West (Southern); Peter Duncker (Toronto); and Ed Walker (Western New York).

Also attending were Thomas A. Kocis, FSCT Director of Field Services, and Patricia D. Viola, Editor of JCT.

Hendry Award Competition

Established in 1986 under the sponsorship of the Southern Society, the Award commemorates the industry contributions of the late Alfred L. Hendry, a Past-President of the Southern Society. This $1,000 cash award is for the best paper on some aspect of coatings technology by an undergraduate student enrolled in a college program. Chairman Lauren stressed the need for Societies to increase publicity regarding this competition on the local level. It was suggested that university chemistry professors be notified to encourage the participation of their students.

FSCT Video, "The Choice"

The recently completed Federation videotape, "The Choice," which is aimed at promoting student interest in careers in the coatings industry, has been distributed to each Constituent Society for showing at local high schools, Education Nights, Career Day programs, and other educational forums.

The 20-minute production depicts coatings as a highly technical industry offering many interesting and challenging job opportunities, and is designed for presentation to high school students.

It was generally agreed that the production is well done, and delivers its message effectively. Discussion focusing on the content and its implications highlighted the following points:

The videotape will become obsolete quickly, and should be shown to targeted audiences as quickly as possible. Societies should plan presentations early in the school year, at as many sites as possible.

Knowledgeable person(s) should accompany the tape, to add meaningful commentary and respond to questions.

Societies should develop "hard data" on student reaction to the videotape and provide this to FSCT headquarters, for file and reference.

Cooperative effort of Societies and local PCAs is important to the success of presentations. It was suggested that the tape should be shown at meetings of local PCAs, and its availability for individual company presentations should be publicized. In addition, local companies should be encouraged to offer job opportunities as depicted in the video, e.g., summer internships and other part-time employment, as well as full-time jobs for qualified applicants.

Consideration should be given to development of a follow-up videotape, aimed at college students, whose career decisions are more immediate.

In conclusion, Chairman Lauren noted that it would be helpful to follow a standard format for the videotape presentation and invited attendees to critique the drafts of a questionnaire/survey sheet he had distributed. He also spoke on the importance of reporting on reactions to videotape presentations. This will provide helpful advice on "how-to-do-it" (or "how-not-to-do-it"), so that the career promotion program will achieve its goal: to help the coatings industry get its fair share of bright, dedicated young people who will become the next generation staffing its plants and laboratories.

Scholarships

Funding for the Federation scholarship program was increased for 1988-89 by the Board of Directors to $36,000. The recipient schools are: University of Detroit—$2,000; Eastern Michigan University—$6,000; Kent State University—$5,000; University of Missouri—Rolla—$8,000; North Dakota State University—$9,000; and University of Southern Mississippi—$6,000.

Society Reports on Activities

The following are summaries of reports on Society Educational activities:

Baltimore

Participated in selection of recipient for Society's scholarship award, which is made annually to children of members . . . Continuing sponsorship of basic coatings technology course at Essex Community College. Held Education Night for members, with featured presentation on coatings failures.

C-D-I-C

Continuing sponsorship of educational after-dinner presentations as part of Society monthly programming (technical presentation precedes dinner). Current year presentations included: Federation videotape on coatings careers, "The Choice"; divestiture of AT&T; review of the stock market crash of October 19, 1987; discussion of Ohio's natural heritage; and an overview of the activities of the FSCT Professional Development Committee by Committee Chairman George Pilcher.

Chicago

Jointly sponsor educational activities with local Paint and Coatings Association . . . Established Coatings Industry Advisory Council for the Elmhurst College Chemistry/Coatings curriculum. Assisted in the promotion of the newly-formed major and in locating instructors for selected courses . . . Presented full-day Management Development seminar ("Creative Management with the Personal Touch"). Featuring a professional trainer, the seminar covered the role of a manager, communication skills, strategies, decision making, and effective delegating . . . Administered grants-in-aid to Eastern Michigan University and North Dakota State University, a grant for equipment to DePaul University for a data station interfaced computer to be used with an FTIR and a DSC, and a scholarship award to a Society member's daughter . . . Sponsored coatings course at DePaul University, which won an MMA Award for its overall excellence.

Cleveland

Major activity continues to be development of annual two-day Advances in Coatings Technology Conference, which this year featured sessions on photochemistry and curing, degradation, powder coatings, and surfaces and treatments . . . Continuing support of the Northeast Ohio Science Fair; cash prizes are awarded to students in both a junior and senior level category (as selected by Society representatives) whose projects relate to the coatings industry.

Detroit

Sponsorship of evening courses at University of Detroit continues. Six courses are currently offered: Electrodeposition; Principles of Color Technology; Fundamentals of Automotive Paint Systems; Polymer Technology for Coatings; Surface Coatings Technology; and a Coatings Lab course . . . Cooperating with U of D Dept. of Continuing Education to offer in-house training courses, which are designed specifically for each company taking part . . . Annual FOCUS had as its theme, "International Trends with Automotive Finishes"; corrosion will be topic of 1989 event, scheduled for April 18 . . . Society contributed funds to equip polymer synthesis course and support graduate research project at U of D . . . Donated funds to Eastern Michigan University in support of high school teachers' workshop . . . Plan to continue Adult Education Lectures on "Automotive Refinishing Basics" . . . Continue to make Federation A/V programs available on loan basis to area paint companies and students in paint courses.

Golden Gate

Ongoing course on fundamentals of coatings technology had disappointing attendance the past year; increased promotion and efforts to attract paint store employees to the course are planned for the coming year . . . Cooperating with Los Angeles Society in evaluating potential for a degree program at California Polytechnic University at San Luis Obispo . . . Scholarship funding provided to students who are dependents of Society or Association members and wish to pursue a coatings curriculum . . . Hosted Western Coatings Societies' Symposium and Show, which won an MMA Award for industry contribution; proceeds from event help support scholarship program.

Houston

Major activity continues to be administration of scholarship program; nine scholarships have been awarded in the five years since the program began. Eligible students are those with suitable academic credentials who are planning a course of study which would lead to employment in the coatings industry; preference is given to dependents of Society members . . . Considering establishment of Memorial Scholarship Fund to honor distinguished Society members.

Kansas City

Main activity is ongoing participation in local Science Fair; Committee works with elementary and high school teachers in selecting suitable projects, attending Fair, and judging entries in the competition. Three winning students are awarded savings bonds, and each of their high school science departments receives a check in matching amount. Students, their parents, and teachers are invited to Society monthly meeting, at which winning exhibits are displayed, for presentation of awards . . . Continuing contribution to scholarship program at University of Missouri-Rolla, in support of students pursuing degrees in polymer science and coatings-related areas.

Los Angeles

Continuing efforts to establish degree program at California Polytechnic State University at San Luis Obispo (undergraduate and graduate curriculum in polymer and coatings technology) . . . Continuing sponsorship of basic coatings technology course, for which Committee provides instructors; students are awarded certificates upon successful completion of course . . . Continuing to monitor scholarship program funded by Society for students planning to major in some aspect of coatings technology, as well as assisting in maintenance of coatings section at City of Commerce Library . . . Planning major effort to promote career opportunities in coatings.

Louisville

Close liaison is maintained with University of Louisville, where continuing education course on the fundamentals of coatings technology is sponsored. Course is offered in four sections: synthetic resins; non-resinous coatings raw materials; coatings formulation and end-uses; and coatings application . . . Also participate in Career Awareness Explorer program of Boy Scouts of America . . . Helped develop programming for Society monthly meetings and Spring Symposium.

Montreal

Continuing sponsorship of bilingual basic coatings technology courses, designed for individuals entering the coatings industry; students are awarded certificates for successful completion . . . Conducting survey to determine interest in advanced course.

New England

Promote and support evening M.S. coatings and adhesives program at University of Lowell; being expanded this fall to include course in colloids . . . Continuing to offer cash prizes for best coatings-related paper authored by full-time college students . . . Considering scholarship funding to attract full-time day students into University of Lowell's M.S. coatings program.

New York

Educational activities jointly sponsored with local PCA . . . Continuing two-year, four-semester course, "Understanding the Basics of Coatings," presented at Fairleigh Dickinson University (East Rutherford, NJ); each one-year, two-semester "module" of the program is a complete course in itself and may be taken independently, with a certificate awarded for successful completion. Each semester qualifies for three CEU's of credit . . . Efforts continue to establish Coatings Center at Fairleigh Dickinson . . . Offering two scholarships annually to Fairleigh Dickinson science majors, *after* successful completion of Society coatings course (which can be taken free of charge) . . . Laboratory Course for Paint Technicians is presented every two or three years, depending on member interest as determined by survey; designed to broaden knowledge and improve skills of technicians with limited industry experience . . . Assist in presentation of ongoing series of seminars which precede Society monthly meetings, at which expert speakers update members on regulatory and management matters . . . Seeking teaching outlines for college level lab experiments on coatings technology.

Northwestern

Held "Career in Coatings" education night in April, attended by 12 area teachers and 15 students from North Dakota State University; program featured Federation videotape, "The Choice," and talk by Dr. Frank Jones, of NDSU . . . Spring Symposium, held March 8, had as its theme, "Titanium Dioxide—Demand, Supply, and Replacement" . . . Continuing funding support of NDSU scholarship program

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. . . Assist in development of programs for monthly Society meetings, which present two speakers—one on a technical subject, the other on a general topic.

Pacific Northwest

Portland Section sponsored basic coatings technology course; this was three-hour evening course, held over seven-week period, and presented at member firm's offices. Planning series of half-day seminars on new product technologies and formulation . . . Vancouver Section sponsored introductory coatings course at Kwantlen College, which provided university credits toward chemical engineering or chemistry degree. Also sponsored advanced technology course on modern coatings resins at British Columbia Institute of Technology . . . Planning to conduct awareness program at area high school to promote coatings career opportunities.

Piedmont

Sponsored half-day seminar on "Experimental Design." . . . Planning to co-sponsor coatings symposium for 1989 Southeastern Regional Meeting of ACS, in Winston Salem, N.C. . . . Continuing sponsorship of summer co-op program for local area college chemistry majors.

Pittsburgh

Participate in regional Science and Engineering Fair; assist in judging and award prizes. . . Sponsored two-day seminar on regulatory affairs. . . . . Planning program of presentations at local high schools to promote interest in coatings careers.

Southern

Close liaison maintained with University of Southern Mississippi, through scholarship funding and sponsorship of annual Water-Borne and Higher Solids Coatings Symposium . . . Continuing sponsorship of A.L. Hendry Award for best undergraduate student-authored paper on some aspect of coatings technology . . . Memphis Section is continuing its scholarship program . . . Sponsored seminar on Statistical Process Control.

Toronto

Continuing to promote and support coatings courses offered by George Brown College. Assisting in updating courses and providing industry instructors; students successfully completing courses are awarded certificates . . . Forming subcommittee to promote career opportunities in coatings.

Western New York

Scholarship program, now in its fourth year, continues; grants are to full-time college students who are dependents of Society members . . . Participating in Western New York Science Congress, providing awards to students with best coatings-related projects . . . Planning program to promote coatings career opportunities among area high school students.

Report on Professional Development Committee Activities

Tom Kocis briefly reviewed the activities of the Professional Development Committee, whose focus is on promoting continuing education opportunities for coatings industry personnel, currently through sponsorship of seminars.

The series of regional seminars on Statistical Process Control for the coatings industry (introductory and intermediate levels) were repeated and were again well attended and well received. The seminar instructor, Dr. Peter Hunt, has become recognized as the "guru" for SPC applications in the coatings industry, and is much in demand for presenting in-house training programs.

A seminar on Project Management (also presented at regional locations), designed to assist coatings chemists in dealing with a multiplicity of projects, was also well received.

Committee is developing program for the 1989 Federation Spring Seminar. Topic is "Modern Analytical Resources—The Coatings Chemist's Ally," and will aim to inform the non-specialist of the various analytical tools and techniques available to help him/her solve specific coatings-related problems.

Committee is also sponsoring symposium on "Advanced Topics in Coatings Research," to be presented at 1988 Annual Meeting; speakers will discuss "high tech" work, still in progress, for which a complete, proven picture may not as yet have emerged.

The PDC is desirous of responding to member needs and interests, and Mr. Kocis invited attendees to forward any comments or suggestions for Committee activity to Federation headquarters for Committee consideration.

Regulatory UPDATE

This digest of current regulatory activity pertinent to the coatings industry is published to inform readers of actions which could affect them and their firms, and is designed to provide sufficient data to enable those interested to seek additional information. Material is supplied by Roy F. Weston, Inc., Washington, D.C.

Wastewater Pretreatment Rule Revisions Take Effect — Revisions to EPA's general wastewater pretreatment regulations, including several changes affecting industrial discharges to Publicly Owned Treatment Works (POTWs) went into effect November 16, 1988. Among the 26 issues addressed by the revisions are ones related to translation of production based discharge limitations into mass or concentration limits; use of a combined waste stream formula to determine compliance with applicable categorical treatment standards; and extension of dilution prohibitions and reporting requirements to noncategorical discharges. See 53 Federal Register 40562 (Oct. 17, 1988).

Among the changes to the pretreatment standards and requirements is one that recognizes as an enforceable pretreatment standard a mass or concentration limit calculated from a production based categorical standard. Before the rule changed, local control authorities were permitted to calculate equivalent concentration or mass limits as a tool for determining compliance with applicable categorical standards. The calculated equivalent limit not withstanding, the industrial user was still held to compliance with the production based standard itself. Compliance with the equivalent mass and concentration limits did not shield the industrial user from enforcement of the production based standard. Under the revised rule, industrial users in compliance with equivalent concentration or mass limits, calculated according to procedures specified in the rule, would not be subject to enforcement of the production based standard itself. The equivalent limits would be recognized as the enforceable limits.

The combined waste stream rule change will allow industrial users to choose between monitoring either a segregated waste stream before treatment or monitoring combined waste streams following treatment for compliance with an applicable categorical standard. Compliance with an applicable categorical standard would be determined following treatment of the combined waste stream by applying the combined waste stream formula. A switch from the monitoring method selected initially would require approval from the control authority.

The pretreatment rules were clarified at several points. Among them is a change that extends the current prohibition of dilution as a means of achieving compliance with categorical pretreatment standards. The revision modifies the dilution prohibition to clarify that it is not limited to categorical pretreatment standards. Under the revised rule, industrial users are prohibited from diluting to comply with local limits as well as the categorical standards.

Industrial users with noncategorical discharges may face new reporting requirements imposed by their local control authority under other EPA rule changes. Although EPA has recognized that appropriate monitoring and reporting for noncategorical industrial users will vary depending on the circumstances, EPA recommends that local authorities require sampling for pollutants not regulated by categorical standards where those pollutants may cause pass-through or interference at the POTW.

The revisions to the general pretreatment regulations were proposed more than two years ago. See 51 Federal Register 21454 (June 12, 1986). They are intended to clarify existing regulations, respond to recommendations of EPA's Pretreatment Implementation Review Task Force, and conform the pretreatment regulations to the National Pollutant Discharge Elimination System (NPDES) permit regulations.

For further information or to provide comments of a technical nature, contact George Utting, Permits Division, (EN-336), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 475-9534.

NTP Completes Study, Seeks Formic Acid Data — The National Toxicology Program (NTP) has completed short term toxicology studies on formic acid and will soon decide whether additional studies are needed, including long-term toxicology and carcinogenicity studies. See 53 Federal Register 44671 (Nov. 4, 1988). Formic acid is used in electroplating and a number of other uses. Before the NTP makes its decision on additional studies, the National Institute of Environmental Health Sciences will review the result of the short-term studies.

The NTP is soliciting information such as current production, use patterns, exposure levels, and toxicology data. Information provided will be considered by the NTP in determining which chemicals require additional studies and in designing these studies.

The completed formic acid studies were 14-day and 90-day inhalation studies in Fisher 344 rats and B6C3F$_1$ mice.

Send information, by December 4, 1988, to Dr. Kamal Abdo, NIEHS/NTP, P.O. Box 12233, Research Triangle Park, NC, 27709, (919) 541-7819. Comments and suggestions submitted after that date will be accepted and used, if possible.

The *Regulatory Update* is made available as a service to FSCT members, to assist them in making independent inquiries about matters of particular interest to them. Although all reasonable steps have been taken to ensure the reliability of the *Regulatory Update*, the FSCT cannot guarantee its completeness or accuracy.

Luminous Paint Ingredient Removed from Hazardous Waste List — Strontium sulfide, used in luminous paint among other things, has been removed from EPA's list of commercial chemical products which are hazardous wastes when discarded. EPA has also removed strontium sulfide from the Resource Conservation and Recovery Act (RCRA) list of hazardous constituents (40 CFR Part 261, Appendix VIII) and from the list of hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). See 53 Federal Register 43881 (Oct. 31, 1988).

EPA has concluded that there is insufficient evidence to support the continued listing of strontium sulfide as either an acute hazardous waste or as a toxic waste. Nonetheless, EPA's final rule does not completely release wastes containing strontium sulfide from regulatory control under RCRA. Waste that contains high concentrations of strontium sulfide may exhibit the characteristics of reactivity. If the wastes exhibit the characteristic of reactivity, they must be handled as hazardous wastes.

For more information, contact the RCRA/Superfund Hotline at (800) 424-9346. For technical information, contact Denny Cruz, U.S. EPA, Office of Solid Waste, (SW-332), 401 M Street, S.W., Washington, D.C. 20460, (202) 382-4802.

New Statistical Methods Adopted for Groundwater Monitoring — Five different statistical methods have been specified by EPA as appropriate in evaluating the presence or increase of contamination under programs for protecting groundwater from hazardous waste releases from landfills, surface impoundments, and waste piles. See 53 Federal Register 39720 (Oct. 11, 1988). These statistical methods have been found to be more appropriate to groundwater monitoring than the currently used Cochran's Approximation to the Behrens-Fisher student's t-test (CABF). Under existing regulations, waste facility owners and operators must sample groundwater at specified intervals and use a statistical procedure to determine whether or not hazardous wastes or waste constituents are contaminating the groundwater.

The amendments to EPA's groundwater monitoring rules (40 CFR Part 264, Subpart F) also outline sampling procedures and performance standards designed to help minimize a statistical indication of contamination when it is not present or fail to detect contamination when it is present. The amendments, which are effective April 11, 1989, apply to hazardous waste land disposal facilities permitted under the Resource Conservation and Recovery Act.

For general information, contact The RCRA/Superfund Hotline, Office of Solid Waste, (WH-563 C), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (800) 424-9346. For technical information, contact EPA's Jim Brown at (202) 382-4658.

Congress Approves Chemical Diversion Controls — Acetone, ethyl ether, methyl ethyl ketone, and toluene are among the common industrial chemicals covered by the Anti-Drug Abuse Act passed by Congress in late October. Import, export, and domestic transactions in these and other chemicals essential to the manufacture of illicit drugs will be subject to reporting and recordkeeping requirements. Criminal penalties are provided for transactions where the chemical supplier knew or should have known that listed essential chemicals were being diverted to illegal drug manufacture.

Title VI, Subtitle A of the drug bill, H.R. 5210, is also known as the Chemical Diversion and Trafficking Act of 1988. Under the Act, The Justice Department's Drug Enforcement Administration (DEA) will set a threshold quantity of essential chemicals that will trigger the regulation of distribution, receipt, sale, import, and export transactions. Under regulations required by the Act, import or export of essential chemicals must be reported to DEA at least 15 days before the transaction takes place. DEA will establish, by regulation, the circumstances in which the notice requirement does not apply to transactions between regulated persons and a regular customer or supplier.

TSCA Inventory Drops 45 Substances — EPA has deleted 45 chemical substances from its Toxic Substance Control Act (TSCA) Chemical Substance Inventory because they were incorrectly reported and listed. Among the chemicals dropped are various oxiranes, paraffin waxes, and hydrocarbon waxes. See 53 Federal Register 44814 (Nov. 4, 1988).

Proposed for deletion but not deleted were four substances including C.I. Pigment Violet 27. The decision to keep the four substances on the TSCA Inventory was made after commenters provided evidence that the substances have been in commercial production prior to January 14, 1988. The deleted substances were removed in the absence of evidence that they have been manufactured, imported, or processed for TSCA commercial purposes since January 1, 1975, and thus were not and are not eligible for the Inventory. Premanufacture notice requirements of TSCA Section 5(a) would apply to future manufacture or import of any of the 45 chemical substances deleted from the Inventory.

For further information, contact Michael M. Stahl, Acting Director, TSCA Assistance Office, (TS-799), Office of Toxic Substances, U.S. EPA, Room EB-44, 401 M Street, S.W., Washington, D.C. 20460, (202) 554-1404.

SUMMARY CALENDAR OF REGULATORY ACTIONS

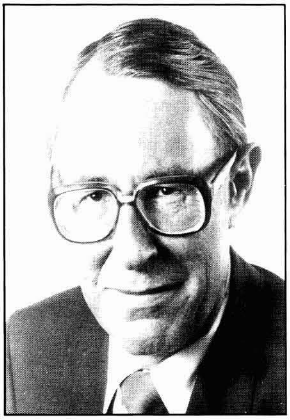
December 4, 1988	Comments due to the National Toxicology Program (NTP) on formic acid studies. (See this issue.)
December 22, 1988	EPA's hazardous substances and petroleum underground storage tank regulations take effect. (See November issue.)
December 22, 1988	Comments due to OSHA on generic exposure monitoring. (See November issue.)
December 27, 1988	Comments due to OSHA on generic medical surveillance program standards. (See November issue.)

Werner E. Funke

Prof. Dr. Werner E. Funke has over 30 years of experience in the field of chemistry. He received the Ph.D. Degree from the University of Stuttgart in 1956. Following positions as Assistant Professor and Associate Professor, he served as Prodekan of the Faculty of Chemistry at the university. From 1977-1979, Prof. Dr. Funke held the position of Dean of the Faculty of Chemistry at the University of Stuttgart. In addition to his current position as Professor for Polymer Chemistry, he is an Associate of the Research Institute for Pigments and Paints in Stuttgart.

In his work at the University of Stuttgart, Prof. Dr. Funke has explored the relationship between polymer structure and properties. Among the additional areas of research are: the determination of the structures of crosslinked polymers, especially unsaturated polyesters; the preparation, characterization, and properties of reactive microgels; and the emulsion polymerization of crosslinking polymers.

Prof. Dr. Funke is credited with many contributions to polymer science and industry including the nonstatistical distribution of crosslinks in polymer networks prepared by polymerization reactions; the preparation of reactive microgels by emulsions and solution polymerization of higher-functional monomers as divinyls and diacrylates; the preparation and characterization of crosslinked macromolecules, a new class of polymers at the border between molecules and particles; self-emulsifying copolymerization of unsaturated UP-resins; and preparation of reactive macromolecules by anionic polymerization of divinylbenzene and diisopropenylbenzene.



Specific areas of research in the paints and coatings field have centered on the structure and properties of paint films; film formation; permeability; and properties of high solids and water-based coatings.

As the author of over 165 publications, Prof. Dr. Funke has contributed much to the current paint and coatings literature. He is a well-known lecturer at international events, including the Gordon Research Conferences; meetings of the American Chemical Society, the Oil & Colour Chemists' Association, the Electrochemical Society, FATIPEC, and symposia at such universities as North Dakota State and Case Western Reserve. Upon special invitation, he has studied and lectured in India, under the auspices of the Council of Scientific and Industrial Research; in the U.S.S.R., by invitation of the Academy of Science; and at the First International Conference of the Society of Polymer Science in Kyoto, Japan. He was named Distinguished Lecturer in 1984 by the Japan Polymer Society. In 1987, Prof. Dr. Funke was invited to participate as a guest lecturer by the Academia Sinica, Institute of Chemistry, Beijing, and the China National Coatings Industrial Association.

Prof. Dr. Funke is Managing Editor of the international journal, *Progress in Organic Coatings*, and is Co-Editor of *Angewandte Makromolekulare Chemie*. Additional activities include membership on the Technical Committee of the German Paint Association; the Standardizing Committee of Paints and Coatings, Subgroup, "Nomenclature"; and the Technical Committee of the German Association of Chemists (GDCh), Section on "Paints and Pigments." Prof. Dr. Funke served as Chairman of Post-Educational Courses in the field of organic coatings at the Technische Akjademia Esslingen. He is a member of the JUPAC, Group "Organic Coatings," and a member of the ACS Polymer Division and Organic Coatings and Plastics Division.

He is the 1965 recipient of the Killoidgesell-schaft Richard Zsigmondy Award; and the GDCh Section Paints and Pigments Award in 1964.

Microgels–Intramolecularly Crosslinked Macromolecules: Potent Components of Organic Coatings

Werner E. Funke
Institut für Technische Chemie der Universität Stuttgart
and
Forschungsinstitut für Pigmente und Lacke e.V.*

Microgels are polymer particles with sizes in the submicron range. At sufficiently small diameters, microgels exhibit properties characteristic of both particles and normal macromolecules: permanent shape and surface area, respectively, solubility. Such microgels can also be named as intramolecularly crosslinked macromolecules. If properly synthesized, microgels may bear reactive groups at their surface and their interior, which endow them with special properties and make them suitable for subsequent reactions. Due to their special rheological, reinforcing, surface, and carrier properties, reactive microgels are useful components for industrial materials, such as organic coatings, adhesives, additives, or biochemicals.

INTRODUCTION

In polymer chemistry, linear and branched macromolecules are distinguished from crosslinked polymers (*Figure* 1). Crosslinked polymers may be formed in one reaction step from monomer mixtures consisting at least partly of a polyfunctional species or from preformed linear or branched macromolecules, so-called primary molecules, which are subsequently crosslinked in a second reaction step. A typical example is vulcanized rubber, where polyisoprene is crosslinked by sulfur.

Under special conditions, however, an intramolecular reaction route may be preferred, leading to small crosslinked polymer particles, which may react later with each other to form crosslinked polymers with an inhomogeneous network structure (*Figure* 2). Such intramolecularly crosslinked polymer particles have been synthesized and described by Staudinger, et al.,[1] in 1934, although much about the particles' mechanism of formation and characteristic structure was not known. In 1948, Schulze and Crouch[2] observed that the viscosity of the soluble fraction on crosslinking styrene/butadiene copolymers dropped distinctly after gelation. One year later, Baker[3] explained this phenomenon by the formation of intramolecularly crosslinked particles, which he called microgels.

In the industrial synthesis of binders such as bodied oils or alkyd resins, for organic coatings, it has long been known that gel-like polymer particles may be formed which adversely affect optical properties of the respective coatings, e.g., smoothness or gloss. Therefore, these undesirable by-products have to be removed by filtration. Bobalek, et al.[4] and Solomon, et al.[5] reported on alkyd resins of high molar masses but with unexpectedly low viscosities, comparable with those of emulsions. They explained this by microgel structures of particle diameters of 0.05-1 μm. They also observed that such alkyd resins dried very rapidly and their films exhibited improved hardness. Later, Kumanotani, et al.[6,7] prepared alkyd resins of molar masses above 10^5 under carefully controlled conditions; coatings prepared from these binders had superior properties. Microgels are probably also re-

Presented at the 66th Annual Meeting of the Federation of Societies for Coatings Technology, Chicago, IL, on October 21, 1988.
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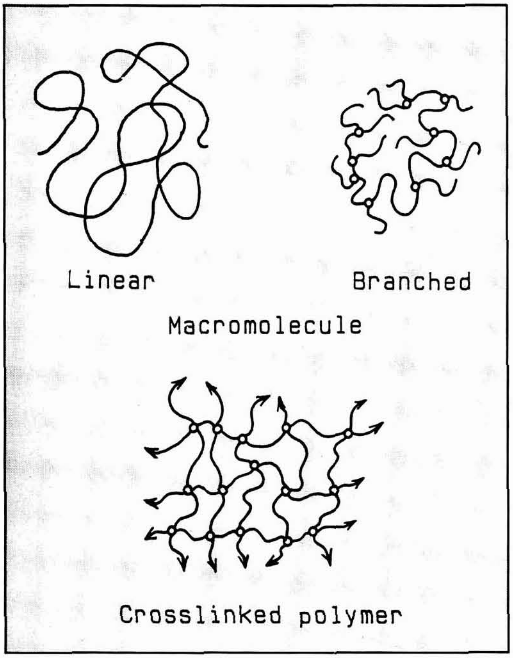


Figure 1—Classical structures of polymers

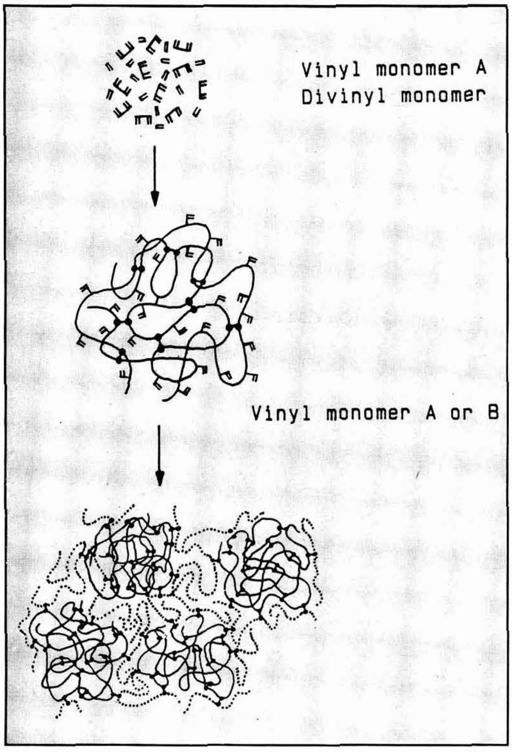


Figure 2—Formation of inhomogeneous polymer networks via reactive microgels

sponsible for the high build or fullness of alkyd resins as compared, e.g., with coatings from simple polyurethanes.

Such systems composed of microgels were considered to be colloidal suspensions rather than solutions, and the low gloss of coatings formed in combination with melamine resins was attributed to the limited wetting of the pigments by these binders rather than to the formation of two-phase structures, which was also possible.

Our approach to microgels was from a different direction. In studying the structure of crosslinked polymers obtained by copolymerization of unsaturated polyesters and styrene, strong experimental evidence was obtained[8] that no homogeneous networks were formed. Rather, structures composed of more densely crosslinked domains attached to each other or embedded in a less densely crosslinked polymer matrix were formed (*Figure* 3). Such inhomogeneous structures, of course, should have consequences with regard to mechanical and physical properties (e.g., swelling), which were not simply correlatable with crosslink density. To study these relationships, model networks of a defined inhomogeneous structure were needed. For this purpose, we wanted to synthesize the densely crosslinked cores first and then disperse and bond them in a less densely crosslinked matrix.[9]

Microgels could be considered as possible cores, but, contrary to the classical microgels, they should be reactive. It was well known that, for sterical reasons and due to restricted segmental diffusion, not all unsaturated groups react on copolymerization with monomers of higher functionality. This would provide residual reactivity of the polymer formed. However, for obtaining cores, a three-dimensional macroscopic crosslinking had to be prevented. Emulsion polymerization offered itself as a suitable method to restrict crosslinking to small domains; however, almost nothing was known about polymerization of crosslinking monomers alone or at least in high proportions. At this time, the use of larger amounts of crosslinking monomers in polymerization was not of much industrial interest, because it was already well known that small quantities suffice to form a macroscopic network and larger fractions cause difficult processability and worsen the mechanical properties of coatings and plastics. Therefore, much experimental work was needed to understand the conditions and mechanisms of crosslinking emulsion polymerization and copolymerization to prepare the reactive microgels in a reproducible way and in large yields.[10-13]

Microgels are usually spherical polymer particles with submicroscopic sizes (*Figures* 4-5). In patent literature, the name "polymer microparticles" is used in addition to "microgels," and sizes cited often extend far into the range of normal pigment particles. This necessitates a more precise description of microgels. It is proposed to define them as intramolecularly crosslinked macromolecules, which, contrary to polymer emulsions, are soluble or form colloidal solutions. In addition, their size compares with coil diameters of linear or branched macromolecules.

In solution the conformation of linear and branched macromolecules changes continuously due to the thermal

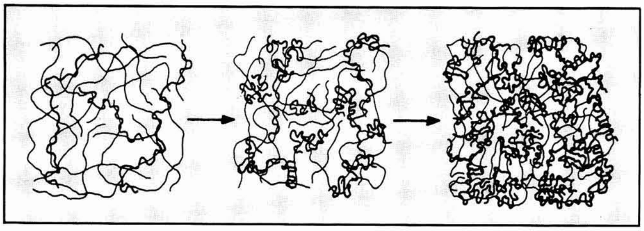


Figure 3—Earlier proposal for the mechanism of inhomogeneous-network formation in copolymerization of unsaturated polyesters and styrene

motions of their chain segments. Accordingly, the surface of their coils varies around some average value. Microgels, however, have a surface fixed by their network structure and, depending on its composition, the mobility of the chain segments is more or less restricted. Therefore, microgels may be considered as species intermediates between large macromolecules and small particles, having some properties characteristic of each. With this distinction, star-shaped macromolecules can be fit between branched and intramolecular crosslinked macromolecules. As will be shown, these types of three-dimensional macromolecules are interesting binders or components of binders for organic coatings.

PREPARATION OF REACTIVE MICROGELS

Reactive microgels may be prepared by polymerization of monomers of a higher functionality in aqueous[11] or nonaqueous emulsions or in solution.[14] It is possible to transfer microgels from an aqueous to a nonaqueous medium or vice versa by aceotropic distillation or by coagulation. More recently, group transfer polymerization has been proposed as a new synthetic route to microgels.[15] In every case, it is necessary to avoid the formation of macroscopic networks.

In emulsion polymerization of monomers, which are scarcely soluble in water, initiation takes place in micelles either by original radicals or by short radical oligomers. The soap molecules prevent a direct contact between the growing polymer particles and thereby prevent their agglomeration to larger units. Because of their small surface area, monomer droplets are mostly excluded from initiation and, if a radical enters a droplet, the growing chain will soon be terminated. Contrary to the classical mechanism of emulsion polymerization as proposed by Harkins, Smith, and Ewart, the polymerization mechanism is different in the case of crosslinking monomers (*Figure* 6). Of course, the likelihood of a radical entering a monomer droplet is also low, but if it occurs, termination is largely excluded due to the Trommsdorf or gel effect.[16] Therefore, monomer droplets fail as a monomer source and suitable reaction conditions must be chosen so that, in the reaction batch, crosslinking monomers are located in micelles. Reactive microgels also may be prepared by polymerization in dilute solution of higher-functional monomers in organic solvents. Though it is well known that even small amounts of monomers suffice to crosslink the whole reaction batch when polymerized in bulk, the proximity of pendant unsaturated groups gives them some preference in polymerization to freely diffusing monomers. Therefore, at least initially, the crosslinking reaction occurs predominantly intramolecularly with the formation of reactive microgels (*Figure* 7A). This preference can be demonstrated by crosslinking a polyfunctional macromolecule, such as poly-4-vinylstyrene, in solution.[17] Despite crosslinking, the solution viscosity initially drops with the reaction time as a consequence of intramolecular crosslinking (*Figure* 8).

PROPERTIES OF REACTIVE MICROGELS AND APPLICATIONS

Reactive microgels, as defined here, are soluble or at least colloidally soluble in organic solvents, or depending on a more hydrophilic surface structure, in water with respect to aqueous systems. The viscosity of solutions of linear or branched macromolecules is usually high, even at a low or moderate molar mass, because their solvated coils are strongly expanded in dilute solution and interact intermolecularly in more concentrated systems. The equivalent coil density of the normal macromolecules at comparable molar masses lies in the range below 0.01 g/cm^3,[18] whereas microgels may have an equivalent density of about 0.3 g/cm^3.[19] Accordingly, their solution viscosities are very low, and at higher crosslink densities, the slope of the KMHS-equation (exponent a) for the relationship between intrinsic viscosity and molar mass may lean towards zero (*Table* 1), i.e., these molecules behave almost like rigid balls which obey the Einstein law of viscosity.

Due to their compact structure, microgels may be dissolved up to molar masses as high as several 10^6 to 10^7, until finally solvatation, which is sometimes restricted to

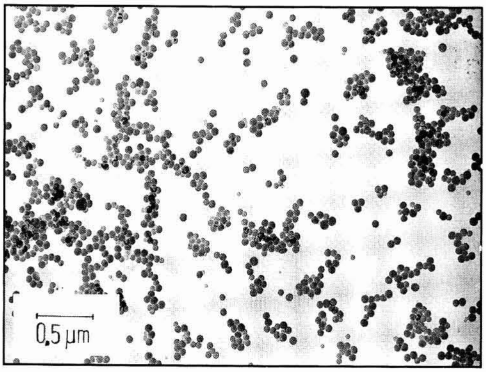


Figure 4—TEM of reactive divinylbenzene microgels

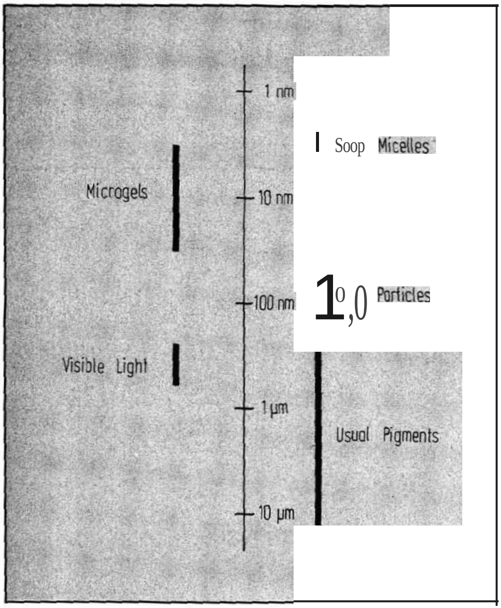


Figure 5-Size of microgels compared with those of other particles

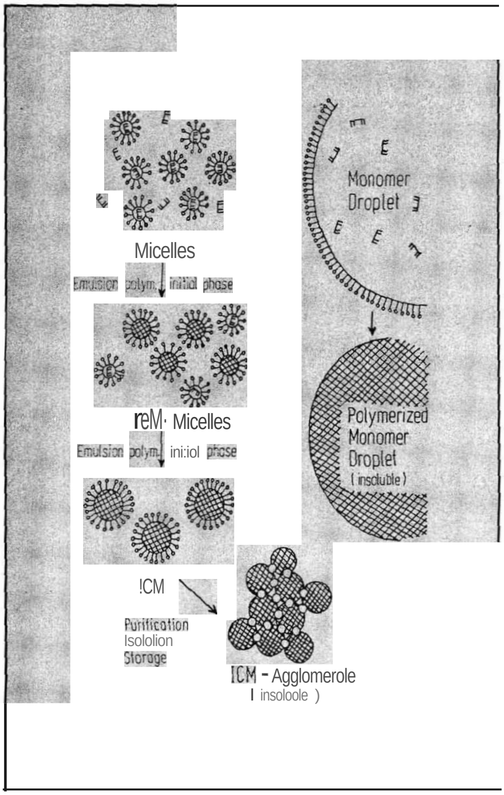


Figure 6- Formation at ICM. Agglomerates and polymerized monomer droplets

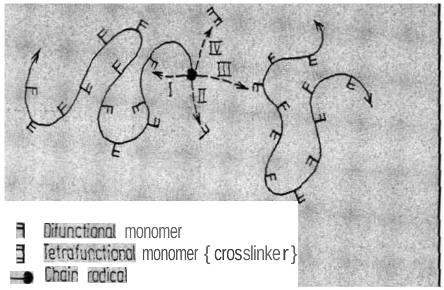


Figure 7-Reaction components of radical chain ends in vinyl-divinyl copolymerization

Table 1-Intrinsic Viscosities and a-Values Of Reactive Microgels and Linear Polymers ot Similar Structure and a Molecular Mass of $\bar{M}_w = 10^?$ (T = 20 °C)

	Monomer	[η] mUg	a-Value[a]	Solvent
Reactive microgels from:	1,4-DVB (solution)	9.7	0.23	Toluene
	DVB (emulsion)	3.5	(b)	Diethyl ketone
	PVS[c] (solution)	16.0	0.15	Toluene
	1,4-DVB/styrene (60:40 solution)	9.5	0.22	Toluene
	UP/styrene (60:40 solution)	3.1	0.13	Dioxane
Linear polymers from:	Styrene (anionic)	234		Toluene
	Styrene	222	0.7	Toluene
	1,4-DVB (anionic)	150		Toluene

(a) Kuhn-Mark-Houwink-Sakurada equation
(b) T = 25 °C
(c) Poly 4-vinylstyrene

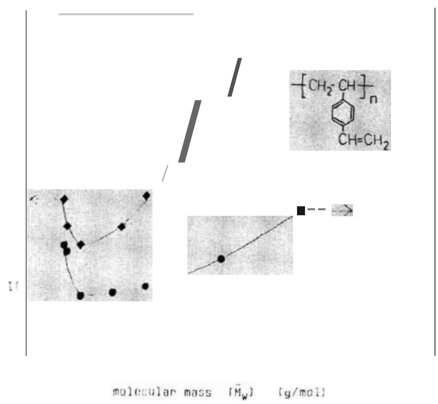


Figure 8-Crosslinking 01 poly-4-vinylstyrene. Dependence of microgel diameter and intrinsic viscosity on molecular mass

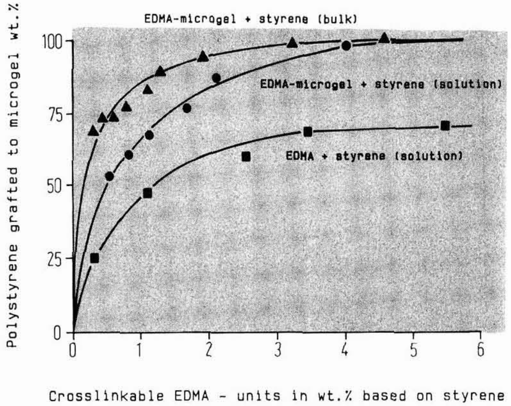


Figure 9—Grafting efficiency of EDMA-microgels on copolymerization with styrene

the surface of the microgels, becomes insufficient to keep them in solution. As the microgels have very small sizes, their surface area is large and allows topochemical reactions to much larger extent than at the macroscopic surfaces of plastics, films, or even fibers.

Microgels obtained by polymerization of tetrafunctional monomers, such as divinylbenzene (DVB) or diacrylates, have a large number of pendant vinyl, respectively, acrylic groups, which have survived polymerization unreacted. Therefore, the functionality of reactive microgels is higher by sizes of order than that of their monomers. These residual reactive groups make microgels useful for reinforcing plastics by copolymerization with linearly polymerizing comonomers and for other purposes.[20] Reactive microgels may be also prepared by emulsion copolymerization of unsaturated polyesters as multifunctional crosslinking components and vinyl monomers, such as styrene.[13] Unsaturated polyesters of suitable chain length and chemical structure are terminated by carboxylic groups. They have emulsifying properties, thus rendering external emulsifiers unnecessary. These polyesters have emulsifying, crosslinking, and reactive functions united in one molecule. As unsaturated polyesters are very versatile in chemical structure, they may be easily tailored to special requirements.

Air-drying microgels have been synthesized in high concentration for water-borne coatings formulations consisting of an alkyd resin and 1,6-hexanedioldiacrylate. Coatings prepared from them possess improved processing and durability properties.[21] The structural reinforcement of polymers by reactive microgels becomes very obvious from the extent of graft polymerization with styrene.[11] At comparable amounts of crosslinkable EDMA-units, styrene is much more effectively grafted to EDMA-microgels than copolymerized with the EDMA-monomer itself (*Figure* 9). This higher efficiency has been explained by a lower probability of intramolecular crosslinking or cyclization as compared with the copolymerization of EDMA and styrene.[22] The extractable amount of polystyrene tends toward zero at a fraction of DVB-microgels of 40 wt % in the reaction batch (*Figure* 10). On addition of these microgels to an unsaturated polyester and styrene, the amount of copolymer grafted to the DVB-microgels also increases substantially with the microgel fraction used (*Figure* 11). In both cases, substantial amounts of styrene are attached to the microgel surface.

Elastomeric reactive microgels with a 50-80 nm diameter prepared by emulsifier-free copolymerization of unsaturated polyesters with carboxyl endgroups and butylacrylate have been proposed for toughening epoxy adhesives.[23] These microgels increase lap shear strength and crack resistance and improve peel strength.

EDMA-microgels are relatively soft macromolecule particles to which monomers are not only grafted at their surface but also invade them and react with residual methacrylic groups in their interior. Depending on the ratio of microgel to styrene, a series of different polymer structures may be obtained, ranging from grafted microgel particles to inhomogeneous networks comparable to interpenetrating networks. However, both networks are chemically bonded to each other.[24]

The change of the slope on plotting mean molar masses of network chains against the formal mean distance of reactive groups in EDMA-microgels, which have been copolymerized with styrene, indicates transition of a network structure with microgel particles contacting each other and with microgel particles connected by polystyrene chains (*Figure* 12).

Whereas towards lower fractions of reactive microgels the connecting polystyrene chains increase in length and grafted individual microgels finally appear, the polystyrene chains crosslinking the microgels internally shorten toward higher fractions of microgels and the network correspondingly becomes denser.

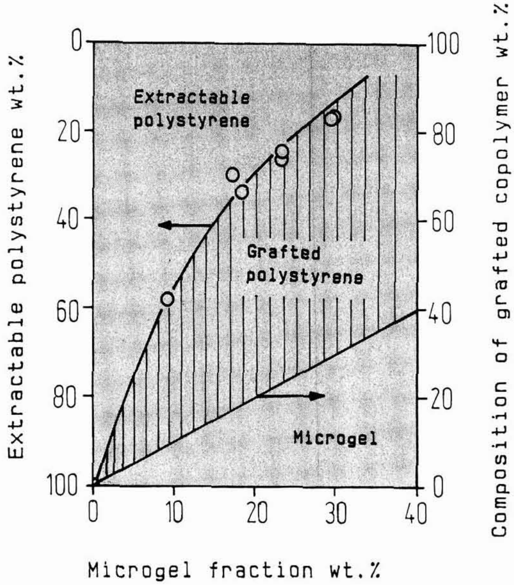


Figure 10—Grafting of polystyrene to microgels prepared from DVB

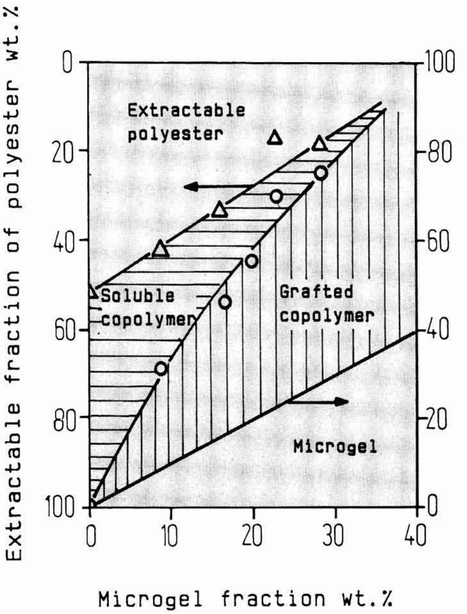


Figure 11—Grafting efficiency on curing of an unsaturated polyester resin in presence of DVB-microgels

By incorporating soft reactive microgels into a matrix of rigid polymer chains, it should be possible to prepare inhomogeneous network structures similar to those of shock-resistant plastics, with processing properties needed for coating systems, because the crosslinking copolymerization takes place during film formation.

Reactivity of microgels is not limited to unsaturation. Reactive microgels may also be formed from monomers with chemical groups capable of condensation or addition reactions.

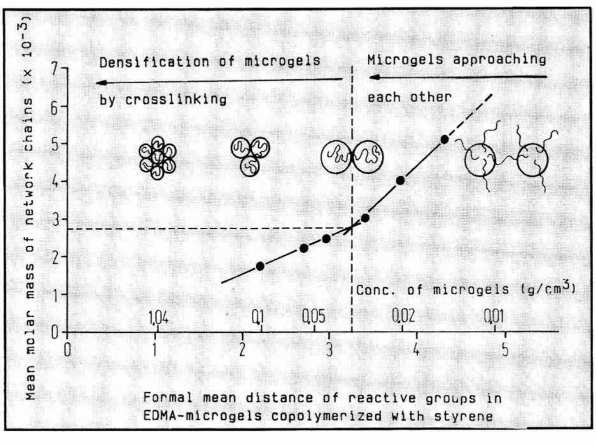
Especially interesting examples of microparticles (though mostly of larger dimensions than those of true microgels) may be synthesized to contain varying amounts of polar groups, such as hydroxyl, carboxyl, or sulfate groups.

Besides the low viscosities characteristic of microgels, their reactive groups may serve many purposes, especially for water-borne and high solid systems.[25-30] Insoluble microparticles have gained considerable importance as binder components of high-solid metallic systems for automotive coatings, especially in water-borne base coats containing aluminum flakes. Initial problems with these metallics systems involved sagging, both upon spraying and baking in the oven. This disadvantage could be avoided by the addition of microgels, which impart to the paint sufficient pseudoplastic or thixotropic properties, which are not much influenced by variation of temperature. Moreover, water evaporates more rapidly, enabling short flash-off times, as the viscosity does not increase very much on evaporation of water. Coatings containing microgels are less sensitive to changes of humidity, popping of entrapped air is avoided, and the flop is improved.

Hydrogen-bonding groups are considered to be responsible for the yield stress, which is characteristic for special rheological properties. Hydrogen-bonding and polar groups may also be introduced into linear or branched macromolecules. However, if they are bonded to surfaces of polymeric microparticles, they are forced to cooperate in their intermolecular interactions and form a three-dimensional network which decays on shearing. During film formation, these polar groups may condense, thus contributing to crosslinking and cure of the coating. Incorporation of microgels in curable polymer systems may reduce shrinkage and increase form stability.

Processing properties of rubber can be markedly improved by the addition of small and hard gel particles of 100 nm diameter and less.[31] The gel particles reduce the elastic strain energy imparted to the material in the stress field and secure a better shape retention on the emergence from the extruder or calandering machine. It is assumed that the increased yield stress is caused by hindrance of slippage of macromolecules and by the interaction between gel particles themselves. Very probably, again interacting polar groups, bound to a polymer surface, are the structural elements which are responsible for this effect. Sulfonated anionic microgels have been reported as antistatic agents in photographic emulsions. They were prepared by emulsion copolymerization of vinyltoluene

Figure 12—Structural change on variation of the EDMA-microgel/styrene ratio



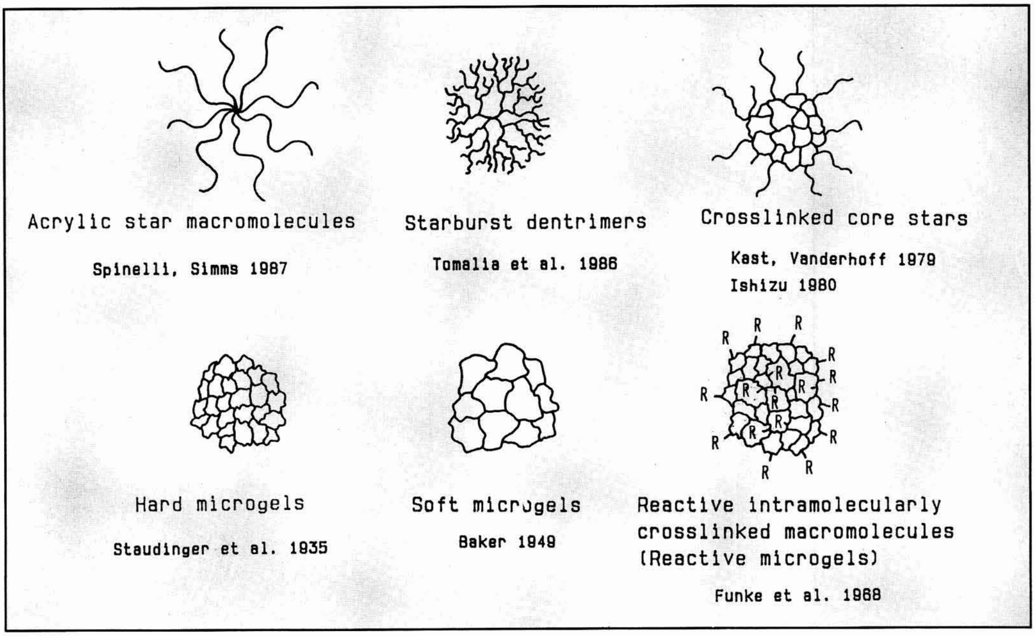


Figure 13—Macromolecules with three-dimensional structure

and DVB with subsequent sulfonation.[32] Microgels with sulfate groups are obtained by emulsion polymerization of DVB with a larger excess of persulfate as radical initiator. By the addition of sulfate anion radicals to the pendant vinyl groups, the solubility changes completely and these styrene-like particles may now be dissolved in methanol.[33]

Finally, it should be mentioned that reactive microgels may serve as carriers for many purposes—not only those related to the paint field. Reactive microgels may be used as supports of enzymes,[34] maintaining high biological activity, and allowing separation and recovery of these costly substances after the reaction. If antibodies are bonded to the surface of reactive microgels and added to a serum containing corresponding antigens, the molar mass increases very strongly, thus providing a very sensitive diagnostical test for detecting diseases by this coupling reaction.

CONCLUSION

For a long time, gel particles have only been considered a nuisance in the synthesis of binders and as a source of defects in organic coatings. If they are kept small enough and are properly synthesized, they are very useful components for paints and other polymer systems. Linear and branched macromolecules and crosslinked polymers have obtained another sister: intramolecularly crosslinked macromolecules or microgels. Together with star shaped and core-stare macromolecules, the intramolecularly crosslinked macromolecules constitute a new structural class of polymers[35-37] between branched macromolecules and crosslinked polymers of macroscopic dimensions (*Figure* 13).

Macromolecules become spatial, not just by the many possible but transient chain conformations but much more distinctly by stable, three-dimensional structures, which impart properties to various polymer systems previously not attainable by conventional macromolecules. Their application in paints is especially promising but not yet fully explored.

ACKNOWLEDGMENT

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Coating Formulation Development Using Critical Pigment Volume Concentration Prediction and Statistical Design

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A method has been devised to obtain optimum coating compositions of multi-pigment systems by integrating critical pigment volume concentration (CPVC) predictions with statistical formulation design. Two parameters are used to predict CPVC—pigment packing factor and oil absorption data. Following prediction of CPVC, a statistical formulation design is utilized to "screen" compositions and quickly optimize the coating formulation. In this manner, a coating with the desired properties is quickly and efficiently obtained.

To demonstrate this approach, five binary pigment systems were evaluated in a two component polyurethane resin system. Rutile titanium dioxide was combined separately with diatomaceous silica, antimony oxide, zinc chromate, vesiculated polymer beads, and solid polymer beads, respectively. Each pigment system was systematically formulated with the binder using a statistical design. After application and cure, the coatings were tested and evaluated for gloss and flexibility to experimentally determine the CPVC of the coating systems. The correlation between the predicted and experimental CPVC was either good or fair for the five systems studied. These results indicate that theoretically predicting CPVC along with a statistically designed formulation procedure will yield an optimum pigment system composition and concentration. Although the approach is presented using binary pigment systems, it has been used in other studies for developing multi-pigment coatings.

INTRODUCTION

A paint can consist of two components or as many as 15 or more. The components which dominate the properties of applied coatings are the polymeric binder and the pigment system. During development of a new coating, determining the optimum concentration of these components is tedious and time consuming for the coatings formulator. One method of obtaining an optimum formulation involves an experimental cycle consisting of preparing, applying, curing, testing, and evaluating candidate coating formulations. This is an evolutionary cycle which is repeated until a coating having the optimum combination of desired properties is attained. Four or more "trial and error" cycles may be required to determine the optimum coating. With the amount of time required for one cycle normally being over two weeks, and possibly much longer with long-term testing, this entire process is inefficient with respect to time, material, and labor. The objective of this paper is to demonstrate a simple but efficient approach to obtaining optimum pigment-binder concentrations for multi-pigment coatings. This technique involves the prediction of critical pigment volume concentrations (CPVC) and subsequently analyzing statistically determined formulations.

The importance of the CPVC in coating performance has been well documented.[1-6] Although addition of pigment to a polymeric binder has significant impact on mechanical, physical, optical, and surface properties of the applied film, these effects are magnified at the CPVC. At the onset of a resin-starved composite system, adding excessive pigment causes voids which significantly reduce strength, increase permeability, and enhance dry hiding. With desired properties of the coating determined prior to formulation development, knowing the CPVC will provide a good indication of potentially successful pigment concentrations. CPVC can be determined experimentally by varying pigment concentration and studying property responses.[6] However, techniques to predict CPVC have also been published[7-13] which are valid and fairly accurate without requiring analysis of numerous compositions.

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Table 1 — Pigment Properties

	TiO_2	SiO_2	Sb_2O_3	$ZnCrO_4$	TiVsBd	TiSlBd
Manufacturer and designation......	Dupont R-960	Johns-Manville Celite 499	Harshaw Kr-325	Hercules Y-2082	Enterprise Chemical	Enterprise Chemical
Appearance	White spherical	White platelet	White nodular	Yellow rectangular	White sperical	White spherical
Density (g/mL)...	4.0	2.36	5.6	3.5	1.30	1.62
Oil absorption ... ASTM D281	29.3	111.2	9.3	25.5	146.8	29.9
Refractive index .	2.76	1.48	2.00	—	—	—
Particle diameter . (microns)	0.3	2.0	0.3	0.25	5.0	4.0
CPVC, theoretical	0.448	0.267	0.641	0.513	0.317	0.658

Development of new materials, especially coatings, requires evaluation of various component mixture ratios. The fundamental objectives are to: (1) identify those components which affect properties and (2) determine the component concentrations yielding the best balance between the desired properties and cost. One approach is to systematically select and analyze component mixtures, and property responses to compositional changes. Two effective methods are a simplex screening design[14,15] and an extreme vertices design[15,16] which are statistical methods for determining compositions to be analyzed. The simplex design selects the vertices of the constraint region, the overall centroid, and several internal compositions of a large formulation region. The extreme vertices approach allows lower and upper constraints to be imposed on component concentrations to reduce the area of potential formulations. Mixtures to be analyzed are selected as vertices, the various centroids, and several internal points of this constrained formulation area. The resulting experimental data can be applied in a regression analysis to obtain an empirical equation which can be used to predict property values from mixture compositions.

In this effort, the CPVC of five binary pigment systems were predicted. The predicted values were then experimentally validated utilizing statistical formulation designs.

CPVC CALCULATIONS

One method for predicting CPVC[7,9] utilizes two physical coating parameters, the maximum packing factor (ϕ_{max}) of the pigment system, and the oil absorption of individual pigments.

Packing Factor

Packing factor, ϕ, is the true volume occupied by distinct particles per bulk volume of those particles. Empirical equations for calculating packing factors of variable-sized spheres were developed by Lee[17] based on experimental volume measurements of dense random arrangements of mono-sized and binary-sized spheres. The maximum packing factor, ϕ_{max}, of mono-sized spheres in a dense random packing was experimentally determined to be 0.640. The packing factors for a wide range of binary-sized spheres (diameter ratios of large to small spheres ranging from 1 to 20) also were experimentally determined and graphically plotted. ϕ_{max} for binary-sized spheres with a diameter ratio of 20 was determined to be 0.850. This is due to the smaller spheres filling the interstices created by the larger spheres, resulting in more efficient packing. As the diameter ratio approaches infinity, the packing factor approaches 0.870. By converting Lee's algorithm into a computer program[9] and providing the particle size distribution of the desired pigment(s), the packing factor of individual pigments and pigment mixtures can be calculated. It should be noted that the interstitial volume between pigment particles is that fraction of the bulk volume which is not represented by the packing factor, and therefore it is equal to $(1 - \phi)$.

Oil Absorption

Oil absorption (OA) refers to the amount of linseed oil required to form a paste-like consistency when combined with a pigment sample. A common oil absorption procedure, the spatula rub-out, is described in ASTM method D 281. The oil absorption value is expressed in grams of linseed oil per 100 g of pigment. In forming the paste, the linseed oil is absorbed, adsorbed, and interstitially bound to the pigment particles. The amount of absorbed oil is dependent upon the chemical and physical nature of the pigment particles, while the amount of adsorbed oil is determined by the surface interaction chemistry between the particles and oil. The OA endpoint signifies the minimum amount of oil necessary to wet the pigment particles and fill the interstitial volume $(1 - \phi)$ between the particles. In effect, this is the same concept as the CPVC except that oil absorption is normally standardized with linseed oil as the binder while CPVC can pertain to any binder. The mathematical expression relating CPVC to oil absorption is:

$$CPVC = \frac{1}{1 + OA} \qquad (1)$$

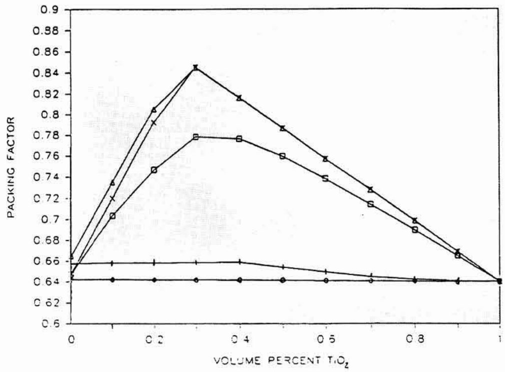

Figure 1—Packing factor vs binary pigment composition. Legend: □ — SiO_2; + — Sb_2O_3; ○ — $ZnCrO_4$; Δ —TiVsBd; and x — TiSlBd

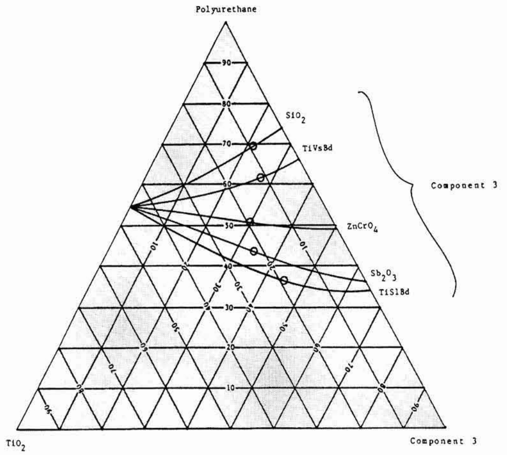

Figure 2—Predicted CPVC and ϕ_{max} for the binary pigment systems. Legend: ____ — CPVC; and ⊖ — ϕ_{max}

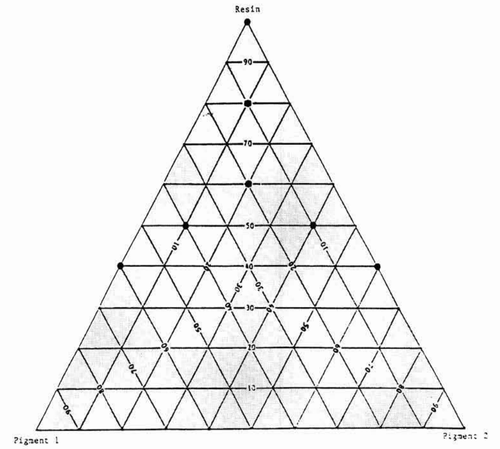

Figure 3—Coating composition via simplex screening design

where oil absorption, OA, is expressed as volume of oil per unit volume of pigment. Note that for individual pigments, the OA value used in equation (1) is simply that for the pigment in question. However, if pigment mixtures are to be used, which is normally the case, the OA of the specific pigment mixture must be used. In addition, if a pigment system is being studied, the packing of one pigment with another becomes a factor to consider, especially if their mean particle diameters are significantly different. This occurs because wider particle size distributions allow the smaller particles to fit into the interstices of the larger particles, thus producing more efficient packing and allowing less interstitial volume for the binder.

The oil absorption value can be separated into three volume components: V_{ab}, V_{ad}, and V_i, representing the absorbed, adsorbed, and interstitial oil, respectively. This can be mathematically represented as:

$$OA = V_{ab} + V_{ad} + V_i \quad (2)$$

It is assumed that, upon mixing pigments, the values of V_{ab} and V_{ad} will not change because they are independent of neighboring pigment particles. In other words, pigment A does not affect the absorption or adsorption of oil into or onto pigment B. However, the value of V_i will change due to a change in ϕ, unless the two pigments have identical particle size distributions. Thus, an equation for computing the oil absorption value of a pigment mixture is:

$$OA_{mix} = X_A(V_{ab} + V_{ad})_A + X_B(V_{ab} + V_{ad})_B + \ldots X_n(V_{ab} + V_{ad})_n + (V_i)_{mix} \quad (3)$$

where X_n is the volume fraction of pigment n in the pigment mixture and $(V_i)_{mix}$ is the interstitial volume of the mixture which is equal to $(1 - \phi_{mix})$. Once OA_{mix} is computed, the CPVC of that system follows from equation (1):

$$CPVC_{mix} = \frac{1}{1 + OA_{mix}} \quad (4)$$

By determining each of the terms in equation (3), $CPVC_{mix}$ for a multi-pigment system may be computed using equation (4). It should be noted that this approach should be valid for multi-pigment systems; however, for ease of illustration, binary pigment systems will be demonstrated. Using Lee's algorithm,[17] ϕ for each individual pigment is calculated. V_i is simply:

$$V_{iA} = 1 - \phi_A \text{ for pigment A} \quad (5)$$

$$V_{iB} = 1 - \phi_B \text{ for pigment B} \quad (6)$$

For equation (2), there are two unknowns for each pigment: V_{ab} and V_{ad}. The sum of these two values can be treated as one unknown $(V_{ab} + V_{ad})$ for each pigment and calculated using equation (2):

$$(V_{ab} + V_{ad})_A = OA_A - V_{iA} \text{ for pigment A} \quad (7)$$

$$(V_{ab} + V_{ad})_B = OA_B - V_{iB} \text{ for pigment B} \quad (8)$$

The particle size distributions for pigments A and B can be combined mathematically and a packing factor for the pigment mixture, ϕ_{mix}, can be calculated using Lee's algorithm. $(V_i)_{mix}$ is then equal to: $(1 - \phi_{mix})$. All of the necessary terms in equation (3) are now known for the calculation of OA_{mix} and thus $CPVC_{mix}$. Expansion of these equations for mixtures of more than two pigments is straightforward.

Appendix A is a listing of the computer program used to calculate CPVC. This program calculates the theoreti-

Table 2 — Polyurethane Resin Formulation

Component I	Weight Percent
Mobay Desmophen 651A-65	7.1
Mobay Desmophen 670-90	23.2
Dibutyltin dilaurate (2% in MEK)	0.7
Monsanto Modaflow (10% in MEK)	1.3
Methyl ethyl ketone (MEK)	28.7
Component II	
Mobay Desmodur N-75	24.7
Propylene glycol monomethyl ether acetate	7.2
Toluene	7.2

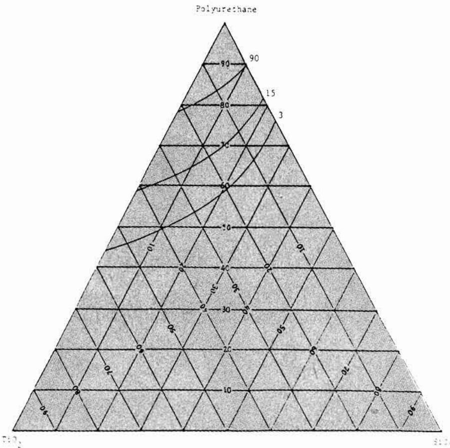

Figure 4—60° gloss for TiO_2/SiO_2/polyurethane

cal pigment packing factor which is utilized in the determination of CPVC values. The required input data for this program consists of the oil absorption value, adsorption layer thickness, particle size distribution, and the volume fraction of each pigment in the pigment system.

PIGMENT CHARACTERIZATION AND CPVC PREDICTION

Three pigment systems were evaluated in this study: (1) titanium dioxide (TiO_2) — diatomaceous silica (SiO_2); (2) titanium dioxide — antimony oxide (Sb_2O_3); and (3) titanium dioxide — zinc chromate ($ZnCrO_4$). Two other pigment systems were similarly evaluated in an associated study[9]: (4) titanium dioxide — titanium dioxide vesiculated beads (TiVsBd); and (5) titanium dioxide — titanium dioxide solid beads (TiSlBd).

These pigments were selected because, in general, they represent a wide variety of commonly used pigments and fillers.[18] Polymer beads are a relatively new class of pigments which are widely used in trade sales paints[19,20]; however, their use in industrial coatings, including aircraft paints,[9,21] is increasing.

Particle size distributions of the previously mentioned pigments were obtained by analyzing as least 200 loose particles of each pigment with a scanning electron microscope at 500X and 2000X. The diameter of each recognizable particle was measured and the particle size distribution was obtained by categorizing and listing the number of particles within specified diameter intervals. The particle size distributions for vesiculated beads and titanium dioxide are provided in Appendix A in the example input. Titanium dioxide, which is listed as the second pigment, contains five particle diameter categories, 0.3 volume fraction, 0.05 micron adsorbed layer thickness, and an OA value of 1.23 mL oil per unit mL of pigment. Titanium dioxide has one particle between 0 and 0.1 microns, 36 particles between 0.1 and 0.2 microns, 143 particles between 0.2 and 0.3 microns, and so forth.

Oil absorption values were determined per ASTM method D 281 using linseed oil with an acid value of 1.15 and a density of 0.929 g/mL. The OA values along with other pigment properties are listed in *Table* 1.

Figure 1 is a graph of packing factor vs pigment composition for the five pigment systems investigated. The zinc chromate and antimony oxide systems produce flatter graphs, not varying as much in packing factor as the other three systems. Their packing factors remain around 0.64 to 0.66 which agrees with data obtained by Lee[17] where binary pigment mixtures with a diameter ratio of 1 yield a maximum packing factor of 0.64. This is low relative to ϕ_{max} of 0.87 discussed previously and is due to the particle size of $ZnCrO_4$ and Sb_2O_3 being closer to that of TiO_2. TiVsBd, TiSlBd, and SiO_2, when mixed with TiO_2, can attain ϕ_{max} of 0.84, 0.84, and 0.78, respectively. These pigments have particle diameters which are an order of magnitude larger than TiO_2. In the systems with the larger particles, the titanium dioxide can fit into the interstices of the larger particles, packing with better efficiency and causing a larger ϕ. The maximum packing factor of these systems occurs around 30 to 35% TiO_2. Deviating from this composition produces less efficient particle packing and thus decreases packing factors.

Three component formulation mixtures can be represented using an equilateral tri-coordinate graph. Each vertex of the triangle represents a volumetric composition of 100% of a component while the opposite axis represents 0% of that component and all of the possible combinations of the remaining two components. The points within the tri-coordinate graph represent all of the possible combinations and concentrations of the three components, with a total composition of 100%. The effect of composition on properties can be graphically represented by contour lines which are constant property values plotted as a function of composition.

Figure 2 is a tri-coordinate graph which illustrates the predicted CPVC contour lines and ϕ_{max} for the five

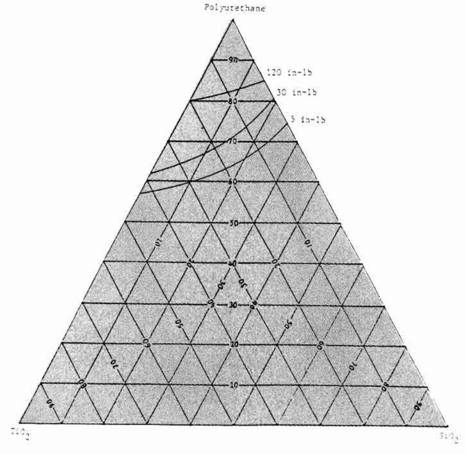

Figure 5—Gardner reverse impact resistance for TiO_2/SiO_2/polyurethane

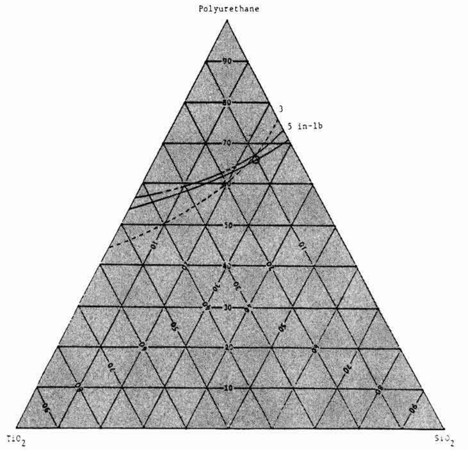

Figure 6—Experimental vs predicted CPVC for $TiO_2/SiO_2/$ polyurethane. Legend: ——-- —— — reverse impact resistance CPVC; — — — — —60° gloss CPVC; ———predicted CPVC; and ⊖ — predicted ϕ_{max}

systems analyzed. The slope of the CPVC lines can be directly attributed to the oil absorption characteristics of the pigment used with TiO_2. Silica and TiVsBd have high oil absorption values and, as they are added to TiO_2 in the resin system, the CPVC decreases. On the graphs, this is seen as an increase in resin content at the CPVC. Conversely, Sb_2O_3, $ZnCrO_4$, and TiSIBd have low oil absorption values which result in a higher CPVC. The indicated point on each of the CPVC lines represents the pigment mixture ratios which theoretically yield the highest packing efficiency (ϕ_{max}). This composition is theoretically the highest filler loading possible without creating a resin starved system. A statistically designed testing and analysis program can be based on these predictions.

The CPVC lines in *Figure* 2 are slightly concave upward. This is due to the more efficient packing of pigment mixtures. As the pigment packs more efficiently and the interstitial volume decreases, less resin is required to reach the CPVC, causing the concave-up graph. However, pigment oil absorption has a more significant and over-riding effect on CPVC.

EXPERIMENTAL APPROACH AND PROCEDURES

The resin system used in this study was a two component, aliphatic polyurethane (*Table* 2). More specifically, this polyurethane was obtained by reacting hexamethylene diisocyanate, HMDI (Desmodur N-75, Mobay Chemical Company*) with a polyester diol (Desmophen 651A-65 and 670-90, Mobay Chemical Company). Polyurethane resins vary in properties. However, this polyurethane resin is known to exhibit good chemical and weather resistance and flexibility characteristics. It has been used to formulate topcoats conforming to MIL-C-83286, "Coating, Urethane, Alipahatic Isocyanate, for Aerospace Applications," commonly used on Navy, Marine Corps, and Air Force aircraft.

A statistical distribution of candidate coating formulations was determined using a simplex screening design.[15] This provided seven compositions for each coating system as shown on the triangular coordinate graph in *Figure* 3. From this model, the specified concentrations of pigments and diol (Component I of the polyurethane resin) were milled in a quart jar, half-filled with 5mm diameter glass beads on a paint shaker, for 30 min to produce a minimum Hegman grind of 5. Then, the diisocyanate component was added and agitated for one minute. The formulations were allowed to set for 15 min to initiate the urethane reaction.

The formulated coatings were applied to 2024 - 0 temper aluminum specimens, anodized in accordance with MIL-A-8625, Type I. The coatings were allowed to cure for one week at ambient laboratory conditions prior to testing. They were evaluated for 60° gloss (ASTM D 523), Gardner reverse impact resistance (ASTM D 2784), and General Electric impact flexibility (Method 6226 of Federal Test Method Standard 141C).

After the initial results were analyzed and compared with predicted CPVC values, a new set of formulations was determined in the CPVC formulation region using an extreme vertices design with revised component restraints. The experimental procedures were repeated to locate the experimental CPVC region for each system.

RESULTS AND DISCUSSION

Contour lines of property values vs composition were obtained by analyzing the raw data with software which utilizes a regression analysis to fit the data to a special cubic equation of the form:

$$Y = aX_a + bX_b + cX_c + dX_aX_b + eX_aX_c + fX_bX_c + gX_aX_bX_c + h$$

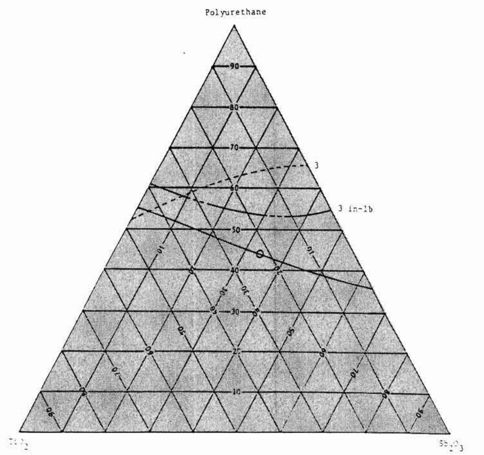

Figure 7—Experimental vs predicted CPVC for $TiO_2/Sb_2O_3/$ polyurethane. Legend same as Figure 6

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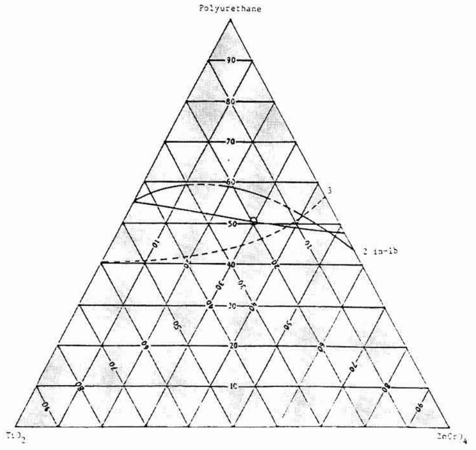

Figure 8—Experimental vs predicted CPVC for $TiO_2/ZnCrO_4/$ polyurethane. Legend same as Figure 6

where X_a, X_b, and X_c are the volume fractions of the three components; a, b, c, etc., are the respective coefficients.

The resulting graphs of the 60° gloss, G.E. impact flexibility, and Gardner impact resistance for the titanium dioxide-silica system are provided in *Figures* 4 to 6. As expected, these figures illustrate that gloss and flexibility decrease as pigment concentration increases. As the pigment concentration of a coating increases, the particles begin to fill the matrix and protrude through the surface, scattering infringing light and reducing gloss. Impact flexibility decreases as pigment concentration increases due to the inclusion of rigid filler particles in the flexible, tough polyurethane matrix. The pigment particles provide sites for crack initiation and decrease the flexibility properties of the matrix, especially when incorporated at high concentrations.[22] This effect is magnified as the oil absorption of the pigment system increases, i.e., adding silica to titanium dioxide. Similar results were obtained and analyzed for the other four pigment systems. These results are discussed in the following section with respect to critical pigment volume concentrations.

The experimental CPVC were determined using the property contour lines on the tri-coordinate graphs. CPVC was observed as a leveling off of flexibility and gloss as illustrated by Patton.[6] Although increased pigment concentration reduces coating gloss and flexibility, the mechanisms which cause gloss reduction and coating cracking are different. Therefore, experimental CPVC determined by these methods are slightly different. *Figures* 7-10 compare the experimental and predicted CPVC for the five pigment systems tested. In general, CPVC determined from gloss data is lower than that determined from flexibility data. As predicted by equation (3), the CPVC is inversely proportional to the oil absorption of the pigment system.

Predicted CPVC are in the same coating composition region as the experimental CPVC and they agree very closely for the SiO_2, Sb_2O_3, and $ZnCrO_4$ systems. However, several discrepancies are evident. The polymer bead systems do not agree as well as the inorganic pigment systems. This may be due to the unique morphology and chemistry of these polymer bead pigments and their interaction with the polyurethane matrix.[23,24]

In most cases, the experimental CPVC are lower than the predicted CPVC. This is especially true for low oil absorption pigment systems (TiO_2/Sb_2O_3 and $TiO_2/$ TiSlBd). This effect is probably due to the large concentration required for low oil absorption pigments. When large pigment concentrations are present, introduction of defects such as pigment clumping and air-voids into the coating is more likely. As stated by Patton,[6] "Latices tend to resist penetration into the innermost voids or fail to adequately wet the pigment surface." Although the paint contains enough binder to fill the pigment interstices, a resin starved-like system is obtained. Dobkowski also observed lower theoretical CPVC than experimental (85° gloss) CPVC with calcined kaolin pigments.[25]

Although the shape of the theoretical CPVC graphs is concave up, several of the experimental curves are concave down. Another reason for discrepancies between predicted and experimental values is the use of the oil absorption value to predict CPVC. Theoretical CPVC is determined with linseed oil while the coatings were formulated with a polyurethane resin. The chemical interaction between pigment and binder has an effect on CPVC; and, therefore, pigments may exhibit different CPVC in chemically different binder systems. A second contribution may be that, although consistent oil absorption values were obtained for all the pigments analyzed, determining the exact endpoint can vary between operators.[26] Therefore, the oil absorption may be slightly different from the experimentally recognized CPVC.

Although the approach of using predicted CPVC in conjunction with statistically designed formulations has

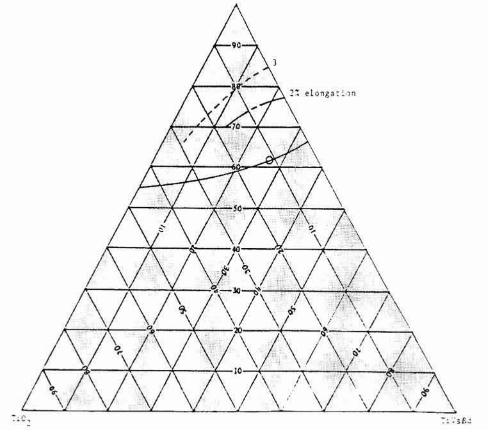

Figure 9—Experimental vs predicted CPVC for TiO_2/TiVsBd/ polyurethane. Legend: ____ _ ____ — impact flexibility CPVC; _ _ _ _ — 60° gloss CPVC; ____ — predicted CPVC; and ⊖ — predicted ϕ_{max}

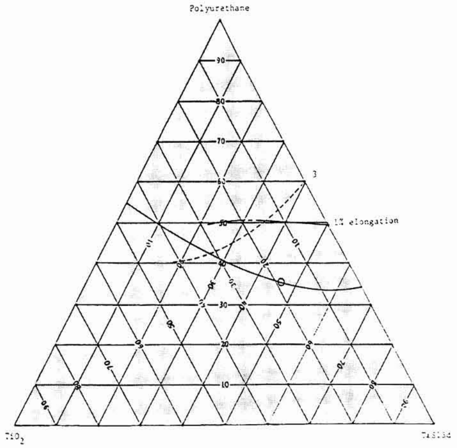

Figure 10—Experimental vs predicted CPVC for TiO_2/TiSIBd/ polyurethane. Legend same as Figure 9

been demonstrated for binary pigment paints, this approach is equally valid and even more beneficial for multi-pigment systems. This concept has been demonstrated in our laboratory with the development of a self-priming topcoat for aircraft.[27] The coating ultimately consisted of a polyurethane binder, similar to that utilized in this study, and five pigments. The development approach was that prescribed in this paper, resulting in the formulation of a complex mixture of components with the desired properties. By quickly predicting the most promising formulation region and statistically selecting different formulations within that region, this developmental effort was completed with a minimum amount of laboratory man-hours.

CONCLUSIONS

The results obtained during this effort demonstrate that CPVC of binary pigment coatings can be confidently predicted using pigment particle size and oil absorption data. Validation of these predicted values with experimental data was accomplished using well defined statistical formulation designs. In effect, this process is a demonstration of the effectiveness of an integrated formulation development. If desired properties are well defined, the coatings formulator can efficiently develop new coatings by:

(1) utilizing historical information on raw materials to select candidate pigments and binders;

(2) characterizing pigments and predicting CPVC of potential pigment systems;

(3) evaluating predicted CPVC with the desired properties to determine potentially successful component concentration ranges; and

(4) utilizing the component ranges in a statistical formulation design. If the potentially successful formulation region is large, a screening method is appropriate. When this region is narrowed, an extreme vertices or factorial design can be used to quickly obtain the optimum binder-pigment(s) concentration.

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APPENDIX A

COMPUTER PROGRAM TO CALCULATE CPVC AND ϕ_{max}

The following is a computer program, example input data, and corresponding output for the calculation of critical pigment volume concentration (CPVC) and maximum packing factor (ϕ_{max}). The program is written in Fortran IV for use on a Control Data Corp. 6600 computer. The example is for a pigment system of volume fraction 0.70 for TiVsBd (Pigment 1) and 0.30 for titanium dioxide (Pigment 2).

```
      PROGRAM AB(INPUT,OUTPUT,TAPE5=INPUT)
      DIMENSION NPART(100),SIZ(100,4),VOL(100),VOLSIZ(100,4)
      DIMENSION VOLPER(100,4),PIGPER(4),TOTVOL(4),NSIZ(4)
      DIMENSION VABS(4)
      DIMENSION COMBSZ(400),VADS(4),PCK(5),OIL(4)
      DIMENSION PHI(100,100),COMBPR(400),VINTER(4)
C   THIS PROGRAM COMPUTES THE PACKING FACTOR OF A SINGLE DRY PIGMENT.
C   ULTIMATELY, IT WILL COMPUTE THE PACKING FACTOR OF A MULTI-PIGMENTED
C   MIXTURE, AND THEN COMPUTE THE CPVC BASED UPON THIS AND THE OIL
C   ABSORPTION VALUES OF THESE PIGMENTS
C
C   NPIG = NUMBER OF PIGMENTS IN SYSTEM
C   VADS (1) = VOLUME OF RESIN ADSORBED IN SINGLE PIGMENT
C   VABS (1) = VOLUME OF RESIN ABSORBED IN SINGLE PIGMENT
C   VINTER (1) = VOLUME OF REIN IN INTERSTICIES OF SINGLE PIGMENT
C   PHIMIX = PH OF MIXTURE
C   OIL = O.A. VALUE IN VOL OIL/VOL PIG
C   TOTVOL (1) = TOT VOL OF THE ENTIRE PARTICLE DIST INCLUDING ADS LAY
C   NSIZ (1) = NUMBER OF PARTICLE SIZE·RANGES
C   PIGPER (1) = PIGMENT VOLUME FRACTION
C   ADSLAY =  ADSORBED LAYER THICKNESS (IN MICRONS)
C   NPART (1) = NUMBER OF PARTICLES
C   SIZ (2) = DIAMETER OF PARTICLES
C   VOL (1) = VOLUME OF ONE PARTICLE
C   VOLSIZ (2) (RANGE,PIGMENT) VOL OF THE ENTIRE PARTICLE RANGE
C   VOLPER (2) (RANGE,PIG) VOL FRACTION DISTRIBUTION
C   PCK (1) PF OF SINGLE PIGMENT
C   COMBSZ (1) MAKES SIZ INTO A 1 DIMENTIONAL ARRAY
C   COMBPR (1) MAKES VOLPER INTO A 1 DIMENTIONAL ARRAY
C   PHI (2) = MAX PF FOR A SINGLE PIGMENT
C   TEMP = TEMPORARY STORAGE OF PF TIMES VOL % DIST
C   DIAMAT = DIAMETER RATIO
C   PHIMIX = PF OF MIXTURE
C   VNTR = VOL FRACTION INTERSTITIAL OF PIG COMBINATION
C   VDS = VOL FRAC ADSORBED (PIG VOL % TIMES THE ADS VOL)
C   VBS = VOL FRAC ABSORBED (FIG VOL % TIMES THE ABS VOL)
C
C   READ IN THE PARTICLE SIZE DISTRIBUTION FOR THE PIGMENT
C   AND CONVERT THIS INTO A VOLUME PERCENTAGE DITRIBUTION
C
      PI=3.1415
      READ *, NPIG
      DO 2 II=1,NPIG
C
C   INITIALIZE TO ZERO
C
      VADS(II)=0.0
      VABS(II)=0.0
      VINTER(II)=0.0
```

APPENDIX A (Continued)

```
      PHIMIX=0.0
      OIL(II)=0.0
      TOTVOL(II)=0.0
      READ *, NSIZ(II),PIGPER(II),ADSLAY,OIL(II)
      M=NSIZ(II)
      DO 1 I=1,M
      READ *, NPART(I),SIZ(I,II)
      VOL(I)=PI*(SIZ(I,II)+2.0*ADSLAY)**3/6.0
      VOLSIZ(I,II)=NPART(I)*VOL(I)
 1    TOTVOL(II)=TOTVOL(II)+VOLSIZ(I,II)
      DO 9 I=1,M
9     VOLPER(I,II)=(VOLSIZ(I,II)/TOTVOL(II))*PIGPER(II)
2     CONTINUE
      M=0
      MO=0
```

APPENDIX B

```
      NPIG1=NPIG+1
      DO 11 IA=1,NPIG1
      PCK(IA)=1.0
      IF(IA.EQ.NPIG1) GOTO 3
      MOE=NSIZ(IA)
      DO 13 K=1,MOE
      COMBSZ(K+M)=SIZ(K,IA)
  13 COMBPR(K+M)=VOLPER(K,IA)
      MO=MO+NSIZ(IA)
      M1=M+1
   3  IF(IA.EQ.NPIG1) M1=1
C
C  COMPUTE PACKING FACTOR FOR PIGMENTS SEPARATELY AND THEN TOGETHER
C
      DO 8 I=M1,MO
      PHI(I,I)=0.639
      TEMP=0.0
      DO 70 J=M1,MO
      IF(I.EQ.J) GOTO 70
      IF(COMBSZ(I).LT.COMBSZ(J)) GOTO 20
      DIAMAT=COMBSZ(I)/COMBSZ(J)
C
C  THIS PART COMPUTES PHIMIX OF BINARY MIXTURE
C
      IF(DIAMAT.GT.15.0) GOTO 22
      PHIMIX=0.872459-0.307908*0.814182**DIAMAT
      GO TO 32
  22  PHIMIX=.000022449*DIAMAT+0.847551
  32   PHI(I,J)=0.639+(PHIMIX-0.639)/(1.15-1.017*PHIMIX)
      GO TO 70
  20  DIAMAT=COMBSZ(J)/COMBSZ(I)
      IF(DIAMAT.GT.15.0) GOTO 21
      PHIMIX=0.872459-0.307908*0.814182**DIAMAT
      GO TO 31
  21   PHIMIX=0.000022449*DIAMAT+.847551
  31   PHI(I,J)=0.639+(PHIMIX-0.639)/(1.017*PHIMIX-0.15)
  70   TEMP=TEMP+PHI(I,J)*COMBPR(J)
      IF(TEMP.LT.PCK(IA)) PCK(IA)=TEMP
  8   CONTINUE
      IF(IA.EQ.NPIG1) GOTO 11
C
C  COMPUTE INTERSTITIAL, ABSORBED AND ADSORBED OIL AMOUNTS FOR
C  EACH PIGMENTS INDIVIDUALLY
C
      VADS(IA)=PI/6.0*((SIZ(I,II)+2.0*ADSLAY)**3-SIZ(I,II)**3)
      PCK(IA)=PCK(IA)/PIGPER(IA)
      VINTER(IA)=1.0-PCK(IA)
      VABS(IA)=OIL(IA)-VADS(IA)-VINTER(IA)
      WRITE 100,IA,PIGPER(IA),PCK(IA),OIL(IA),VINTER(IA),VABS(IA),
     $ VADS(IA)
```

APPENDIX B (Continued)

```
      M=M+NSIZ(IA)
   11 CONTINUE
  100 FORMAT(/,* PIGMENT NO.*,I2,*  AT VOL. *
     & *%*,F6.4,*    PACKING FACTOR *,F9.6,/,T17,*O.A. VALUE =*,
     # F7.4,*    INTERSTITIAL OIL =*,F7.4,/,T17,*ABSORBED OIL =*,
     # F7.4,*    ADSORBED OIL =*,F7.4)
C
C  COMBINE ALL THE DIFFERENT PIGMENT OIL VALUES TOGETHER
C
      VNTR=1.0-PCK(NPIG1)
      VDS=VBS=0.0
      DO 5 I=1,NPIG
      VDS=VDS+PIGPER(I)*VADS(I)
    5 VBS=VBS+PIGPER(I)*VABS(I)
```

APPENDIX C

```
C
C  COMPUTE CPVC
C
      CPVC=1.0/(1.0+VNTR+VDS+VBS)
      WRITE 120,PCK(NPIG1)
  120 FORMAT(//,T20,* PIGMENT COMBINATION*,/,* PACKING FACTOR =*,
     $ F10.6)
      WRITE 300,VNTR,VDS,VBS,CPVC
  300 FORMAT(* VOL. INTERSTITIAL =*,F10.6,/,* VOL. ADS. *,F10.6,
     & /,* VOL. ABS. *,F10.6,/,* CPVC =*,F10.6)
      STOP
      END
```

APPENDIX D

EXAMPLE INPUT

```
2
37 0.7 0.05 2.16
7 0.5
5 1.
9 1.5
30 2.0
37 2.5
50 3.0
57 3.5
72 4.0
61 4.5
72 5.0
57 5.5
61 6.0
53 6.5
37 7.0
32 7.5
31 8.
23 8.5
23 9.
20 9.5
14 10.
14 10.5
7 11.
5 11.5
8 12.
6 12.5
5 13.
7 13.5
3 14.
```

APPENDIX D (Continued)

```
2 14.5
2 15.
3 16.
2 16.5
1 17.5
1 18.5
1 19.
1 24.5
2 30.
5 0.3 0.05 1.23
1 0.1
36 0.2
143 0.3
29 0.4
1 0.5
```

EXAMPLE OUTPUT

```
PIGMENT NO. 1  AT VOL. % .7000     PACKING FACTOR    .664890
               O.A. VALUE = 2.1600    INTERSTITIAL OIL =  .3351
               ABSORBED OIL = 1.8244    ADSORBED OIL =  .0005

PIGMENT NO. 2  AT VOL. % .3000     PACKING FACTOR    .640232
               O.A. VALUE = 1.2300    INTERSTITIAL OIL =  .3598
               ABSORBED OIL =  .8697    ADSORBED OIL =  .0005

                    PIGMENT COMBINATION
PACKING FACTOR =    .845139
VOL. INTERSTITIAL =    .154861
VOL. ADS.    .000524
VOL. ABS.   1.537969
CPVC =    .371284
```

Removal of Water-Borne Paint Solids From Paint Booth Spray Water

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This paper addresses the problem of removing water-based paint solids from automotive spray booth water. By using cationic flotation reagents in a 10 cm diameter flotation column, it has been demonstrated that almost complete removal (>90%) of water-borne paint solids can be attained in less than 10 min retention time. The approach is suitable for current industrial water recovery tanks.

INTRODUCTION

Stringent controls are being introduced on the quantity and type of solvent released into the atmosphere by automotive manufacturers through the use of solvent-borne paints. The principal problem is that solvents are volatile organic compounds and most react photochemically with atmospheric gases to generate ozone.[1] In response, some manufacturers are now using paints with a higher nonvolatile content (decreased solvent consumption), which makes handling and application of the paints more difficult and can result in poorer quality of finish. Another response has been to employ water-borne paint as the primary base coat. This paper addresses a significant problem resulting from the latter approach, the removal of paint solids from spray booth water.

In high volume paint booths, oversprayed paint is removed from the booth by an air stream carrying it downward through a grating in the floor. This stream then passes through a series of baffles, where it is mixed with water to remove the paint droplets from the air. In order to recycle spray water, the paint first must be removed. Several methods of paint removal have been employed; a relatively common approach is to allow the paint sufficient time to rise to the surface of the water from where it can be skimmed as a sludge. Often the water is modified with a clay-based material or with a chemical system to enhance the flocculation of the paint solids and to detackify it. While these are effective for flocculating the collected paint, they may also increase the density of the dispersed paint particles sufficiently that they may settle to the bottom of the tank, which is undesirable.

The use of water-borne paints creates a problem in the conventional paint waste removal system, since the overspray largely remains dispersed in the wastewater tanks. Skimming or filtering the wastewater becomes ineffective for the removal of the paint wastes since there is no natural hydrophobicity or coagulation. This system requires that some other type of recovery system be used, since a chemical modification of the paint is considered less practical.

The objective of the work reported here was to develop a method for water-borne paint removal from the spray water tank, utilizing the present wastewater handling system at the General Motors truck plant in Oshawa, Ontario, Canada. Process constraints included:

(1) a recovery period not to exceed about 10 min, since this is the average residence time in the recovery tank;
(2) minimal (or no) sinking of the paint to the bottom of the tank, which is a significant problem with current methods; and
(3) a process that is usable with minimum structural changes to the existing recovery system.

Treatment methods for the removal of water-borne paint solids have not been extensively studied. Bottino, et al.[2] suggested ultrafiltration. In the study reported here,

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the method selected as offering the most promise of satisfying the previously mentioned constraints was froth flotation. Flotation is a physicochemical process in which particulate matter is caused to become hydrophobic by adsorption of appropriate surfactants, and is subsequently removed from the liquid through attachment to gas bubbles that are forced into the tank. Test work included surfactant selection as well as evaluation of process parameters such as surfactant dosage, paint concentration, and pH.

Table 1—Collector Properties

Collector Name	Molecular Weight	Structure	Hydrocarbon Chain Length
EHDABr	378	Cationic, quaternary	15
Arquad 12-50	263	Cationic, quaternary	12
Arquad C-50	278	Cationic, quaternary	14
Arquad 16-50	319	Cationic, quaternary	16
Arquad 18-50	347	Cationic, quaternary	18
Dowfroth 1012C	400	Neutral, glycol	—
Sodium lauryl sulfate (NaLS)	288	Anionic	11

PROCESS BACKGROUND

Froth Flotation

Froth flotation is used in several industries, both to purify the liquid carrier and to selectively separate solids carried by the liquid. For example, both the mining and oil industries use froth flotation to effect a separation of raw materials. In wastewater treatment, sewage water may be purified by flotation before release into the environment. The pulp and paper industry also uses flotation to de-ink paper before it is recycled. Froth flotation goes well beyond these uses as it is an efficient particulate separation technique suitable for the treatment of large volumes.[3,4]

In the process, solid particles suspended in the liquid undergo collisions with gas bubbles. During particle/bubble contact (typically of the order 5-30 ms) thinning of the liquid film between the particle and the bubble occurs. For those particles that are sufficiently hydrophobic, the film thinning process is rapid enough for spontaneous film rupture to occur before particle/bubble disengagement, resulting in three-phase contact and particle attachment to the bubble. Upon arriving at the surface, the solids-laden bubbles form a froth, typically 10-50 cm in depth. The primary function of the froth is particle transport over the lip of the cell.

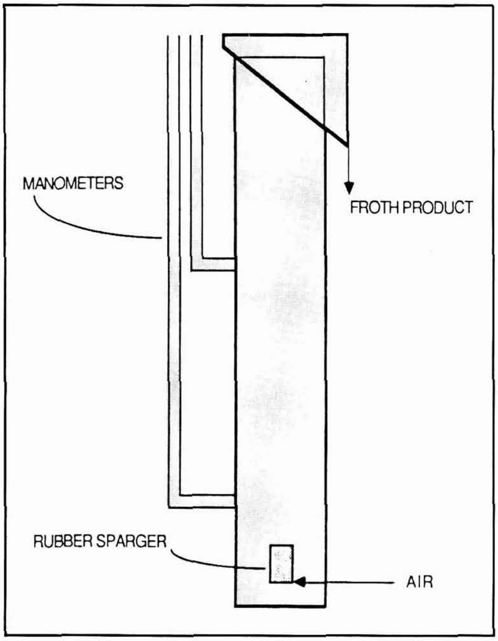

Figure 1—Batch column used for paint nonvolatile flotation

Bubbles are generated by: direct injection through a sparger; mechanical shearing at the tip of an impeller; or self nucleation (dissolved air flotation). To attain appreciable rates of particle collection, the bubbles must be small and gas rates must be reasonably high. For sparged and mechanically sheared systems bubble diameter, d_b, is typically 0.5-1.0 mm, and superficial gas velocity (gas flowrate per unit area), v_g, is 0.5-2.0 cm/s. For dissolved air flotation, d_b is typically 0.1 mm and v_g is 0.02-0.1 cm/s.[4]

Paint Composition

The composition of water-borne paint is different from that of solvent-borne paint because of the condition that each of the components must be soluble (or suspended) in water. Paint components may include resin, metal flake, solvent, and surfactant. The paint resin is an emulsion polymer made up of varying amounts of the monomers methylmethacrylate (MMA), ethylhexylacrylate (EHA), butylacrylate (BA), hydroxyethylacrylate (HEA), allylmethylacrylate (AMA), and methacrylic acid (MAA). Also contained in the aqueous phase are the pigments and melamine-formaldehyde resin, which is added to increase hardness upon baking. The function of the MAA is to help stabilize the emulsion by placing -COOH functional groups near the periphery of the polymer droplets. The polar nature of these droplets would suggest that a polar collector would be most suitable for causing the aqueous phase to become hydrophobic. Furthermore, the -COOH groups would be expected to bear a slightly negative charge, so the preferred collector would be expected to have a positively charged polar group, in other words, a cationic collector.

Metal flakes in the paint are usually aluminum and are naturally hydrophobic. The paint solvent is mostly water and contains small amounts of organic solvents and a surfactant, which is added to stabilize the dispersion. These organic liquids are generally low molecular weight alcohols, such as isopropanol, isobutanol, butoxy-ethanol, and ethylene glycol. It would not be expected that these solvents would be collected in a flotation system,

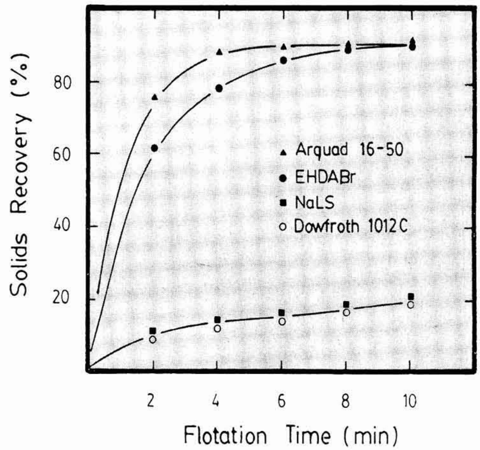

Figure 2—Effect of collector type on recovery vs time. Conditions: collector concentration—5.3 × 10^{-5} molar; paint concentration—120 ppm, pH 7

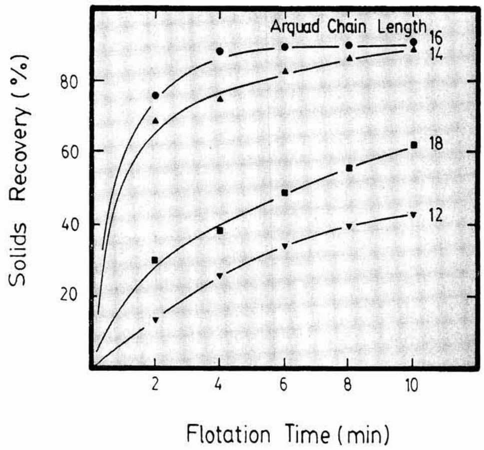

Figure 3—Effect of Arquad chain length on recovery. Conditions: collector concentration—5.3 × 10^{-5} molar; paint concentration—120 ppm, pH 7

since they are completely miscible with water. The paint also contains a small amount of a surfactant, which is added to stabilize the emulsion.

Flotation Surfactants

The two surfactants commonly employed in froth flotation are a frother and a collector. Frothers aid in the generation of small gas bubbles and help to provide froth stability. They are usually heteropolar nonionic molecules that have a polar group, such as carbonyl (– CO), hydroxyl (– OH), or ester (– COOH), attached to a nonpolar hydrocarbon chain. Frothers change the interfacial characteristics of a liquid by aligning themselves at the interface so that the polar end is within the water phase and the nonpolar end is attracted to the air interface. The net result is a lowering of the interfacial tension, favoring the formation of smaller bubbles.

A collector is used to modify the particle/water interface. Collectors may be ionic or nonionic heteropolar molecules, polymers or monomers, or oil-based materials. The function of a collector is to adsorb onto the surface of the particle to be collected, effectively making it more hydrophobic. The increased hydrophobicity of the particle then favors film thinning and the subsequent attachment of the particles to the air-liquid interface. Some collectors also exhibit frothing properties, in which case the use of a frother may not be required (as was the case in this study).

The nature of the water-borne paint resin suggests that a cationic collector would be most appropriate. A common class of cationic collectors is quaternary ammonium salt and the specific compound selected from this class for evaluation of paint flotation was ethylhexadecyldimethylammoniumbromide (EHDABr), which ionizes in water to

$$[CH_3(CH_2)_{15}](CH_3)_2(C_2H_5)N^+ \text{ and } Br^-.$$

EHDABr also possesses frothing properties, so it serves the dual role of collector and frother.

EXPERIMENTAL

The flotation cell used for these experiments was an acrylic cylinder, 10 cm in diameter by 140 cm high, with a total capacity of about 11 L (see *Figure* 1). A transparent wall permitted visual estimation of the relative concentration of the solid components of the paint (metal flake, pigment). The sparger consisted of a 6 cm diameter by 8 cm long rubber sleeve pierced with holes and clamped around a perforated steel mandrel. Air was regulated at 70 kPa and metered at 1.0 cm/s. An adjustable speed peristaltic pump was used to circulate the contents of the column prior to start of an experiment. Gas holdup was measured using two water manometers, spaced 60 cm apart.

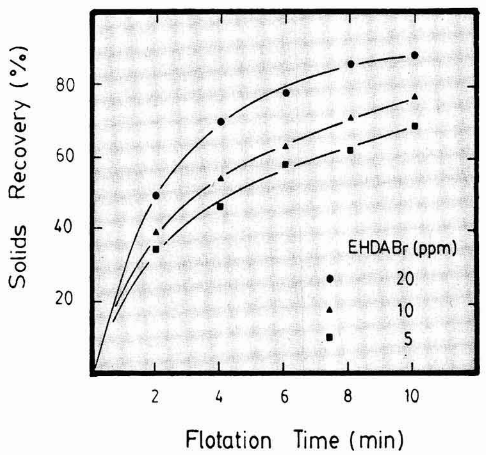

Figure 4—Effect of collector (EHDABr) concentration on recovery. Conditions: paint concentration—60 ppm, pH 5

Batch experiments were conducted by first conditioning the mixture of paint-water-collector for about five minutes, at which time the air supply was turned on (time zero). Froth overflowed the column (unaided) through a launder into a collection vessel for a predetermined time ranging from 2 to 10 min.

Paint solids content was defined as the fraction remaining after complete drying at 125°C. From six replicates the mean solids content of the as-received paint was found to be 16.65%, with a standard deviation of 0.08%. The dry portion of the paint is considered the maximum amount that can be collected; the other paint constituents (alcohol, water) remain in solution. Paint recovery from the water was calculated on the basis of measurements of mass and paint concentration of both the feed and the froth products.

The collectors tested included: EHDABr; Arquad surfactants having hydrocarbon chain lengths of 12,14, 16, and 18; neutral Dowfroth frothers; and an anionic collector, sodium lauryl sulfate (NaLS). *Table* 1 summarizes the collector properties. Arquad collectors belong to the same chemical family as EHDABr (quaternary ammonium salt) and can be considered as the commercial equivalent of EHDABr. Collector dosage was varied from 5 to 20 ppm (20 ppm EHDABr is 5.3×10^{-5} molar). Paint concentration in the water was varied from 30 to 120 ppm (total paint), which covers the approximate paint concentration expected in practice. pH was adjusted with either dilute HCl or dilute NaOH, and was tested over a range of 5-8.

RESULTS AND DISCUSSION

The flotation results, summarized in *Figures* 2 to 6 are expressed in terms of percent nonvolatile recovered to the froth product vs flotation time. In all experiments, the metal flake was observed to float at a higher rate than the pigment-resin particles.

Results for four collectors (EHDABr, Arquad 16-50, Dowfroth 1012C, and NaLS) are shown in *Figure* 2 at a collector concentration of 5.3×10^{-5} molar (20 ppm EHDABr) and paint concentration of 120 ppm. As expected from the analysis of surface charge, the cationic collectors yielded high recoveries, while the neutral and anionic collectors were relatively ineffective. (Other Dowfroth glycols tested yielded lower extractions than Dow 1012C.) At high recoveries (>85%), the water remaining in the flotation cell after 10 min of flotation was almost colorless, compared to a dark blue color prior to flotation. For recoveries less than about 85%, some blue coloration was still evident.

Water carried with the froth was minimal. The loss of water to the froth was less than 5%, and most of this would be recycled subsequent to filtration of the froth product.

The effect of hydrocarbon chain length for the Arquad series is shown in *Figure* 3. The Arquad 12 did not produce a froth stable enough to be removed. Arquad 16 and 14 (C) both gave a high collection rate and both produced an adequately stable froth. Arquad 18 produced large amounts of virtually unbreakable froth, and was therefore less effective in removing the paint.

A collector dosage of about 20 ppm EHDABr yielded a high recovery (89%) after 10 min of flotation (see *Figure* 4). The 10 min recoveries for 10 and 5 ppm EHDABr were 77 and 68%, respectively. Paint concentration also affected collection recovery. It is shown in *Figure* 5 that at a collector (EHDABr) concentration of 10 ppm the 10 min paint recovery increased from 68% at 30 ppm paint to 88% at 120 ppm paint.

Figure 6 illustrates that pH had no significant recovery effect over the pH range 5-8. The only pH effect observed was that the froth at pH 8 contained a higher moisture level than at pH 5. This caused more adhesion of the paint froth to the sides of the froth collection launder, and therefore required more careful cleaning of the apparatus. The pH range investigated was relatively narrow. How-

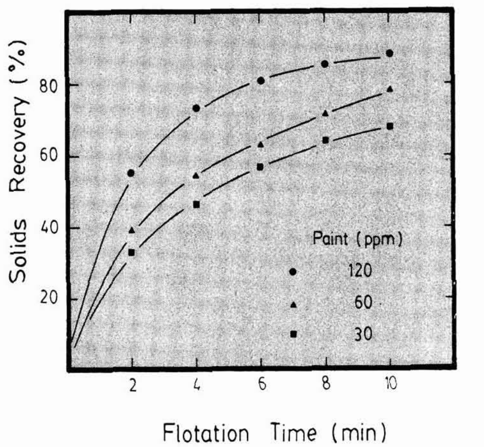

Figure 5—Effect of paint concentration on recovery. Conditions: collector (EHDABr) concentration—10 ppm, pH 5

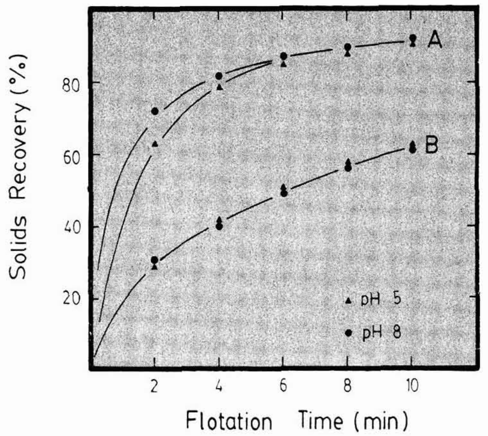

Figure 6—Effect of pH on recovery. Conditions: A—EHDABr concentration—20 ppm, paint—120 ppm; B—EHDABr concentration—5 ppm, paint—30 ppm

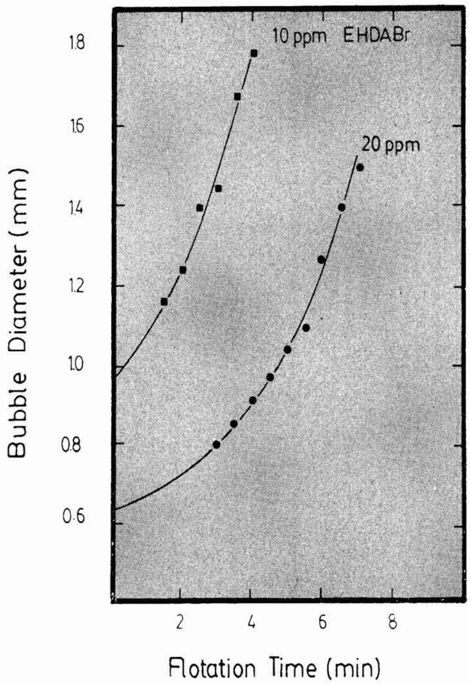

Figure 7—Mean bubble size for two EHDABr dosages as a function of flotation time. Paint concentration is 60 ppm

ever, since the collector was a strong cationic base, pH is not expected to have much influence over the intermediate pH range, e.g., 3-9.

From measurements of gas holdup and gas flowrate, bubble diameter can be estimated, using a well-defined phase velocity relationship.[5] This bubble size method has been confirmed photographically. Using the gas holdup values obtained during some of the experiments, bubble diameter vs time of flotation has been calculated and is shown in *Figure* 7 for a paint concentration of 60 ppm and two collector dosages, 10 and 20 ppm EHDABr (for a bubble diameter of 1 mm, gas holdup was about 10%). The higher EHDABr concentration clearly produced smaller gas bubbles, indicating again that the collector does exhibit frothing properties. As the collector was consumed during the experiment, bubble size increased.

For fine particles, the rate of particle collection by a bubble is approximately proportional to d_b^{-2}.[6] Thus, a significant cause of improved paint solids recovery at the higher collector dosage can be ascribed to the generation of smaller bubbles; a higher level of particle hydrophobicity would also be expected. Since the paint also contains a small quantity of surfactant, the increase in recovery with increased paint concentration may be also attributed to a bubble size effect.

SUMMARY

Froth flotation using a cationic collector has been shown to be an efficient method for removing water-borne paint solids from automotive spray booth water. At a collector dosage of about 20 ppm, 85 to 90% paint solids removal is achieved in less than 10 min. This reduces the water to a colorless state. Application on an industrial level should be relatively straightforward, as the flotation system can be easily adapted to most existing industrial water recovery tanks.

ACKNOWLEDGMENTS

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Predicting White Hiding Power

Fred B. Stieg
PigmenTech Consulting*

Introduction

The several mechanisms that determine the hiding power produced by any given loading of titanium pigment have been recognized for many years, but relatively little use has been made of that knowledge to predict how specific paint formulas might be altered to provide the required hiding power using a reduced amount of titanium dioxide. Most paint laboratories adhere to the rule "If it works, don't fix it!" However, with titanium dioxide in short supply, supporting continued price increases, it is important that paint manufacturers employ much closer control over the use of this essential commodity than many may have at the time their stock formulations were originally developed.

Many such products, for example, have been formulated at lower solids than necessary from an application standpoint, in the mistaken belief that low solids are directly related to lower costs. *It requires more titanium dioxide, however, to produce a given level of hiding power at low solids than it does at higher solids*, and costs at higher solids may prove to be lower, for that reason, rather than higher.

In addition, some of these products will contain titanium pigments of relatively low titanium content, having been developed at a time when such pigments were being actively promoted by their suppliers as producing higher dry-hiding power in flat latex paints. Titanium pigment content may be reduced, without lowering titanium dioxide content, by simply switching to an enamel grade, and developing high dry-hiding by increasing PVC, or by utilizing high oil-absorption extenders, to create the dry-film porosity that actually produces the effect.

One reason that many products are still consuming an excessive amount of titanium pigment, relative to the hiding power developed, has been the fact that most formulators find the task of making an acceptable match for any existing product even more difficult than its original development. Before it had been added to the product line, no hard-and-fast specifications existed as to its washability, angular sheen, hiding power, or tinctorial strength. Now, extensive laboratory work will be required on any new product that is to take its place, because each of those properties has become a performance standard.

It has been said that "The paint industry spends thousands of dollars trying to save cents per gallon!" While this quote was intended as a criticism by someone with a fine disdain for the profit motive, it has been all too true in the past because of the large number of man-hours consumed by experienced personnel in the formulation, preparation, and evaluation of laboratory test batches. It is the purpose of this article to demonstrate that much of the expensive experimentation is unnecessary, removing one of the more common objections that may be raised to the idea of product reformulation for greater efficiency.

Measurement of White Hiding Power

It is probable that the problem contributing most to the well-known reluctance of most paint formulators to modify any product once it has been accepted for one of the company's standard product lines is the excessive amount of time that will be required to accurately match the hiding power and tinctorial strength of the original, particularly in the case of a flat wall paint with "high dry-hiding" to duplicate. The lack of time and manpower is always a strong argument in favor of maintaining the status quo.

As a matter of fact, existing methods for determining absolute hiding power are so complex and time-consuming that they find little use outside the research laboratories of pigment suppliers. The complexity arises from the fact that there is no method of adequate accuracy for the direct measurement of wet-film thickness, making it necessary to calculate wet-film thickness from the measured weight of a known area of dry film, the measured percent solids by weight, and the measured density of the wet paint. These measurements must be made with

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great precision if the end result is to be even moderately accurate.

So many potential sources of error exist that accuracy can be assured only by a considerable number of replications at every stage of each procedure. In the case of those procedures employing the Kubelka-Munk theory to calculate the K-M "scattering coefficient," some additional problems are added by a need to calculate what the wet-film thickness would be if the dry-film contrast ratio were actually 98%.

Since the K-M scattering coefficient has been shown to vary with the film thickness at which it is determined, the need for replication arises not only from the nonuniformity of film application, but also from the fact that it is necessary to first determine the applicator clearance that will come closest to providing 0.98 contrast ratio for the tested paint—increasing the similarity of results. This is one required aspect of ASTM Method D 2805's claim to precision.

In practice, therefore, outside the research laboratories, hiding power is commonly evaluated by various comparative methods that are somewhat less time-consuming, but they still require the sequential preparation of test batches to be physically evaluated. This trial-and-error procedure is a major contributor to the total time consumed.

The side-by-side drawdown is a common feature of most of these methods, due to the general conviction that any simultaneous application will eliminate the variable film thicknesses resulting from variations in application rate, but too many fail to appreciate that differences in wet-paint rheology can still result in errors as large as 100%, while pigmentation changes tend to create such differences.

Of the simultaneous drawdown methods, by far the most accurate is the "tinting strength" method employed by titanium pigment producers for control purposes (a modification of ASTM's Method D 2745), because it eliminates any need to determine actual film thickness, so long as the substrate is completely obscured. Relative hiding power is calculated from measured reflectances using the K-M theory. Tinting must be carried out very precisely, using an analytical balance, and reflectance readings made to at least three decimal places in triplicate, so that "R" may be calculated to four places by averaging the results. This method is less time-consuming than ASTM's Method D 2805 for "absolute" hiding power, and is potentially more accurate for comparative values, but colorant interaction (flooding, floating, and/or flocculation) has been found to be a problem by some.

Factors Affecting White Hiding Power

While some theorists may question how precisely all of the necessary factors may be quantified, few will quarrel with the following observations:

(1) The hiding efficiency of titanium pigment, expressed as either sq ft per pound at 0.98 contrast ratio, or K-M scattering coefficient, is constant below an effective PVC of about 10%.

(2) The hiding efficiency of titanium pigment decreases as effective PVC (or volumetric concentration in the film) is increased above 10% by either adding titanium, or removing other solids.

(3) For given volumes of titanium pigment, extender, and binder, the effective PVC decreases with an incease in extender dilution efficiency.

(4) For given volumes of titanium pigment, extender, and binder, the effective PVC decreases with increasing dry-film porosity.

(5) For a given volume of titanium pigment and a given effective PVC, the hiding efficiency of titanium dioxide increases with increasing dry-film porosity, as a function of Fresnel reflectivity.

(6) All else being equal, hiding power per gallon is directly proportional to percent total solids by volume.

(7) All else being equal, dry hiding power in latex paints increases as polymer binding power index decreases.

The Mathematical Approach

Few of the previously detailed factors may be identified by calculation alone. The calculation of film porosity, for example, requires the experimental determination of volumetric oil absorption (mL oil/mL pigment). This necessarily introduces the possibility of experimental error, although it is somewhat less for the volumetric procedure than for the original "spatula rub-out" method based upon weight (ASTM Method D 281). As previously published in the literature:

1-PI = (1-PVC) / (PVC × OA)
where PI = porosity index
PVC = formulation PVC
OA = volumetric oil absorption

Since the term "PI" is equal to the volume percentage of air in the binder/air mix of the dry paint film, "1-PI" becomes equal to the volume percentage of binder, and:

vol binder/ (1-PI) = vol binder + vol air

The volume of air is necessary for calculating the effective PVC of the titanium dioxide in porous paint systems, as will be shown later.

The same terms related to porosity are necessary for calculating the average refractive index of the binder/air mix and the Fresnel reflectivity of the pigmented system:

average refractive index =
1.00 + 0.5 (1 − PI)
for rutile, F = [(1.22 + 0.5 PI) /
(4.22 − 0.5 PI)]ˆ2
where F = Fresnel reflectivity

Since the Fresnel reflectivity of rutile titanium dioxide in a nonporous system is equal to [(2.72 − 1.50) / (2.72 + 1.50]ˆ2, or 0.08358, the hiding efficiency of titanium dioxide in a porous system will be increased by a ratio that will be called the "porosity factor":

porosity factor = F/0.08358 = 11.96 F

The relative hiding efficiency of titanium pigment in the presence of extenders is known to be related to both the particle size and particle size distribution of the extender combination. Essentially all extenders, except the coarsest, have some effect upon the so-called spacing of titanium pigment in a dry paint film. The term "spacing" has assumed an exaggerated importance to some in terms of uniformity of TiO_2 particle separation, but the volume concentration of the total pigment establishes the average center-to-center spacing of its TiO_2 "core," rather than volume concentration of TiO_2.

It is possible to experimentally derive a numerical rating representing the apparent volume percentage of a tested extender that is contributing to this spacing, the so-called "Dilution Efficiency." This has been found to vary in the same rank order as mean particle diameter, from a high of E_d = 1.00, at or below a mean particle diameter of about 0.75 mm, down to E_d = 0.0 for mean particle diameters exceeding 10 mm. Values are only approximate.

There are existing differences of opinion as to whether the overall effect of extenders upon hiding power should be attributed to a detrimental "crowding effect" due to the larger particles present, while the finer particles make no contribution of any kind, or to a beneficial "spacing effect" from the finer particles, without any detrimental effect produced by the larger ones. Generally speaking, the crowding theory seems to be espoused by the manufacturers of titanium pigments and the spacing theory by the producers of fine particle size extenders. It all depends upon how similar experimental observations have been interpreted, both lacking any hard scientific explanation.

No differences of opinion exist as to the fact that hiding power is increased when a coarse extender is replaced with a finer extender, or the fact that PVC may be raised by replacing vehicle solids with fine particle size entender without causing the efficiency of the titanium content to be reduced, while its efficiency will be reduced by using a coarser extender for the purpose. These facts may be predicted mathematically, using the effective PVC concept and E_d values, irrespective of how they may be interpreted.

Effective PVC

The "effective PVC" is a term used to describe the effective volumetric concentration, or dilution, of titanium pigment in a paint film, as distinct from that volumetric concentration that may be calculated by simply dividing the volume of titanium dioxide present by the volume of total solids, as sometimes has been done in research work.

This differentiation is necessary for predicting the hiding efficiency of the titanium pigment, since the effective volume of a dry film will be diminished by the degree to which its extender content departs from the particle-size distribution required of a perfect "spacer," and increased by the volume of entrained air present due to porosity. The former may be accounted for by consideration of the extender dilution efficiency (E_d) and the latter by use of the porosity index (PI) calculated from total pigment volumetric oil absorption:

$$\text{eff PVC} = \text{vol } TiO_2/\text{vol } [TiO_2 + \text{extender} \times E_d + \text{binder}/(1\text{-PI})]$$

where TiO_2 = titanium pigment, as used

Basic Hiding Power Equation

The original relationship between the hiding power of rutile titanium pigment and volumetric concentration in a dry paint film was derived semi-empirically from a large volume of data for single-pigment alkyd systems, accumulated over a period of several years. In its original form, it could be written as:

$$HP = 370\,[1 - 1.1054 \times PVC^{\wedge}(1/3)]$$

where HP = hiding power per lb TiO_2, as used

This equation reproduced the averaged experimental values over a range of 10 PVC-45 PVC with an average deviation of only 0.87%, which is less than the average deviation to be expected between repeat determinations by the same operator, using ASTM Method D 2805, for similar formula types (alkyd enamels or semi-gloss).

Data for anatase titanium pigment in similar systems could be reproduced with an equation differing from this equation only in the value of the constant outside the brackets (370); for anatase, this constant possessed the value of 298. The ratio of 370/298 was found to be the same as the ratio of Fresnel reflectivity for the two pigments, from which it was deduced that an equation for either might be written:

$$HP = F \times 4427\,[1 - 1.1054 \times PVC^{\wedge}(1/3)]$$

Since the Fresnel reflectivity "F" is as much a function of the refractive index of the medium in which the pigment is dispersed as it is of the refractive index of the pigment, it was also deduced that this term might provide a way to incorporate the "porosity factor."

All-Purpose Hiding Power Equation

To be of practical value, the prediction of hiding power must do more than provide an absolute hiding power value for one type of titanium pigment in a single pigment, nonporous alkyd system. It must be applicable to the calculation of hiding power per gallon of any type of paint, as applied, water-based as well as solvent-based.

Much of this added versatility was supplied by replacing the formula PVC term with the "effective PVC" of the titanium pigment used. This replacement makes it possbile to account for differences in extender dilution efficiency, and to add the volume of entrained air to the total dry-film volume.

The additional effect of this entrained air on Fresnel reflectivity is obtained by simply multiplying by the previously described porosity factor.

The transition from hiding power per pound of TiO_2 to hiding power per gallon of paint is simple, but it provides an opportunity to introduce a necessary term for the variable TiO_2 content of different grades of titanium pigment. It is only the TiO_2 content of a pigment that produces hiding power, although the high oil-absorption produced by voluminous surface treatment will increase dry-film porosity.

This also means that the constant, 370, of the basic equation must be modified to account for the fact that the original data was based upon pigment containing only 95% TiO_2. No adjustment needs be made to accommodate this fact when calculating effective PVC, since the center-to-center spacing of a pigment is not related to its TiO_2 content. These modifications and additions result in the following form of the hiding power equation:

$$HP/gal = TiO_2/gal \times F \times 4660\,[1 - 1.1054 \times \text{eff } PVC^{\wedge}(1/3)]$$

where TiO_2 = pigment as used × % TiO_2 content

Latex Systems

The Fresnel reflectivity (F in the previous equation) for a porous latex paint film is higher than for a solvent-based system of otherwise similar composition because of lower "binding power" in the latex vehicle. The binding power index (BPI) becomes a factor in calculating the average refractive index for the binder/air mix in the dry paint film:

$$\text{average refractive index} = 1.00 + 0.5\,(1 - PI) \times BPI$$

The determination of BPI for the latex vehicle to be employed would detract from the time to be saved by eliminating the hiding power determination were it not for the fact that its actual value will make no difference in the relative hiding power of any two paints formulated with the same latex vehicle. Since this condition would normally pertain in the reformulation process, and since the BPI is seldom found outside the range of 0.65-0.75, an estimated value somewhere in this range is considered adequate for practical purposes.

Experimental work has shown that BPI increases with decreasing latex particle size and with decreasing glass transition temperature. These data are usually available, and can help in arriving at an estimate.

Experimental Procedure

Experimental proof of the accuracy of the basic hiding power equation has appeared in a number of publications, but this has not been true for the modified "all purpose" equation that has been the subject of this article, although it has been in practical use for a number of years. To remedy this deficiency, a test series of flat latex paints was designed, prepared in a laboratory high-speed disperser, and evaluated for relative white hiding power by the "tinting strength" method of ASTM's D 2745.

Three different grades of titanium pigment, ranging in TiO_2 content from 80%

Table 1—Flat Latex Paint A-55

	Lb	Gal
Water	453.5	54.4
Ethylene glycol	9.3	1.0
Defoamer	1.0	0.1
Thickener	5.0	0.4
KTPP	0.4	—
Wetting agent	3.4	0.4
TiO_2 "A" (80%)	175.0	5.7
Calcined clay	75.0	3.4
Calcium carbonate	165.7	7.3
Dispersing agent	4.3	0.5
Defoamer	1.0	0.1
PVA latex (55%)	241.5	26.5
	1135.1	99.8

% PVC — 55.0 % Solids (v) — 30.0

to 93%, were used in the series, each at formula PVC's of 55%, 60%, and 65%. The titanium pigment loading was the same, by weight, in each formulation (175 lb), the balance of the pigmentation being made up of two extenders of markedly different particle size. One, a fine particle size calcined clay, was kept constant at 75 lb in each pigmentation, while the other, a natural dry-ground calcium carbonate with a mean particle diameter of 5.5 μm, was varied to compensate for differences in the densities of the three titanium pigments and to replace vehicle solids when adjusting the formula PVC. Total solids were held constant, as were the total volume and composition of the additives used.

The formulation of *Table* 1, incorporating Pigment "A" (80% TiO_2) at a formula PVC of 55%, is representative of the rest of the series.

Dry-blends were made of each of the nine pigmentations before preparing the test paints, and volumetric oil absorption determined for each by the spatula rub-out method (ASTM D 281).

An 8 fl oz aliquot of each test batch was tinted with 1 g of dispersed lampblack (weighed to four places on an analytical balance) hand-stirred until uniform, and set aside overnight before testing. Drawdowns were then made on gray lacquered cardboard panels, using a 0.006-in aperture, after re-stirring.

The drawdowns were allowed to dry overnight in a horizontal position. Reflectance readings were then made in triplicate, using a Colormaster reflectometer, and the readings averaged ("R" in *Table* 2) to four decimal places. Kubelka-Munk "K/S" values were next calculated, using the following equation:

$$K/S = [(1 - R)^2]/2R$$

where K = absorption coefficient
S = scattering coefficient
R = dry-film reflectance

The value of K was assumed constant for all samples (an assumption justified in the literature), permitting relative white hiding power (HP_r) to be calculated by setting S equal to 100 for the sample with the lowest reflectance (C-55 in *Table* 2), which yielded a hypothetical value of 37.9 for K.

Hiding power per gallon was calculated for all test formulations based upon composition and the previously determined oil absorption values. These were used to produce a second series of predicted HP_r values that could be directly compared with those obtained experimentally. The predicted HP/gal for formula C-55 was assigned an HP_r value of 100 to provide a uniform basis for the comparison.

Predicted vs Experimental Results

The experimental data and calculated results for the test series are given in *Table* 2. An assumed value of 0.70 for the latex vehicle BPI was employed in the hiding power predictions. As previously noted, any error in this assumed value would not affect relative hiding power values—only the reported absolute values. Based upon mean particle diameter, dilution efficiency was assumed to be 1.00 for the clay, and 0.15 for the calcium carbonate.

Using all of the data, the average percent deviation of the predicted HP_r values from the experimental is 1.64, with a standard deviation of 2.24 — which strongly suggests an experimental error, since a value of 7.79 for formula A-65 is more than three times the standard deviation.

If this questionable value is thrown out, the average percent deviation is 0.87 (with a standard deviation of 0.56), which is the same as for the original alkyd enamel data, despite the added variable of porosity.

It should be noted, however, that even a deviation of 7.79% is well within the average variation accepted for a repeat determination by the same operator using ASTM Method D 2805. This "referee method" is none too accurate for porous flat wall paint formulations.

Limitations

Although, in this instance, the accuracy of prediction was extremely good for relative white hiding power, there is no proof that the absolute hiding power values are equally accurate. The predicted values are necessarily based on an assumption of reasonably good dispersion, while actual hiding power would reflect any deficiency in the manufacturing process, or in the dispersability of selected pigments and extenders. The predicted values also ignore any effect of absorption.

In reformulation work, these factors are generally constant, and do not affect relative values, but an occasional problem can arise from the use of an ultra-fine particle size extender with poor dispersing characteristics as a "spacer." When poorly dispersed, such an extender will not develop the dilution efficiency, nor the oil absorption, upon which the hiding power prediction has been based. The overall effect can reduce dry hiding power well below the predicted level.

Fortunately, such problems are rare in practice since there is no real advantage to be gained from any particle size below about 0.75 μm, and cost generally increases as particle size is reduced, making the choice of an excessively fine extender rather impractical.

Applications

The ability to accurately calculate the effect of any proposed formula change upon hiding power confers the ability to accurately compare the cost, or relative desirability, of matching hiding power by various different formula changes:

(1) Hiding power may be matched at lower titanium contents by replacing titanium pigment with spacing extender, calculating the effect upon hiding power, returning hiding power to its original level by increasing total solids, and calculating resultant cost. By using decreasing amounts of titanium pigment, the composition producing matching hiding power at minimum cost may be identified.

(2) The cost effectiveness of various extenders may be evaluated by substituting the E_d of one for the other, adjusting to a hiding power match, and recalculating total cost.

(3) For porous paint systems, dry-film porosity may be matched, as well as hiding power, by adjusting formula PVC to match the original value of PI, using the value of OA_v for the new pigmentation.

(4) Hiding power may be matched at different dry film porosities, and relative costs compared.

Table 2 — Experimental Verification

Formula	Experimental R	Experimental HP_r	Predicted HP/Gal	Predicted HP_r	% Deviation
A-55	0.4680	125	323	124	0.80
B-55	0.4584	118	310	119	0.85
C-55	0.4295	100	260	100	0.00
A-60	0.4860	139	356	137	1.44
B-60	0.4774	133	340	131	1.50
C-60	0.4405	106	278	107	0.94
A-65	0.5033	154	369	142	7.79
B-65	0.4913	143	366	141	1.40
C-65	0.4538	115	300	115	0.00

(5) The desirability of replacing one grade of titanium pigment for another may be determined by comparing costs at matching hiding power.

All of the above may be accomplished without the preparation and evaluation of laboratory test grinds. While many of the calculations are complex, field testing has proved that all of the described interrelationships are easily handled by computer.*

*Reformulating software is available from PigmenTech Consulting, 903 Beachview Drive, Jekyll Island, Ga 31520.

Summary

Much of the time-consuming preparation and evaluation of test batches in the paint laboratory, when modifying standard products for greater cost efficiency, or adapting to the changing cost and/or availability of raw materials, may be eliminated by basing such work upon predicted hiding power.

The technology has been developed to allow such predictions to be made with a degree of accuracy that is superior to most of the experimental test methods in everyday use by working paint formulators.

The greatest value of this technology does not lie in the providing of absolute hiding power values, however, but in the conferred ability to evaluate, and/or to match the performance of existing products and raw materials without trial-and-error experimentation.

When the necessary equations have been embodied in a computer program, work that formerly required the services of an experienced formulator may be performed by a semi-skilled technician.

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Pigments

Polymeric Components

Polymers

Pretreat Application

Solvents

Substrates

Alphabetical Listing of Papers

A

B

C

Letters to the Editor

Author Index

A

B

C

D

E

F

G

H

I

Constituent Society Papers

BALTIMORE .... SEPT.

"Environmental Update"

Joseph D. Giusto was re-elected Society Representative to the Federation Board of Directors.

The meeting's speaker was Hugh M. Smith, of Sun Chemical Corp. Dr. Smith's presentation was an "ENVIRONMENTAL UPDATE."

The speaker's talk centered on the workplace and the environment. He explained the new guidelines issued by OSHA for their inspectors and the detailed ways to check MSDS sheets. Dr. Smith stated that EPA would like to use a standardized MSDS sheet throughout the industry.

Threshold limit values, permissible limit values, and recommended limit values were discussed by Dr. Smith. He said hazardous waste sites will be diminishing and the cost to each company would probably increase 10 times in the next decade.

According to the speaker, an EPA list of 39 materials that have to be pretreated before disposal has been issued. New EPA proposals on municipal landfills would be regulated by imposing Federal Standards on nonhazardous wastes, stated Dr. Smith.

GARY MORGERETH, *Secretary*

CHICAGO................ SEPT.

"New Multi-Purpose Coalescent"

John Wamelink, of Reichhold Chemicals, Inc., was elected Society Representative to the Federation Board of Directors.

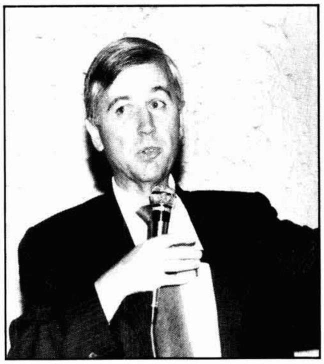
The evening's first speaker was William D. Arendt, of Velsicol Chemical Corp. Mr. Arendt's topic was "ISODECYL BENZOATE, A NEW MULTI-PURPOSE COALESCENT FOR LATEX PAINT."

The speaker said isodecyl benzoate recently was established as a viable, cost effective coalescing aid alternative to the existing general use alcohol-ester type coalescent. The coalescent was evaluated as a coalescing aid in interior flat, semi-gloss, and high-gloss paints and in an exterior low sheen paint formulation versus a commercial coalescent control. The coalescent was tested for color and gloss retention, scrubability, porosity, minimum film forming temperatures of the coating, and stability.

The second speaker was Wayne A. Kraus, of Hercules Incorporated. Mr. Kraus, a member of the Philadelphia Society, discussed "FORMALDEHYDE FREE KITCHEN CABINET FINISHES."

Mr. Kraus compared the technology of alkyd/urea-formaldehyde finishes, for many years the preferred finish used by kitchen cabinet manufacturers, with nitrocellulose/urethane materials in kitchen cabinet applications. He said that alkyd/urea-formaldehyde acid catalyzed coatings or conversion varnishes, are under scrutiny by OSHA because of their formaldehyde content. The speaker stated that nitrocellulose/urethane lacquers are formaldehyde free, tested to National Kitchen Cabinet Association standards, and adaptable to conveyor line schedules. Mr. Kraus concluded that the parameters for pot life, cure speeds, and oven resistance times and temperatures were shown to be acceptable for the urethanes in today's production environments.

KARL E. SCHMIDT, *Secretary*



ISODECYL BENZOATE — William D. Arendt, of Velsicol Chemical Co., speaks at the September meeting of the Chicago Society. Mr. Arendt's topic is "Isodecyl Benzoate, a New Multi-Purpose Coalescent for Latex Paint"

LOS ANGELES........... SEPT.

"Formation of Latex Films"

A moment of silence was observed for Mark W. Kelly, of TCR Industries, Inc., and Bill Mark, who died recently.

The officers for 1988-1989 were installed as follows: President—Melinda K. Rutledge, of Allo Colouring Co.; Vice President—Parker Pace, of Behr Process Corp.; Secretary—James D. Hall, of Sinclair Paint Co.; and Treasurer—James F. Calkin, of E.T. Horn Co.

Ms. Rutledge, the first female President of the Society, was presented the President's Gavel by Robert Backlin, of Nuodex Hüls.

Jan P. Van Zelm, of Byk Chemie U.S.A., continues as Society Representative to the Federation Board of Directors.

Environmental Committee Chairman Dave Muggee, of E.T. Horn Co., reported that Congress has directed the EPA to take broader responsibilities on lead based paint testing and abatement standards. He also said that SCAQMD has decreased the allowable emissions of VOC from lacquers

1988-89 CHICAGO SOCIETY OFFICERS (l-r): FSCT Executive Committee Member — Richard M. Hille; Treasurer — Theodore J. Fuhs; Ronald A. Lawrence; President — Evans Angelos; Membership Committee Chairman — William W. Fotis; Society Representative — John Wamelink; Vice President — Kevin P. Murray

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Snyder's Willow Grove, Linthicum, MD). GARY MORGERETH, McCormick Paint Works, 2355 Lewis Ave., Rockville, MD 20851.

BIRMINGHAM (First Thursday—Strathallen Hotel, Birmingham, England). D.A.A. WALLINGTON, Ferro Drynamels Ltd., Westgate, Aldridge, West Midlands, England WS9 8YH.

CDIC (Second Monday—Sept., Dec., Mar. in Columbus; Oct., Jan., Apr. in Cincinnati; and Nov., Feb., May in Dayton). W.E. "BUDDY" WHITLOCK, Ashland Chemical Co., P.O. Box 2219, Columbus, OH 43216.

CHICAGO (First Monday). KARL E. SCHMIDT, Premier Paint Co., 2250 Arthur Ave., Elk Grove Village, IL 60007.

CLEVELAND (Third Tuesday—meeting sites vary). RICHARD J. RUCH, Kent State University, Dept. of Chemistry, Kent, OH 44242.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). RHONDA MILES, Union Carbide Corp., 2326 Lonnecker Dr., Garland, TX 75041.

DETROIT (Second Tuesday—Ukrainian Cultural Center, Warren, MI). LIANA CALLAS ROBERTS, A.T. Callas Co., 1985 W. Big Beaver, Suite 308, Troy, MI 48043.

GOLDEN GATE (Monday before third Wednesday—Alternate between Francesco's in Oakland, CA and Holiday Inn in S. San Francisco). JACK DUIS, Pacific Coast Chemical, 2424 Fourth St., Berkeley, CA 94710.

HOUSTON (Second Wednesday—Look's Sir-Loin Inn, Houston, TX). MICHAEL G. FALCONE, International Paint (USA) Inc., 17419 Little Shoe Ln., Humble, TX 77396.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). MARK ALGAIER, Hillyard Chemical, P.O. Box 909, St. Joseph, MO 64501.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). JAMES D. HALL, Sinclair Paint Co., 6100 S. Garfield Ave., Los Angeles, CA 90040.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). JAMES SIMPSON, Reliance Universal, Inc., Resins Div., 4730 Crittenden Dr., P.O. Box 37510, Louisville, KY 40233.

MEXICO (Fourth Thursday—meeting sites vary). GERARDO DEL RIO SEC, G.B.W. De Mexico, S.A., Poniente 116 No. 576, Nueva Industrial Vallejo, 02610 Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Bill Wongs Restaurant, Montreal). ROBERT BENOIT, NL Chemicals Canada Inc., 4 Place Ville-Marie, Ste. 500, Montreal, Que., H3B 4M5 Canada.

NEW ENGLAND (Third Thursday—Sheraton, Lexington, MA). ARTHUR LEMAN, Samuel Cabot Co., 100 Hale St., Nebt, MA 01950.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). ROGER P. BLACKER, Whittaker, Clark & Daniels, Inc., 1000 Coolidge St., So. Plainfield, NJ 07080.

NORTHWESTERN (Tuesday after first Monday—Jax Cafe, Minneapolis, MN). TERRY STROM, Ti-Kromatic Paints, Inc., 2492 Doswell Ave., St. Paul, MN 55108. WINNIPEG SECTION (Third Tuesday—Marigold Restaurant, Winnipeg). EDWIN R. GASKELL, Guertin Bros. Coatings & Sealants Ltd., 50 Panet Rd., Winnipeg, MB, R2J OR9 Canada.

PACIFIC NORTHWEST (PORTLAND SECTION—Tuesday following second Wednesday; SEATTLE SECTION—the day after Portland; BRITISH COLUMBIA SECTION—the day after Seattle). JOHN BERGHUIS, NL Chemicals Canada Inc., 3450 Wellington Ave., Vancouver, B.C., V5R 4Y4 Canada.

PHILADELPHIA (Second Thursday—Williamson's GSB Bldg., Bala Cynwyd, PA). CHRISTOPHER H. HUHN, Loos & Dilworth, Inc., 61 E. Green Ln., Bristol, PA 19007.

PIEDMONT (Third Wednesday—Ramada Inn Airport, Greensboro, NC). GARY L. WATERS, Sadolin Paint Products, Inc., P.O. Box 669, Walkertown, NC 27051.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). CAROL STORME, Valspar Corp., 2000 Westhall St., Pittsburgh, PA 15233.

ROCKY MOUNTAIN (Monday following first Wednesday—Holiday Inn North, Denver, CO). BRUCE REHMANN, Komas Paint, 1201 Osage St., Denver, CO 80204.

ST. LOUIS (Third Tuesday—Salad Bowl, St. Louis, MO). TERRY GELHOT, Rockford Coatings Co., 1825 Avenue H, St. Louis, MO 63125.

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; and MIAMI SECTION—Tuesday prior to Central Florida Section). JAMES R. SALISBURY, Union Carbide Corp., 2043 Steel Dr., Tucker, GA 30084.

TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). GERRY PARSONS, DeSoto Coatings Ltd., 895 Rangeview Rd., Mississauga, Ont., L5E 3E7 Canada.

WESTERN NEW YORK (Third Tuesday—meeting sites vary). MARKO K. MARKOFF, 182 Farmingdale Rd., Cheektowaga, NY 14225.

and other coatings for wood furniture and cabinets. According to Mr. Muggee, their goal is the use of water-based coatings by 1996. In 1989, 1992, 1994, and 1996 there will be graduated decreases in the amount of VOC allowed.

In addition, Mr. Muggee stated that Governor Deukmejian has vetoed a bill to allow the public to vote on a measure to bring state, county, and municipal agenies and water districts under the authority of Proposition 65.

The meeting's speaker was Dennis H. Guthrie, of The Dow Chemical Co. Mr. Guthrie spoke on "HUMIDITY AND TEMPERATURE EFFECTS UPON THE FORMATION OF LATEX FILMS 'COMPENSATED BY COALESCING AGENTS.'"

The speaker discussed humidity and temperature on film formation, the most significant factors in making a switch from solvent to water-borne systems in the VOC compliance effort. Mr. Guthrie stated that humidity and temperature have been investigated from a theoretical computer model and with laboratory investigation. The data he presented demonstrated how the selection of a proper coalescent package can help compensate for atmospheric conditions that can be encountered during the application of latex coatings.

Mr. Guthrie presented information on the use of seven commercially available coalescents on two distinctly different latexes. Two of the most important properties of a coalescent are: efficiency of the coalescent in lowering the minimum film formation temperature of the specific latex used; and evaporation rate of the coalescent and the effects of this on film formation, and the hardness development speed.

Q. Do any of the coalescents you discussed form azeotropes with water? If so,

CABINET FINISHES — Philadelphia Society member Wayne A. Kraus, of Hercules Incorporated, lectures on "Formaldehyde Free Kitchen Cabinet Finishes" at the Chicago Society September meeting

how does this effect their performance as humidity changes?

A. Yes, two of them do, EB and DB. Apparently, the azeotrope formation and the effect of humidity on the evaporation of EB is not drastic. EB evaporates so quickly anyway, that the azeotropic effect is not large. However, with DB, that apparently is not the case. It is something that I have meant to reverify in the laboratory but have been unable to do so. Initial investigations indicate that, indeed, DB can be a bit of a self-monitoring coalescent from the standpoint that if the humidity increases the azeotropic effect of DB will increase. More water will be absorbed and the evaporation rate of DB therefore will be decreased. It can have a self compensating effect, although not completely under a high humidity situation.

JAMES D. HALL, *Secretary*

PITTSBURGH .... SEPT.

"New Performance Solvents"

David Darr, of Union Carbide Corp., was the meeting's speaker. Mr. Darr gave a slide presentation on "NEW PERFORMANCE SOLVENTS FOR HIGH SOLIDS AND WATER-BORNE COATINGS."

The speaker discussed the increasing use of water-borne coatings throughout the coatings industry. He stated that this increase has led to the demand for efficient coalescing solvents. Mr. Darr explained that the need could be met through the use of propylene oxide-based glycol ethers because they exhibit excellent performance properties.

M. CAROLE STORME, *Secretary*

ST. LOUIS .... SEPT.

"Additives"

Chicago Society member Patrick Gorman, of Nuodex Hüls, presented the President's gavel to Robert L. Wagnon, of Mozel, Inc.

Mr. Wagnon awarded Society Representative John Folkerts, of Futura Coatings, Inc., with a 25-Year Pin.

Al Zanardi, of C.L. Smith, is Chairman of a new committee in charge of developing guidelines whereby scholarship monies will be distributed.

Technical Committee Chairman Michael R. Vandemark, of the University of Missouri-Rolla, will set up a program at Rolla for his students to work on a technical project. The students' work will be monitored by the Society.

The technical speaker for the evening was Rudy Berndlmaier, of King Industries. Mr. Berndlmaier, a member of the New York Society, talked on "ADDITIVES."

The speaker discussed the trend toward lower VOC coatings which makes it necessary to re-evaluate additives. He stated that in higher solids coatings, an additive must minimize application viscosities and eliminate surface defects without affecting recoat, settling, color stability, and sagging.

Mr. Berndlmaier said traditional additives used in conventional coatings are less effective in high solids systems. Also, greater demands are being put on additive performances.

According to the speaker, low VOC formulations must optimize the following properties: selection of dispersants and flow agents along with ways to determine their optimum levels; viscosity reductions with prevention of sagging; and catalyst selection.

TERRY GELHOT, *Secretary*

LOS ANGELES SOCIETY — Robert Backlin, of Nuodex-Hüls, presents Melinda K. Rutledge, of Allo Colouring Co., with the President's Gavel

Elections

BIRMINGHAM

Active

WARNE, PHILIP A.—Polyvinyl Chemie, Downs Barn Mkeynes, Bucks.

C-D-I-C

Active

CULHANE, WILLIAM J.—MEAD, Chillicothe, OH.
RAY, ROBERT D.—Lilly Industrial Coatings, Indianapolis, IN.

Associate

FRESHWATER, MARK A.—Hoechst Celanese, Erlanger, KY.
RIES, STEPHEN V.—ChemCentral Corp., Columbus, OH.

CHICAGO

Active

AHMON, NEVILLE T. — Color Corp. of America, Rockford, IL.
ASHWORTH, NOLA — O'Brien Corp., South Bend, IN.
BLAZEVICH, JOHN P. — Ace Paint Div., Ace Hardware, Matteson, IL.
BOJARSKI, SUZETTE M. — Finishes Unlimited, Sugar Grove, IL.
BURTON, KEN — Finishes Unlimited, Sugar Grove.
ENGELKING, MARCIA R. — Valspar Corp., Kankakee, IL.
GIESKE, PATRICK S. — Seymour of Sycamore Inc., Sycamore, IL.
HIGGINS, DANIEL G. — Accurate Coatings, South Holland, IL.
HOFFMAN, ELAINE F. — O'Brien Corp., South Bend.
HURLEY, STEVEN M. — S.C. Johnson & Son, Racine, WI.
KAMDAR, ASHVIN S. — Valspar Corp., Kankakee.
KURZHAL, BRI N — Valspar Corp., Wheeling, IL.
MCCREARY, BRYAN F. — Ashland Chemical Co., Willow Springs, IL.
MILOS, JERRY — O'Brien Corp., South Bend.
MURPHY, THERESE B. — DeSoto, Inc., Des Plaines, IL.
OLSON, MARK — Finishes Unlimited, Sugar Grove.
PYCLIK, BRIAN R. — O'Brien Corp., South Bend.
SAYRE, LARRY G. — O'Brien Corp., South Bend.
SCHWARTZ, JOHN — Finishes Unlimited, Sugar Grove.
SINGLETON, CHLOE — DeSoto, Inc., Des Plaines.
TRAISTER, ANDREW — O'Brien Corp., South Bend.
WIMMER, RONALD M. — Specialty Coatings Co., Elk Grove Village, IL.

Associate

ANTTILA, ARTHUR L. — Aqualon Co., Arlington Heights, IL.
BAUMAN, MIKE J. — Rohm and Haas Co., Niles, IL.
BOERNER, THOMAS W. — Fitz Chem. Corp., Chicago, IL.
BROUWERS, HANS J. — GMD Systems Sales, Inc., Mt. Prospect, IL.
CARRINGTON, FRANCIS J. — George C. Brandt, Inc., Elmhurst, IL.
ECKARDT, JOHN C. — Van Waters & Rogers, Inc., Schaumburg, IL.
ENGELKING, GERALD L. — Valspar Corp., Kankakee, IL.
FOY, JAMES A. — T.H. Hilson Co., Lombard, IL.
HICKEY, MARY LU — Hitox Corp., Hinsdale, IL.
HILL, DAVE A. — Dow Chemical Co., Rolling Meadows, IL.
LAWRENCE, RONALD A. — PMC Specialties GR, Chicago.
MILANO, ROBERT L. — Fitz Chem. Corp., Chicago.
MULLER, MARC S. — Paramount Design Group, Waterford, WI.
PISARSKI, RICHARD W. — Pico Chemical Corp., Tinley Park, IL.
SAMPSON, DANIEL M. — Magrabar Chemical, Morton Grove, IL.
SZARZYNSKI, ROBERT P. — Seremet Co., Inc., Highland, IN.
VONESH, LAWRENCE R. JR. — Pico Chemical Corp., Tinley Park.
WHITING, JAMES F. — G.R. O'Shea Co., Westchester, IL.

CLEVELAND

Active

ANDREWS, ANNE M. — Sherwin-Williams Co., Cleveland, OH.
CASSIDY, PHILLIP S. — Sherwin-Williams Co., Cleveland.
FEDOR, GREGORY R. — Q-Panel Co., Cleveland.
FENSEL, FRED A. — Tremco Corp., Shaker Heights, OH.
KARP, EDMUND J. — Sherwin-Williams Co., Hudson, OH.
KEARNEY, SARAH L. — Sherwin-Williams Co., Cleveland.
KIRKPATRICK, ROBERT J. — Gibson-Homans Co., Twinsburg, OH.
LEJARDE, KATHLEEN F. — Sherwin-Williams Co., Cleveland.
LEONE, MARIE-ELANA — Sherwin-Williams Co., Cleveland.
MILLER, JAMES A. — Adhesive Consultants Inc., Akron, OH.
PROVDER, DIANA R. — Sherwin-Williams Co., Olmsted Falls, OH.
SABO, LYNN O. — The Glidden Co., Strongsville, OH.
SHERMAN, CHARLES J. — Sherwin-Williams Co., Cleveland.
SNIDER, THERESA M. — W.J. Ruscoe Co., Akron.
SWEETAPPLE, GARY G. — Ricerca Inc. Analytical, Painesville, OH.
VINA, CANDIDO N. — Harrison Paint Corp., Canton, OH.
WILK, STACEY A. — Sherwin-Williams Co., Cleveland.
ZIETLOW, DEBRA D. — Sherwin Williams Co., Cleveland.

Associate

GERLACH, IRVING J. — ICI Resins US, North Olmsted, OH.
GRUBBS, DONALD C. — Neville Chemical Co., Strongsville, OH.
JONES, JACK F. — SCM Chemicals, Brunswick, OH.
PEACOCK, GARY E. — J.H. Hinz Co., Rocky River, OH.

Retired

DEANE, EUGENE M. — Medina, OH.
HIGGINS, WILLIAM A. — Gates Mills, OH.
REED, FRANCIS E. — Lyndhurst, OH.

HOUSTON

Active

COSDEN, JOSHUA S.— Reliance Universal, Inc., Houston, TX.
SCHREINER, GORDON R. — Seamaster Marine Co., Channel View, TX.

Associate

COGAN, TERRY F. — Raw Material Corp., Houston, TX.

LOS ANGELES

Active

AHERN, DON P. — Sierracin/Transtech, Sylmar, CA.
BALBUS, RUTH KEIRSEY — Tek Concepts, Pomona, CA.
BAUTISTA, WILFRED D. — Dunn-Edwards Corp., Los Angeles, CA.
BELLETTIERE, SAMUEL J. — Sinclair Paint Co., Los Angeles.
CALETTE, MIGUEL GONZALEZ — Pinturas Y Barnices Calette, San Ysidro, CA.
DENNEY, VERLIN — Mar-Lak Products Co., Hawaiian Gardens, CA.
DOTAN, PATRICK K. — Valspar Corp., Azusa, CA.
ECHEUARRIA, ROXANNE — Decratrend Corp., Industry, CA.
ELLIS, KEN — Trail Chemical Corp., El Monte, CA.
GEE, ELIZABETH — Surface Protection Industries, Inc., Los Angeles.
HAHN, KENNETH S. — Dynaran, Inc., Huntington Beach, CA.

Hiserote, Scott D. — McCloskey Corp., Commerce, CA.
Jara, Norma D. — TW Graphics Group, Commerce.
Javien, Nellie V. — Chemical Technology Labs, Inc., Long Beach, CA.
Kashmer, George M. — Consultant, Los Angeles.
Lim, William T. — Day-Glo Color Corp., Curahy, CA.
Lu, Hsay-Ping — Advanced Coatings, Temple City, CA.
Maruyama, Robert T. — Burke Chemicals, Long Beach.
Meyers, Francis H. — Universal Paint Corp., Lapuente, CA.
Mira, Lindy S. — Davis Colors, Los Angeles.
Myers, Jeff J. — Cal-Co Products Inc., Rancho Cucamonga, CA.
Narayan, Sethu A. — Sinclair Paints, Los Angeles.
Ngo, Tuan Q. — Devoe Marine Coatings, Riverside, CA.
Osen, Lambert O. — Trans Western Chemicals Inc., City of Commerce, CA.
Peters, Frank A.C. — Dunn-Edwards Corp., Los Angeles.
Queja, Corazon B. — Reliance Universal, Inc., Brea, CA.
Rodriguez, Dionisia — Avecor, Inc., San Fernando, CA.
Rowland, James D. — Whittaker Corp., Colton, CA.
Sarte, Eduardo L. — Koppers Company, Commerce.
Spiering, Edward J. — Mar-Lak Products Co., Hawaiian Gardens.
Toha, Abul K. — Pervo Paint Co., Los Angeles.
Tran, Than G. — Burke Chemicals, Long Beach.
Tzeng, Chau — Pervo Paint Co., Los Angeles.
Velasquez, Antonio A. — Advanced Coatings, Temple City.
Winters, Harry — Gruber Systems, Valencia, CA.

Associate

Bassman, Jeff — Samson Chemical Co., Gardena, CA.
Edwards, Rick — Sherwin-Williams Co., City of Commerce, CA.
Jackson, Lauren L. — Jackson & Associates, San Clemente, CA.
Kowach, Richard A. — Davis Colors, Los Angeles, CA.
Marfisi, Larry E. — Samson Chemcial Co., Gardena.
Martorina, Nunzio — Samson Chemical Co., Gardena.
McMillen, James R. — Akzo Coatings America, Inc., Torrence, CA.
Melton, Douglas M. — Myers Engineering Inc., Bell, CA.
Murnik, Jon R. — PPG/Mazer Chemicals, Mission Viejo, CA.
Neff, Jane — Sanncor Industries, Alameda, CA.
Olquin, James H. — Sherwin-Williams Co., City of Commerce.
Roberts, Archie — BASF Corp., El Monte, CA.
Sakamoto, Barry T. — Surface Protection Industries, Inc., Los Angeles.
Smith, Donald A. — Samson Chemical Co., Gardena.
Smith, Michael R. — Samson Chemical Co., Gardena.
Stull, Justin — Pacific Coast Chemicals, Los Angeles.
Venia, Caryn — Tavco Chemicals Inc., Laguna Hills, CA.
Wolsky, Harvey — Permuthane Coatings, Huntington Beach, CA.

Educator/Student

Pachon, Carrie — Commerce Public Library, Commerce, CA.

LOUISVILLE

Active

Elmore, Jim D. — Interez, Jeffersontown, KY.
Hanks, Robert D. Jr. — Reliance Universal, Inc., Louisville, KY.
House, Andy R. — Devoe Coatings, Louisville.
Jacobs, Al — Olympic Home Care Products Co., Louisville.
Lockhart, Chris A. — Devoe Coatings Co., Louisville.
Mattingly, Wayne T. — United Catalysts Inc., Louisville.
McCracken, Eric — Reliance Universal, Inc., Louisville.
Moilanen, Mike R. — United Catalysts, Inc., Louisville.

Associate

Applegate, Bob — Midwest Color Tech, Columbus, OH.
Charland, Al - American Cyanamid, Louisville, KY.
Clanton, Wayne A. —Spartan Color Corp., Warren, AK.
Drancik, Wendy A. — Shell Chemical, Oak Brook, IL.
Freshwater, Mark A. — Hoechst Celanese, Erlanger, KY.
Griffiths, George S. — Union Carbide Corp., Louisville.
Hays, Michael B. — Reichhold Chemicals, Westerville, OH.
Machek, Alan L. — Dow Corning Corp., Cincinnati, OH.
Puntney, Steven J. — ICI Resins U.S., Schaumburg, IL.

NEW YORK

Active

Chaplin, Gregg E.—G.E. Chaplin Inc., Flemington, NJ.
Hickey, Jack—International Paint Co., Inc., Union, NJ.
Panila, Donnalynn—Benjamin Moore & Co., Newark, NJ.

SARE, EDWARD J.—Georgia Kaolin Research, Springfield, NJ.

Associate

AZAR, ALISON M.—Sylvachem Corp., Panama City, FL.
BURNS, JOSEPH F.—Sun Chemical Corp., Carlstadt, NJ.
DENT, BENJAMIN J.—Troy Chemical Corp., Newark, NJ.
DRUFFNER, ANN M.—Angus Chemical Co., Jersey City, NJ.
JONES, ROBERT L.—ChemCentral Corp., Cedar Knolls, NJ.
RIPA, IRENE A.—Angus Chemical Co., Bridgewater, NJ.
ROSSOMANDO, ROBERT—Pan Chemical Corp., Hawthorne, NJ.
ROWLES, STEVE M.—NL Chemicals, Newark.
SYLVESTER, CARMEN D.—US Bronze Powders, Flemington, NJ.

Retired

LEANZA, FRANK J.—Dover, NJ.

NORTHWESTERN

Associate

CIEZ, MARGARET A.—Rohm and Haas Co., Niles, IL.

PHILADELPHIA

Active

HARRIS, CAROL—Thoro System Products Inc., Bristol, PA.

Associate

SUBACH, DANIEL J.—Silberline Mfg. Co., Lansford, PA.

ST. LOUIS

Associate

CALDWELL, DOUG—I.T. Bauman Co., St. Louis, MO.
DUCHARDT, JOHN J.—Mozel Inc., St. Louis.
NORTON, GARY A.—I.T. Bauman Co., St. Louis.
SAGURTON, J. DAVID—Georgia Kaolin Co., Inc., Union, NJ.
SCHULD, KEITH J.—Mobay Corp., St. Louis.

TORONTO

Active

HALEY, FRANK M. — C-I-L Paints, Inc., Toronto, Ont.
SHAW, CHARLIE — C-I-L Paints, Inc., Newmarket, Ont.

Associate

GEORGE, CHRISTOPHER J. — Columbian Chemicals Canada Ltd., Hamilton, Ont.
GOSSE, JIM — The Source Canadian Dist. Inc., Brampton, Ont.
SMITH, LAWRENCE R. — Columbian Chemicals Canada Ltd., Hamilton.

Future Society Meetings

Birmingham

(Jan. 12)—"Recent Advances in Metal Can Interior Coatings"—R.H. Good, Holden Surface Coatings.

(Feb. 2)—"Powder Coatings: Polyurethane or Polyester?"—Dr. Kreuder, Bayer A.G.

(Mar. 2)—"Coil Coating"—G.C. Simmons, Becker Paints U.K. Ltd.

(Apr. 6)—"Zinc Phosphate (An Anticorrosive Pigment)"—Keith Chater, I.S.C. Alloys Ltd.

(May 4)—60th Annual General Meeting.

Dallas

(Jan. 12)—"Hitox—Past, Present, and Future"—Jack Dittman, Hitox Corp.

(Mar. 8-10)—Southwestern Paint Convention, Dallas, TX.

(Apr. 13)—"New Developments in Vinyl Resins"—Tom Ginsburg, Union Carbide Corp.

Golden Gate

(Jan. 16)—"Modified S/B Latexes to the Rescue for Meeting VOC Limitations and Still Produce Quality Coatings"—John A. Gordon and Violet Stevens, Dow Chemical, Francesco's Restaurant.

(Feb. 17)—Joint Meeting with Golden Gate PCA. Holiday Inn.

(Mar. 6)—"High Solids and Solventless Silicone Resin Based Paints for Various Coating Applications"—Bill Saad, General Electric Silicones, Francesco's Restaurant.

(Apr. 17)—"Rheological Measurements as a Guide to Additive Performance"—Marvin Schnall and James Jodrey, Troy Chemical, Holiday Inn.

(May 15)—"Carbon Blacks—Pigments for Coatings, Production, Properties, Application, Dispersion"—Maria Nargiello, Degussa Corp., Francesco's Restaurant.

(June 19)—Manufacturing Committee Program. Holiday Inn.

Houston

(Dec. 14)—Speaker to be announced.

(Jan. 11)—"Hitox—Past, Present, and Future"—Jack Dittmar, Hitox Corp.

(Mar. 8-10)—Southwestern Paint Convention. Dallas, TX.

(Apr. 12)—"New Developments in Vinyl Resins"—Tom Ginsberg, Union Carbide Corp.

(May 10)—Speaker to be announced.

Kansas City

(Jan. 12)—Manufacturing Night. "Inerting in Coatings Plants: Economics and Safety"—Gary Halpern, Neutronics, Inc.

(Feb. 9)—"Update on Hardboard Siding—Technical Committee Research"—Steve Bussjaeger, Davis Paint Co.

(Mar. 9)—Hallmark Card Tour, Leavenworth, KS.

(May 11)—Education Night.

Los Angeles

(Jan. 12)—"Modified S/B Latexes to the Rescue for Meeting VOC Limitations and Still Produce Quality Coatings"—John A. Gordon and Violet Stevens, Dow Chemical.

(Mar. 1)—"High Solids and Solventless Silicone Resin Based Paints for Various Coating Applications"—Bill Saad, General Electric Silicones.

(Apr. 12)—"Rheological Measurements as a Guide to Additive Performance"—Marvin Schnall and James Jodrey, Troy Chemical Corp.

(May 10)—"Carbon Blacks—Pigments for Coatings, Production, Properties, Application, Dispersion"—Maria Nargiello, Degussa Corp.

New England

(Jan. 17)—Joint Meeting with New England PCA. "The Economy—Scoring the Fourth Quarter of 1988 and Forecast of 1989"—Staff Economist, Du Pont Co.

(Feb. 16)—"Crowding and Spacing Titanium Dioxide Theory and Example"—Rebecca W. Craft, Du Pont Co.

(Mar. 16)—"Computer Controlled Production Plant for Industrial Paints"—Pius Eigenmann, Buhler-Miag, Inc.

New York

(Jan. 10)—"Non-Metallic Fungicide"—Dennis Dalton, Cosan Chemical Corp.

(Feb. 9)—Seminar and Joint Meeting with Metropolitan New York PCA. "'89 Legislative Update."

(Mar. 14)—"Statistical Quality Control"—Heinz Newmann, Rohm and Haas Co.

(Apr. 11)—"Novel New Uses for Isoparaffins"—Mark Danti, Exxon Chemical Co.

(May 9)—Past Presidents' and PaVaC Awards Night.

Northwestern

(Feb. 7)—"New Products for Defoaming and for Additives for Trade Sales and Industrial Paints"—Chuck D'Amico, Ultra Additives.

Pacific Northwest— Portland, Seattle, & Vancouver Sections

(Jan. 17-19)—"Modified S/B Latexes to the Rescue for Meeting VOC Limitations and Still Produce Quality Coatings"—John A. Gordon and Violet Stevens, Dow Chemical.

(Mar. 7-9)—"High Solids and Solventless Silicone Resin Based Paints for Various Coating Applications"—Bill Saad, General Electric Silicones.

(Apr. 18-20)—"Rheological Measurements as a Guide to Additive Performance"—Marvin Schnall and James Jodrey, Troy Chemical Corp.

(May 16-18)—"Carbon Blacks—Pigments for Coatings, Production, Properties, Application, Dispersion"—Maria Nargiello, Degussa Corp., Portland Motor Inn.

Philadelphia

(Dec. 8)—"Isocyanate—Free Alternatives to Two-Package Urethanes"—Eric Percy, Cray Valley Products, Inc.

(Jan. 12)—Joint Meeting with Philadelphia PCA.

(Feb. 9)—"Correlation of QUV Testing to Exterior Durability"—Douglas Grossman, Q-Panel Co.

(Mar. 9)—"New Approaches to Evaluating Performance of Industrial Maintenance Coatings"—Bernard Appleman, Steel Structures Painting Council, Pittsburgh, PA.

(Apr. 29)—Awards Night.

(May 11)—"ASTM Methods for VOC Determination"—Hiroshi Fujimoto, Inmont Corp.

Technical Committee Meetings

Philadelphia Society Technical Committee Meetings are held on the first Thursday of each month at the Schwarzwald Inn, Second St. & Olney Ave., Philadelphia.

(Jan. 5)—"Novel Epoxy Resins for Coatings"—E.G. Bozzi, CIBA-GEIGY Corp.

(Feb. 2)—"Comparative Analysis of Salt Fog and Exterior Exposure Results"—P. Velis, NL Chemicals.

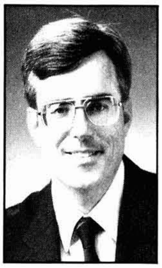
(Mar. 2)—"Hydrophobic Silica Formulations as Antifoams in Coating Systems"—R.E. Patterson, The PQ Co.

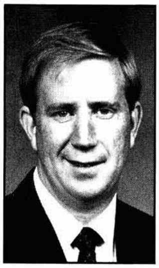
(Apr. 6)—"Multi-Metallic Complexes as Oxidative Catalysts in Coatings"—D. Mahoney, Hüls America Inc.

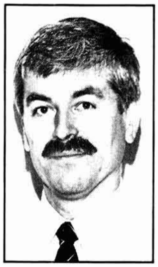
(May)—Technical Seminar.

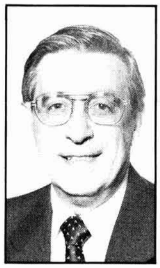
(June 8)—Diffusion Project, First Phase, Wrap-up Meeting.

People


D.P. Farragher


J.W. Mooney


R. Gruening


J.S. Ostrowski

Furane Products, a CIBA-GEIGY Co., has announced the appointment of **Dennis P. Farragher** to the position of Manufacturing Manager. In this newly-created position, Mr. Farragher will oversee all the manufacturing, engineering, and plant site functions at the company's Los Angeles, CA, location.

John W. Mooney has been appointed Marketing Manager/Chemicals for National Starch and Chemical Corp., Bridgewater, NJ. Mr. Mooney joined National in 1974 and most recently served as Market Development Manager/Specialty Polymers.

The Specialty Chemical Division of Etna Products, Chagrin Falls, OH, has appointed **Ed Sabo** as Product Manager. His experience includes three and one-half years as a Chemist at Glidden's Research Center in Strongsville, OH, three years as the Technical Director of Star Bronze Co., and he was recently employed as a Technical Sales Representative for Dar-Tech, Inc. Mr. Sabo is a member of the Cleveland Society.

J.M. Huber Chemicals Division, Havre de Grace, MD, has named **John E. Luppino** Division Purchasing Manager. Mr. Luppino was most recently employed by Westvaco Corp.

Max Buten has been appointed Vice President of Finance and Treasurer of Buten—the Paint and Paper People. Mr. Buten, a Past-President of the National Decorating Products Association, has been with the firm for 36 years.

The Industrial Products Division of Colorcon, Inc., West Point, PA, has promoted **Edward J. Furmanek, Jr.,** to the position of Sales Manager. He will manage and coordinate the sales activities of the company's nontoxic printing inks.

In addition, **James A. Lucchesi** has joined the staff of Colorcon as a Technical Sales Representative. In this new position, Mr. Lucchesi will have sales responsibility in the midwest region of the United States for ink and ink related products distributed to the printing, packaging, and converting industries.

William E. Rudlof has been elected a Vice President of Troy Chemical Corp., Newark, NJ, by its Board of Directors. He will fill the new position of Vice President of Operations. Mr. Rudlof will be responsible for the overall operations of the manufacturing plant, productions engineering, product distribution, and environmental affairs.

Also, **Rainer Gruening** has joined Troy as Senior Chemist in Research and Development. Dr. Gruening comes to Troy from Desowag-Bayer Holzschutz GmbH, in Krefeld, West Germany, where he was involved in R&D in the area of wood preservation for the past nine years.

Jerry D. Handegan has been appointed General Manager of the Rock Hill, SC, plant of Monsey Products Co., Kimberton, PA. Mr. Handegan will have overall management responsibilities for plant operations and sales of the company's emulsions, coatings, and sealant products.

Steve Satinsky has been promoted to Regional Manager of the Mid-Atlantic region for Liquid Carbonic Industrial/Medical Corp., Chicago, IL. Mr. Satinsky brings 25 years of experience in the industrial gases industry to this position.

Nalco Chemical Co., Naperville, IL, has named **Steve C. Argabright,** Marketing Manager in the Utility Chemicals Group. Having joined the company in 1973 as a District Representative in the Water Treatment Chemicals Group, Mr. Argabright has held several positions since then.

Dexter Packaging Products Division, Coatings & Encapsulants Group, The Dexter Corp., Waukegan, IL, has announced the following appointments: **Harold T. Crutcher**—President; **John S. Ostrowski**—Vice President/Research and Development; **M. Scott Zolna**—Vice President/Finance; **Frank Roccasalva** and **Michael G. Miller**—Technical Sales Specialists/End Sealant Product Group; **D.W. Long**—Vice President/Operations; and **George Leotsakos**—Technical Manager/Food Container Coatings. Mr. Ostrowski is a member of the Chicago Society.

In addition, Dexter Specialty Coatings Division has named the following: **Richard Krause**—Vice President and General Manager; **Philip Jacoby**—Quality Manager; and **Arthur Wells**—Regional Laboratory Supervisor. Mr. Wells is a member of the Chicago Society.

The Coatings & Additives Group of Hercules Incorporated, Wilmington, DE, has added the following three people to its sales staff as Technical Representatives: **Bradford A. Lee, Lisa A. Caruccio,** and **Paul Lozanoski.**

Max Turnipseed, Ethyl Corp.'s Manager of International Trade Affairs, has been temporarily assigned to the staff of the Chemical Manufacturers Association, Washington, D.C., as Special Advisor for the current round of negotiations on the General Agreement on Tariffs and Trade. He will serve in this position for about 18 months. Mr. Turnipseed will help develop, coordinate, and advocate industry tariff and trade positions in Washington and Geneva, site of the negotiations.

Georgia Kaolin Co., Union, NJ, which is a unit of Combustion Engineering, Inc., of Stamford, CT, has announced the appointment of **William L. Hartley** as President. He succeeds **Jean-Paul Richard,** who has accepted a promotion at Combustion Engineering headquarters.

Attaining the office of President is the latest in the continuing advancements of Mr. Hartley within Georgia Kaolin since joining the company in 1963. Previously, he held the position of Executive Vice President.

Ray Felice has joined the staff of Samuel Cabot Inc., Boston, MA, in the newly-created position of Human Resources Manager.

The Macbeth Division of Kollmorgen Instruments Corp., Newburgh, NY, has appointed **David L. Mowery** as an Applications Engineer for its off-line color measurement instrument products. He will be based at company offices in Columbus, OH.

The Society of Manufacturing Engineers, Dearborn, MI, has announced two promotions. **Richard A. Vogelei** has been named Manager/Market Planning and Communications Division, and **Michael Karam** has been appointed Manager/Purchasing and Office Service. Mr. Karam succeeds **Clemente Vianueva** who recently retired after 27 years of service.

The following promotions have been announced by Goodyear, Akron, OH: **Kenneth W. Seals**—Director/General Products Manufacturing, Logan, OH; **John W. Fisher**—Director/Chemical Production, Chemical Division; **Terry L. Persinger**—Director/Polyester Manufacturing and Development; **Robert W. Ekiss**—Plant Manager, Logan; **E.S. "Stan" Hollingsworth**—Plant Manager, Jackson, OH; and **Nate L. Casteel**—Plant Manager, Bowmanville, Ontario, Canada.

The Board of Directors of Seibert-Oxidermo, Inc., Detroit, MI, has announced the election of **T.A. McGregor** as Senior Vice President. Mr. McGregor will retain his current responsibilities as Vice President and General Manager of Detrex Corp., the parent company of Seibert-Oxidermo.

Obituary

Charles M. Jackson, Past-President of the Louisville Society, died on October 18, 1988. He was 76 years old.

After graduating from Lehigh University with a M.S. Degree in Chemistry, Mr. Jackson joined Devoe & Raynolds Co. (now Hi-Tek Polymers) in Louisville. His 42 years of service with Devoe included responsibility in the Marine Laboratory, various phases of laboratory administration, and developing a system for writing manufacturing specifications for trade sales products. Following his 1977 retirement from the company, he continued as a consultant for several years.

In addition to the Louisville Society, he was affiliated with the New England and New York Societies. He served as President of the Louisville Society in 1955 and was re-elected in 1956. In 1964, he received the Outstanding Service Award from the Society.

In the Federation, Mr. Jackson served as Chairman of many committees, including the Trigg Awards, Educational, and George B. Heckel Award and as a member of the Corrosion, Program, By-Laws, and Roon Awards Committees. Mr. Jackson served for three years on the FSCT Board of Directors.

XIXth FATIPEC Congress Attracts 825 to Aachen, Germany; Annik Chauvel, of France, Elected President for 1989-90

The XIXth Congress of FATIPEC, held in Aachen, West Germany, September 18-25, was attended by 825 persons. The presiding Chairman was FATIPEC President Prof. Dr. Lothar Dulog, of the German Association.

FATIPEC is the Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe. It is composed of seven member organizations: France, Belgium, Holland, Germany, Italy, Switzerland, and Hungary. The official languages of FATIPEC are French, German, and English. The site of the biennial Congress rotates among the member countries.

Dr. Christian Bougery, a founding member, has served as Secretary General of FATIPEC since its establishment in 1950. His office is in Paris.

North Americans in Attendance

Among the registrants were 25 North Americans: FSCT President Deryk Pawsey and Fran; FSCT Executive Vice President Robert Ziegler and Elaine; Dr. Gordon Bierwagen (Avery Products); Charles Brez (Monsanto); Arthur Fiorelli (Monsanto); Dr. Donald Gardner (Monsanto); H.P. Harris (Monsanto); Dr. Isidor Hazan (DuPont); Dr. Roger Heckman (ARCO); Dr. Richard Himics (Daniel Products); Dr. Wilfried Holtje (DuPont); Dr. Jerome Knapczyk (Monsanto); Dr. and Mrs. James Krutak (Eastman Chemicals); A. Melik (Aquaday International); Patrick Mormile (Monsanto); Tinh Nguyen (National Bureau of Standards); Dr. and Mrs. Angelos Patsis (State Univ. of New York); Prof. Max Saltzmann (Los Angeles); Prof. Henry Schreiber (Ecole Polytechnic); and Dr. and Mrs. D.T. Wu (DuPont).

111 Papers Presented

One hundred and eleven papers were presented by authors from around the world during the four full days of programming. The speakers presented the papers in one of the three official languages with simultaneous translation of plenary papers only through special radio headphones.

The FSCT-sponsored paper was "The Origin of Organoclay Rheological Properties in Coating Systems," by Charles Cody, Steven Kemnetz, and Arlene Sill, of NL Chemicals, Inc., Hightstown, NJ, and Rolf Schwindt, of Kronos Titan GmbH, Leverkusen, West Germany.

All papers have been published in the official FATIPEC Congress Proceedings. For information about price and availability, contact Mrs. Elvira Moeller, Congress Secretariat, Forschungsinsitut für Pigmente und Lacke e.V., Allmandring 37, D-7000 Stuttgart 80, West Germany.

International Coordinating Committee

The International Coordinating Committee (ICCATCI) held its annual meeting during the Congress. Present were: *FATIPEC* — Lothar Dulog, Dante Pagani, Jacques Roire, Annik Chauvel, Christian Bougery, and Mrs. Bougery who served as interpreter; *Oil and Colour Chemists' Assn.* — John Bourne, President; *Scandinavian Federation of Paint and Varnish Technologists* — Arja Saloranta, President; *Japan Society of Color Material* — Yuzo Takahashi; and *FSCT* — Deryk Pawsey and Robert Ziegler.

1989-1990 FATIPEC President

The 1989-1990 President of FATIPEC will be Annik Chauvel, Editor of the coatings journal, *Double Liaison*, Paris, France.

1990 FATIPEC Congress

The next Congress of FATIPEC will be held in Nice, France, September 17-24, 1990.

63rd ACS Colloid Symposium Slated for June 18-21

The American Chemical Society Division of Colloid and Surface Science will hold its 63rd annual symposium at the University of Washington, in Seattle, WA, on June 18-21.

Among the topics to be covered are: adhesion, colloid stability, dense and structured dispersions, structured liquids, and aerocolloidal systems and colloidal ceramics. In additon, discussions will be held on advances in instrumentation, thin films and membranes, surface science/catalysis, as well as biological and fibrous materials.

For additional details, contact Symposium Chairman John C. Berg, University of Washington, Dept. of Chemical Engineering, BF-10, Seattle, WA 98195.

MEMBERS OF THE ICCATCI International Coordinating Committee met during the FATIPEC Congress in Aachen. (Left to right): Yuzo Takahashi, Delegate from Japan Society of Colour Material; Arja Saloranta, President of Federation of Scandanavian Paint and Varnish Technologists; Deryk Pawsey, President of FSCT: John Bourne, President of Oil and Colour Chemists' Association; Dante Pagani, founding member of FATIPEC; Annik Chauvel, incoming President of FATIPEC; Lothar Dulog, President of FATIPEC; Christian Bourgery, Secretary of FATIPEC; Jacques Roire, Past-President of FATIPEC; and Mrs. Bourgery

16th Water-Borne and Higher-Solids Symposium Scheduled for February 1-3 in New Orleans

The University of Southern Mississippi and the Southern Society for Coatings Technology will cosponsor the 16th Annual Water-Borne and Higher-Solids Symposium on February 1-3, at the Hyatt Regency Hotel, in New Orleans, LA.

The Symposium will focus on the chemistry, formulations, and new developments in water-borne and higher-solids coatings. Among the presentations scheduled are:

Plenary Lecture, "Chemistry of the Silane Coupling Agent in Coatings"—J.O. Stoffer, University of Missouri-Rolla

"Water-Borne Automotive Topcoats"—R. Laible and D.V. Beelen, of Akzo Coatings GmbH

"Silicones in High Solids and Water-Borne Coatings: The Influence of Chemical Structure Upon Properties"—E.W. Orr, Byk Chemie

"Water-Borne Corrosion Protective Coatings for Steel and Concrete Based on Polymers Crosslinking with Active and Reactive Pigments"—W. Tippi

"Water-Borne Coating Systems for Drawn Wall-Ironed Food Containers"—P.J. Palackdharry and M.J. Flament-Garcia, of Midland Div., Dexter Corp.

"Properties of Coatings Derived from an Unfilled and Filled Ionic Polyurethane"—C.L. Beatty, of University of Florida

"Compliant Coatings for Aerospace Applications"—D.F. Pulley, of Naval Air Development Center.

"Coupling Solvent Effects on Water-Reducible Alkyd Resins"—R.G. Vance and N.H. Morris, of Dow Chemical U.S.A.

"Modified Water-Borne Phenoxy Resins"—R.N. Johnson and R.F. Eaton, of Union Carbide Corp.

"Moisture Vapor Barrier Latexes with Alkali Resistance"—V.L. Stephens and R. Lednicky, of Dow Chemical Co.

"Compliant Coatings for the Aircraft Industry"—J.W. Gooch, of Georgia Tech Research Institute

"Water-Borne Polymers by Cerium IV Grafting of Vinylidene Chloride-co-Methyl Acrylate from Poly (Vinyl Alcohol)"—R.F. Storey and L.J. Goff, of University of Southern Mississippi

"An Interior Two-Coat System for Metal Food Closures"—P.J. Palackdharry and L. Seibel, Midland Div.

"A Comparison of Methods for the Preparation of Acetoacetylated Coating Resins"—J.S. Witzeman, W.D. Nottingham, and F.D. Rector, of Eastman Chemicals Div., Eastman Kodak Co.

"On the Interpretation of the Flow Curves of Paper Coating Suspensions"—P. Lepoutre, G. Engstrom, and M. Rigdahl, of Pulp and Paper Research Institute of Canada

"Thermal and Mechanical Properties of Reactive Coatings: Property Development as a Function of Cure"—W.P. Yang and L.C. DeBolt, of Sherwin-Williams Co.

"Chemistry and Coatings Applications of MAGME Crosslinkable Monomer"—R.G. Lees, et al., American Cyanamid Co.

"A New General Purpose Coalescing Aid for Latex Paint"—W.D. Arendt, of Velsicol Chemical Corp.

"Zirconium Silica Hydrogel . . . A Unique, New Compound"—D.A. De Santis, of Silica Products Group, M MII Incorporated

"Choosing the Most Effective Dispersants for High Solid Coatings Systems"—J.W. Joudrey and M. Schnall, of Troy Chemical Corp.

"Approaches to Water-Based Radiation Curable Coatings"—F.J. Kosnik, of Interez, Inc.

"High Solids Coatings Compositions Containing Polymer-Bound Light Stabilizer Acrylic Resins"—P.A. Callais, V.R. Kamath, and J.D. Sargent, of Lucidol Div., Pennwalt Corp.

"Investigations about the Mechanisms of Pigment Stabilization in Water Dilutable Paint Systems"—M. Cremer, of Sachtleben

"Developmental Studies of the Effects of Filler/Additives on Formulated Elastomeric Adhesive-Sealants"—S.S. Sandhu, of the University of Dayton

"Thermal Sag Control in High Solids Baking Enamels"—A. Smith, W.W. Reichert, and H. Nae, of NL Chemicals

"Polyurethanes as Reactive Co-Solvent in Water-Borne Coatings"—W.J. Blank, of King Industries, Inc.

"Carboxyl Modified Polyols in Water-Borne Urethane Applications"—R.C. Hire, of Olin Corp.

"Solvent and Catalyst Effects in the Reaction of Aliphatic Isocyanates with Alcohols and Water"—S.D. Seneker and T. Potter, of Mobay Corp.

"Novel One-Component Urethane Coatings"—B. Taub and G. Petschke, of NL Chemicals, Inc.

"An Overview of Electron Beam Chemistry and Applications for Radiation Curing of Fluorinated Acrylates, Poly (Vinyl Alcohol), and Poly (Vinyl Butyral)"—J. Pacansky and R.J. Waltman, of IBM Almaden Research Center

"Novel Metal Oxide/Polymer Microcomposite Films and Coatings via Sol/Gel Chemistry"—K.A. Mauritz, C.K. Jones, and R.M. Warren, of University of Southern Mississippi

"Long-Term Stability of Cellulose-Ester Coatings"—N.S. Allen, M. Edge, and T.S. Jewitt, of Manchester Museum, Manchester University

"Recent Studies of the Curing of Polyester-Melamine Enamels. Possible Causes

CALL FOR PAPERS

15th International Conference On Organic Coatings Science & Technology
July 10-14 Athens, Greece

The 15th International Conference on Organic Coatings Science and Technology will be offered from July 10 to 14 in Athens, Greece. The purpose of the conference is to bring together scientists, engineers, and educators in an international forum to discuss recent research and development work covering all aspects of organic coatings. Approximately 15 leading researchers from various countries will be invited to present lectures on topics of high current interest selected by a Scientific Committee.

People interested in presenting papers are invited to submit abstracts (no more than one page) on subjects related to the science and technology of organic coatings, no later than January 1, 1989.

Contributed papers will be reviewed by the Scientific Committee and will be given between 15-30 minutes for presentation, depending on the time available and the number of papers submitted. Manuscripts are not required. However, if speakers wish to submit manuscripts for publication in the proceedings of the conference, they must submit them no later than March 1. Mail abstracts to: Professor Angelos V. Patsis, Director, Materials Research Laboratory, CSB 209, State University of New York, New Paltz, NY 12561.

of Overbake Softening"—F.N. Jones, S. Gan, and R.D. Solimeno, of North Dakota State University and L.W. Hill, of Monsanto Polymer Products Co.

"Going Against Tradition: A New Family of Epoxy Resins Which Are Weatherable and Reactive at Ambient Temperatures"—M. Agostinho, of CIBA-GEIGY Corp.

"Effects of Particle Size Distribution in Latex Paint"—A. Rudin, University of Waterloo

"Swelling and Solubility Studies in Methacrylate Interpenetrating Polymer Networks"—J.C. Graham, P.K. Kukkala, and S. Shyu, Eastern Michigan University.

Prior to the symposium, five short courses will be held:

"Fundamental Concepts of Polymer Science" will introduce basic concepts of synthesis, characterization, and properties of polymers. In addition, it will provide an overview of polymer science for chemists, chemical engineers, and chemical technicians.

"Modern Coatings Technology" is designed for those individuals with managerial responsibilities for coatings development, as well as those scientific personnel who have responsibility for designing, formulating, manufacturing, and testing coatings.

An up-to-date treatment of the theoretical and experimental aspects of thermoanalytical studies of polymers will be the focus of the short course, "Thermal Analysis." Lectures will cover underlying concepts, the various experimental methods and techniques, and specific examples of thermal analysis as applied to polymeric materials.

"Water-Soluble Polymers" is organized specifically for industrial scientists and will emphasize synthesis, structural methods of identification, solution properties, and rheological behavior.

The short course on "Degradation and Stabilization of Polymers" will cover the basic mechanisms responsible for the thermal and photodegradation of polymers. Methods for measuring the extent of degradation and predicting the effect of stabilizers on extending the effective lifetime of polymer materials will be considered from both a fundamental and practical point of view.

Short course registration fee of $495 includes instruction, preprinted notes, two continental breakfasts, and refreshments.

Registration for the symposium is $295 and information can be obtained by contacting Dr. Gordon L. Nelson, Box 10076, Southern Station, Department of Polymer Science, University of Southern Mississippi, Hattiesburg, MS 39406.

ASTM Sponsors Program On Adhesion of Coatings

ASTM Committee D-1 on Paints and Related Coatings and Materials will hold a program on Adhesion of Coatings on January 17 in Fort Lauderdale, FL. Three papers will be presented, "Testing of Coating Adhesion on Plastic Substrates," by Gordon Nelson, of University of Southern Mississippi; "Measuring Coating Adhesion: 35 Years of Frustration," by Harry Ashton, of the Canadian National Research Council; and "The Constrained Blister Test for Adhesion," by Abdelsamie Moet, of Case Western Reserve University and Michael J. Napolitano, of Hercules Incorporated.

For more information, contact William C. Golton, E.I. du Pont de Nemours & Co., Marshall Laboratory, Philadelphia, PA 19146, or David Bradley, ASTM, 1916 Race St., Philadelphia, PA 19103.

House Paint & Primer

Information on an all-weather alkyd house paint and primer designed to increase painter productivity by making application quicker and easier has been published. The products can be used on exterior wood siding, trim, sash and primed masonry, or metal surfaces, and come in over 800 colors. For information on the All-Weather™ line of products, contact Devoe & Raynolds Co. Div. of Grow Group, Inc., 4000 Dupont Circle, P.O. Box 7600, Louisville, KY 40207.

Cable Coating

Technical literature is available on a proprietary coating which stops shipboard fires that ignite cable systems. The coating is nonconductive, even in its wet stage, and can be applied directly to one coat of energized power cables, making it unnecessary to shut down power during application. Additional information, including a videotape and brochure, on PITT-CHAR® 200 coating is available by writing PPG Industries, Trade Paint Marketing, One PPG Place, Pittsburgh, PA 15272.

Technical Papers

A 12-page directory which lists titles of more than 80 technical papers on viscosity measurement and control has been published. Many subjects are covered, including: process controls, food, paints and coatings, biological, ceramics, plastics, pharmaceuticals, thick film inks, paper coating, high temperature, and general interest topics. Request publication #091-C from Brookfield Engineering Laboratories, Inc., Dept. NR 61, 240 Cushing St., Stoughton, MA 02072.

Defoamer Selector Chart

A selector chart designed to assist in choosing the correct product in such applications as coatings, inks, adhesives, caulks, and metalworking fluids is available. The reference chart simplifies specifying the proper defoamer by listing each of the company's performance additives, along with its physical properties, use levels, special features, and recommended applications. Information is obtainable by contacting Troy Chemical Corp., One Avenue L, Newark, NJ 07105.

Gas Chromatograph

Product literature is available on a new high-temperature, high-resolution gas chromatograph that ensures constant flow and linear output up to 500°C. Polymers, triglycerides, and surfactants are just a few of the high temperature application usages. Write HBI, Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001, for more information on the Carlo Erba Mega Series 5300 High-Temperature, High- Resolution Gas Chromatograph.

Pressure-Sensitive Adhesive

A water-borne pressure-sensitive adhesive for permanent labels is the subject of technical literature. The new product does not emit solvent vapors during coating operations and is designed to blend with tackifiers by simple mixing. For additional details on Robond® PS-95 adhesive, contact the Rohm and Haas Co., (PS-95), P.O. Box 8116, Trenton, NJ 08650.

Gas Detection Software

An eight-page brochure which describes a multi-channel microprocessor-based gas detection system is now abailable. This system can accommodate up to 16 channels of flammable gas, oxygen, or parts per million monitoring. For full details and specifications, contact Control Instruments Corp., 25 Law Dr., Fairfield, NJ 07006.

Fiber and Plastic Drums

Recently released information describes a specially-designed fiber or plastic, open-head drum which can be incinerated instantly. The drums are designed to eliminate downstream liability and enable chemical manufacturers to avoid re-pack charges. These containers are authorized under the Dept. of Transportations' specification #21-C for shipment of dry and semi-moist sludges, slurrys, and waste stream substances, classified as hazardous by federal regulations. For information on fibre drums, contact Tom Eden, Marketing Manager, Sonoco Fibre Drum, One Parkway Center, 1850 Parkway Pl., Ste. 820, Marietta, Ga, and for information on plastic drums, write to Doug Kreitzer, Marketing Manager, Sonoco Plastic Drum, 1225 Davies, Lockport, IL 60441.

Pigment Dispersion

The addition of two new pigment dispersion products to a company's line of dispersions has been announced in a technical bulletin. The products reportedly achieve stable dispersion without the use of resins. Complete details may be obtained from Sun Chemical Corp., Colors Group, Pigments Div., 411 Sun Ave., Cincinnati, OH 45232.

Dicarboxylic Acid Product

Literature is now available which details the features of a mixed dicarboxylic acid product used for producing polyols for urethane manufacture. The blended acid, a raw material source for production of polyester polyols, is charcterized by a low metals content and a low proportion of nitrogen-containing compounds. For additional information, contact Du Pont Co., External Affairs Dept., Wilmington, DE 19898.

Urethane Prepolymers

A two-page brochure describes a new family of cast urethane polymers designed to yield high-performance urethane elastomers over a wide hardness range. The brochure features charts for the vulcanizate properties of the amine-cured prepolymers and illustrates data on formulation, processing conditions, physical properties, test methods, and other properties such as physical form, gravity, viscosity, and thermal stability. For further information, contact Polariod Chemicals, 238 S. Main St., Assonet, MA 02702.

Phenolic Resin

A high-solids phenolic resin developed for metal finishing has been introduced in literature. This etherified, low molecular weight, heat-reactive resin is designed to serve as a co-resin in chemical-resistant formulations such as baking coatings for cans, containers, process equipment, metal furniture, general metal applications, and as coil coating primers. Further information on UCAR® Phenolic Resin BKS-7570 can be obtained from Union Carbide Corp., UCAR Coatings Resins, Dept. L4489, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Rheology Control Additives

A thermally stable liquid calcium sulfonate rheology control additive for high solids solvent-based coatings formulations is the subject of a technical data sheet. For more information on Ircogel® 905 and 905L, contact Dan Subach at Lubrizol Corp., 29400 Lakeland Blvd., Wickliffe, OH 44092.

Spectrophotometer

The latest addition to a line of spectrophotometers has been introduced in literature. This new color analyzer includes both a hard disk capable of storing more than 1000 color standards and 3-1/2 in. floopy disk access for storage and to back up files on the hard disk. For details on the Color Mate HDS™, contact Milton Roy, 820 Linden Ave., Rochester, NY 14625.

Color Measurement

An eight-page brochure describes the capabilities, features, and applications of a color measurement system. The four-color brochure illustrates screen displays that present batch data with dual color plots and spectral curves. It provides specifications and photographs of the equipment. Copies of the brochure may be obtained by writing to Macbeth Div., Kollmorgen Corp., P.O. Box 230, Newburgh, NY 12550.

Viscometer

A battery-operated viscometer designed for use in a typical quality assurance laboratory, as well as in full production processing is the focus of technical literature. The portable viscometer is capable of executing shear rate ramp programs and automatically storing the measurement data in memory. The stored information may be later transmitted to a printer or computer via an integrated interface. Write to Contraves Industrial Products Div., 11258 Cornell Park Dr., Cincinnati, OH 45242 for more information.

Fast-Dry Lacquers

A line of lacquer products that offer the fast dry and durability needed for one-day wood finishing applications is being introduced. The product can be used on woodwork, doors, kitchen cabinets, furniture, shelving, and fixtures. Further information on De-Vo-Lac® Lacquers can be obtained by contacting Devoe & Raynolds Co. Div. of Grow Group, Inc., 4000 Dupont Circle, P.O. Box 7600, Louisville, KY 40207.

Moisture Detector

Information has been released which describes a new electronic moisture detector which provides instant readings of moisture levels in fiberglass boat hulls, lumber, concrete, bricks, stone, and plaster. This descriptive leaflet may be obtained from Paul N. Gardner Company, Inc., P.O. Box 10688, Pompano Beach, Fl 33061-6688.

Dibasic Ester

A recently published technical bulletin focuses on a company's dibasic ester for use as a purge solvent in the polyurethane industry. The product is a blend of dimethyl succinate, dimethyl adipate, and dimethyl glutarate, in proportions of 17, 17, and 66%, respectively. Reader inquiries outside the U.S. should be directed to: Du Pont France, 0137, rue de l'Universite F-75334, Paris Cedex 07, France. From within the U.S., contact: Du Pont Company, Room HR 1033, Wilmington, DE 19880-1723.

Polyurethane Coatings

Recently published literature describes a coating used to protect aircraft components from erosion. The coating is designed to resist impact, abrasion, erosion, petrochemicals, and solvents. These polyurethane coatings are not affected by ethylene glycol de-icing solutions used in winter weather. For more information, write: Lord Corporation, Industrial Coatings Div., 2000 W. Grandview Blvd., P.O. Box 10038, Erie, PA 16514-0038.

Mixer

Information has been released on a new compact mixer for use in biotechnology and pharmaceutical applications. The mixer is designed for processes in the 40 to 200L range, and features a single, dry running mechanical seal. Additional details may be obtained from Steve Zimmerman, Mixing Equipment Co., 221 Rochester St., P.O. Box 190, Avon, NY 14414.

Batch Weighing

A two-page technical data sheet describes the features of a new automated batch weighing system. The bulletin details both the network and stand-alone operation of the system and describes system functions such as batch creation, batch ticket printing, material usage tracking, precision tolerances, etc. For a free copy of the data sheet, contact Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543.

Solvent Handling

The new 1988-89 edition of a guide to the safe handling of chlorinated solvents has been published. Entitled "Specialty Chlorinated Solvents Product Stewardship Manual," the 64-page four-color booklet covers the safety, health, environmental aspects, and bulk handling information needed by an industrial user of methylene chloride, perchloroethylene, trichloroethylene, and 1,1,1-trichloroethane and their formulations. For copies, contact: Chemicals and Metals Dept., The Dow Chemical Co., 2020 Willard H. Dow Center, Midland, MI 48674.

Solvent

A recently released technical bulletin details a new solvent which has been approved by the Dept. of the Navy for use in various thinners for aircraft coatings. These thinners, covered by Military Specification MIL-T-81772 are of two categories: Type I (polyurethane) and Type III (acrylic and alkyd). Copies of the bulletin describing Ektapro® EEP solvent are available from Eastman Chemical Products, Inc., Kingsport, TN 37662.

UV/VIS Spectrophotometry

An advanced PC-controlled UV/VIS spectrophotometer system is the subject of new literature. The system is designed for a range of applications, including environmental, pharmaceutical, and biochemical. For further information, write: The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0012.

Copolymer

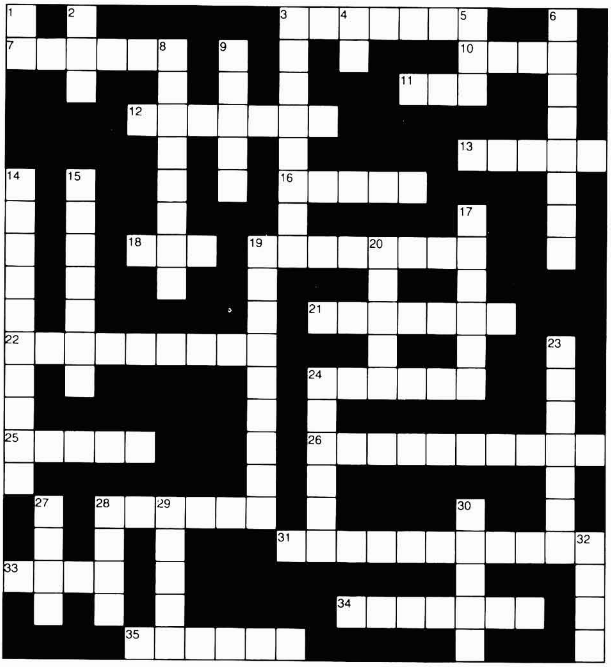
A styrene-alkyd copolymer with aliphatic solvent reducibility is described in a technical data sheet. This resin can be crosslinked with isocyanate, urea, or melamines. For more information on Hy-Var high-solids resins, write to David M. Setzer, Vice President, Commercial Development, The McCloskey Corp., 724 W. Lancaster Ave., Ste. 100, Wayne, PA 19087.

Ink Additives

A 30-color (flat color) brochure demonstrates rheological additives for ensuring consistent ink products. The four-page, single-fold brochure is 8 1/2 x 11 in. For more information, contact ECC America Inc., 5775 Peachtree-Dunwoody Rd., N.E., Ste. 200 G, Atlanta, GA 30342.

CrossLinks

by Earl Hill



No. 27

Solution to be Published in January issue

ACROSS

3. Acid used in resin making
7. Last word of 1 Down
10. Chemical used to prepare UF resins
11. Phosphate plasticizer (Abr.)
12. Layered
13. Fine surface texture; promotes adhesion
16. Drying oil (West Africa), I_____
18. Masstone black
19. Natural silicate occurring in granite
21. To float, as aluminum powder
22. Viscosity increaser
24. Factory machine lubricant
25. Writing material
26. Water-soluble gum, T_______
28. Reaction vessel for varnish manufacture
31. Partially opaque
33. Benard c_____
34. Rottenstone
35. Test m____d

DOWN

1. Spectrum portion
2. Wood decomposition
3. Something that sets or fixes
4. Melamine-formaldehyde (Abr.)
5. Viscosity measuring device
6. What we work all year for
8. To copy by contact (Printing)
9. A group of three colors
14. Rheological term; false body; shear thinning
15. Vehicular movement (paint type)
17. Metallic alloy, primarily copper
19. To make
20. Metallic oxide coating, its form is frequently 12 Across
23. A surface design
24. A channel at the eaves of structures
27. Tetrahydrofurfuryl alcohol (Abr.)
28. A chamber to dry wood
29. Cast (Syn.)
30. Hardness measurement
32. Painted tinware (Fr.)

Marketing Connotation: Paint/Coatings Industry

To the Editor:

In the paint industry, which is now being referred to as the coatings industry, there are a number of words commonly used which are not really understood by many people. It is essential that coatings' users and people associated with these activities have a clear understanding of terminology which has a real meaning.

This is of particular interest to those people who deal in coatings distribution such as paint stores, hardware stores, and other distribution outlets. These products are many times categorized as "trade sales," which is really jargon often used by coatings' marketing personnel and has little meaning to anyone except those intimately involved with such marketing activities.

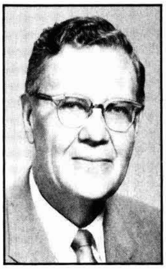
A much more appropriate terminology for coating products marketed and used on the interior and exterior of buildings, such as homes and commercial structures, would be "architectural coatings." Recently, there appears to be a tendency for the media to adopt this designation when writing or discussing these types of products. Of course, the words trade sales to designate a certain type of distribution organization for architectural coatings would be entirely proper when used strictly within the industry which understands it.

The "Paint/Coatings Dictionary" published by the Federation of Societies for Coating Technology (Copyright 1978) contains a wide range of coatings industry definitions. It is very useful for understanding words for some of the technical aspects as well as the broad utilization of coatings. However, for the general public, who are mainly concerned with the everyday use of coatings, many word connotations are used rather loosely.

The rapid change in the coatings industry is being brought about by new raw materials and use requirements. This is being met by intensive research and development activities. There is a realization and concern for the preservation of our air, water, and land environment which is being impacted by chemical emissions and waste disposal actions. This requires an understanding and appreciation by the public of the much improved service that new type coatings will provide when properly used.

The effort to provide clear and effective communication in the coatings industry is obviously needed. Meaningful words and the understanding of coatings must be available to convey fully all aspects of the benefits which accrue when coatings are applied. The words "architectural coatings" have a much more meaningful and understandable connotation than trade sales, particularly when it is discussed by architects, contractors, and owners, as well as the general public.

Loren B. Odell, FAIC
Technical Consultant



Loren B. Odell, after 42 years of service in the coatings industry, retired from the Napko Corporation in 1978. Currently, he is a technical consultant for all phases of the coatings field. Mr. Odell, who is a fellow of the American Institute of Chemists, worked 15 years for the Napko Corporation. He was Technical Administrative Manager of Napko's Laboratories. During his long industry involvement, Mr. Odell had experience as a corporation President (James Bute Company), a Technical Director, Research Director, Plant Manager, and Technical and Sales Service Representative. He was active in the installation of paint plants, the establishment of laboratories, in the directing and training of technical personnel, and in the development and marketing of coating products.

He is an Honorary member of the Federation of Societies for Coatings Technology, as well as the Houston Society.

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact FSCT, 1315 Walnut St., Philadelphia, PA 19107 (215-545-1506).

1989

(May 16-19)—Federation "Spring Week." Seminar on the 16th and 17th; FSCT Incoming Society Officers Meeting on the 18th; FSCT Board of Directors Meeting on the 19th. Los Angeles Airport Marriott, Los Angeles, CA.

(Nov. 8-10)—67th Annual Meeting and 54th Paint Industries' Show. Rivergate, New Orleans, LA.

1990

(Oct. 29-31)—68th Annual Meeting and 55th Paint Industries' Show. Convention Center, Washington, D.C.

1991

(Nov. 4-6)—69th Annual Meeting and 56th Paint Industries' Show. Convention Center, Toronto, Ontario, Canada.

SPECIAL SOCIETY MEETINGS

1989

(Feb. 1-3)—Southern Society 16th Annual Water-Borne and Higher-Solids Coatings Symposium. New Orleans, LA. (Dr. Gordon L. Nelson, Chairman, Dept. of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Mar. 14-16)—Western Coatings Societies' 19th Biennial Symposium and Show. Disneyland Hotel and Convention Center, Anaheim, CA. (Andrew R. Ellis, NL Chemicals, 231 E. Imperial Highway, Suite 221, Fullerton, CA 92635).

(Apr. 5-7)—Southern Society. Annual Meeting. Hyatt Regency Westshore, Tampa, FL.

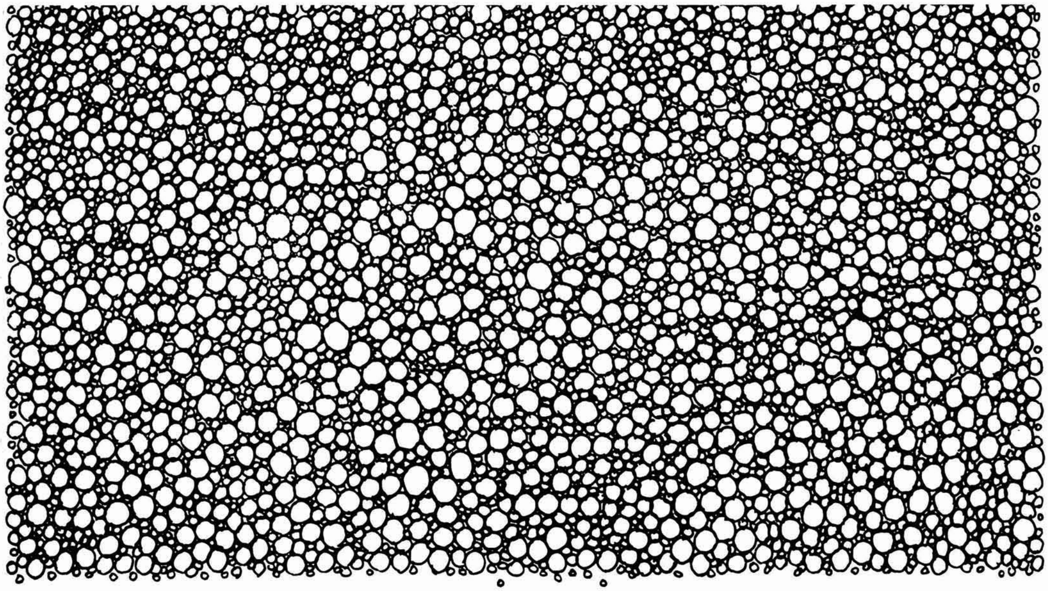
(Apr. 19)—14th Annual FOCUS Conference of Detroit Society. Management Education Center, Troy, MI. (Detroit Society, 26727 Newport, Warren, MI 48089).

(May 4-6)—Pacific Northwest Society. Annual Symposium. Portland Marriott, Portland, OR. (John Daller, McCloskey Corp., 4155 N.W. Yeon, Portland, OR 97210).

OTHER ORGANIZATIONS

1989

(Jan. 15-18)—ASTM Committee D-1 Meeting. Fort Lauderdale, FL. (David Bradley, ASTM, 1916 Race St., Philadelphia, PA 19103).



(Jan. 23-27)—The American Electroplaters and Surface Finishers Society's Annual Winter Meeting. Orlando Twin Towers, Orlando, FL. (AESF, Central Florida Research Park, 12644 Research Pkwy., Orlando, FL 32826).

(Jan. 24-26)—"Bridge/Highway Structures Coatings Inspection" Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Feb. 1-5)—International Symposium on Industrial Metal Finishing. Karaikudi, India. (Central Electrochemical Research Institute, Karaikudi-623 006, Tamil Nadu, India).

(Feb. 19-22)—"Principles of Adhesion" Short Course and 12th Annual Meeting of The Adhesion Society. Marriott Hotel, Hilton Head Island, SC. (Don Hunston, National Bureau of Standards, Polymers Div., Gaithersburg, MD 20899).

(Feb. 28-Mar. 2)—"Level II—Industrial Maintenance Course" sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Mar. 13-17)—Color '89. Sixth Congress of the International Color Association (AIC). Centro Cultural San Martín, Buenos Aires, Argentina. (Color '89, Grupo Argentino del Color, c/o Divisiön Optica, Inti, C.C. 157, 1650 San Martín (BA), Argentina).

(Mar. 14-16)—"Inspection of High Performance Coatings" Course sponsored by KTA-Tator, Inc., Pittsburgh, PA. (KTA-Tator, Inc., 115 Technology Dr., Pittsburgh, PA 15275).

(Mar. 20-24)—"Surface Science and Technological Applications." Second Annual Short Course sponsored by the University of Florida, Gainesville, FL. (Dinesh O. Shah, Center for Surface Science & Engineering, University of Florida, 425 Chemical Engineering, Gainesville, FL 32611).

(Apr. 8-9)—Eastern Decorating Products Show sponsored by the National Decorating Products Association. World Trade Center, Boston, MA. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Apr. 11-14)—"Advances in Corrosion Protection by Organic Coatings" Symposium. Christ's College Cambridge, England. (David Scantlebury, Corrosion and Protection Centre, UMIST, P.O. Box 88, Manchester, U.K. or Martin W. Kendig, Rockwell International Science Center, Thousand Oaks, CA 91360).

(Apr. 11-14)—International Surface Finishing '89. Sponsored by International Institute of Surface Finishing. Metropole Hotel, Brighton, England. (Secretary, The Institute of Metal Finishing, Exeter House, 48 Holloway Head, Birmingham B1 1NQ).

(Apr. 17-21)—Corrosion/'89 sponsored by the National Association of Corrosion Engineers. New Orleans, LA. (NACE, Conference Manager, P.O. Box 218340, Houston, Tx 77218).

(Apr. 23-28)—"7th International Meeting on Radiation Processing." Noordwijkerhout, The Netherlands. (E. Franken, 7th International Meeting on Radiation Processing, P.O. Box 4240, 6710 EE Ede, The Netherlands).

(Apr. 24-26)—"Crosslinked Polymers: Chemistry, Properties, and Applications" Short Course sponsored by State University of New York at New Paltz. Hotel Thayer, West Point, NY. (Angelos V. Patsis, Chemistry Dept., State University of New York, New Paltz, NY 12561).

(Apr. 24-28)—"Applied Rheology for Industrial Chemists." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(Apr. 24-29)—Materials Research Society Spring Meeting, Symposia, and Exhibition. San Diego, CA. (MRS, 9800 McKnight Rd., Ste. 327, Pittsburgh, PA 15237).

(May 1-4)—Society of Manufacturing Engineers' International Conference. Cobo Hall, Detroit, MI. (Violet Greco, SME, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(May 8-12)—"Dispersion of Pigments and Resins in Fluid Media." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(May 22-26)—"Adhesion Principles and Practice for Coatings and Polymer Scientists." Short Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(May 24-26)—11th International Conference on "Advances in the Stabilization and Controlled Degradation of Polymers." Luzern, Switzerland. (Angelos V. Patsis, Institute in Materials Science, CSB 209, State University of New York, New Paltz 12561).

(May 29-31)—3rd International Conference on "Crosslinked Polymers." Luzern, Switzerland. (Angelos V. Patsis, Institute in Materials Science, State University of New York, New Paltz, NY 12561).

(June 5-9)—"Advances in Emulsion Polymerization and Latex Technology." 20th Annual Short Course sponsored by Lehigh University, Bethlehem, PA. (Mohamed S. El-Aasser, Emulsion Polymers Institute, Mountaintop Campus, Bldg. A, Lehigh University, 111 Research Dr., Bethlehem, PA 18015).

(June 11-14)—Dry Color Manufacturers' Assoc. Annual Meeting. The Greenbrier, White Sulphur Springs, WV. (Tracy Kruisselbrink, DCMA, Ste. 202, 206 N. Washington St., P.O. Box 20839, Alexandria, VA 22314).

(June 18-21)—63rd Colloid and Surface Science Symposium. Sponsored by American Chemical Society Division of Colloid and Surface Science. University of Washington, Seattle, WA. (John C. Berg, Symposium Chairman, University of Washington, Dept. of Chemical Engineering, BF-10, Seattle, WA 98195).

(June 21-23)—Oil and Colour Chemists' Association Biennial Conference. Grosvenor Hotel, Chester, England. (Mr. Christopher Lacey-Day, Director, OCCA, Priory House, 967 Harrow Rd., Wembly, Middlesex HA0 2SF, England).

(June 28-30)—"Chemically Modified Oxide Surfaces" Symposium. Holiday Inn, Midland, MI. (W.T. Collins, Mail Stop C41C00, Dow Corning Corp., Midland, MI 48686-0994).

(July 10-14)—15th International Conference on "Organic Coatings Science and Technology." Athens, Greece. (Angelos V. Patsis, Institute in Materials Science, CSB 209, State University of New York, New Paltz 12561).

Advertisers Index

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'Humbug' from Hillman

Welcome, Roy Wilkinson, of Scott Bader, Northhamptonshire, England, to our exclusive ranks of brave contributors with:

• If you cannot laugh at yourself, you may be missing the joke of the century.

• There are few things in life more depressing than being in a strange place, in the dark, with no toilet paper.

The recent, bemoaned athletic show in Korea reminded me of Barry Lamb's contribution of Richard Lederer's "Student Bloopers." Here's the reminder and a bit more:

• In the Olympic Games, Greeks ran races, jumped, hurled the biscuits, and threw the java. The reward to the victor was a coral wreath.

• When the pilgrims landed at Plymouth Rock, they were greeted by the Indians, who came down the hill rolling their war hoops before them. The Indian squabs carried their porpoises on their backs. Many of the Indian heroes were killed, along with their cabooses, which were very fatal to them.

• The winter of 1620 was a hard one for the settlers. Many people died and many babies were born. Captain John Smith was responsible for all this.

If you think the above was funny, I have a good chance of getting away with this:

A badly bruised knight returned to his castle after a hard battle. He was a mess. His armor was dented, his helmet was askew, his face was bloody, his horse was limping, and the knight was listing to one side in the saddle.

The lord of the castle saw him coming and went out to meet him, asking, "What hath befallen thee, Sir Knight?"

Straightening himself up as well as he could, the knight replied, "Oh sire, I have been laboring dutifully in your service, pillaging and fighting all your enemies to the west."

"You've been what?," cried the startled nobleman. "But I haven't any enemies to the west!"

"Well, now you do," said the knight.

—Rotary Down Under via Roy Tasse

— The world's shortest horror story: The last man on earth sat alone in his room; suddenly, there was a knock on the door!

— When young, you adjust your hair to the existing hair style; when old you adjust your hair style to the existing hair.

— A little tot, in church for the first time, watched the ushers pass the collection plate. When they neared his pew, he piped up, "Don't pay for me Daddy, I'm under five!"

—The Lion

Folks On the West Coast can skip this next portion. John Burlage found the following in Paint Palaver at a WC seminar (West Cost seminar, that is)!

From *Britannica 1988 Year Book*:

• Acetaldehyde is an important flavor component of yogurt.

• Chocolate contains 835 flavor compounds, only 225 of which are FDA-acceptable for food. Some of the balance are outright toxic (e.g., pyridene). One of the GC peaks corresponds to that for fecal matter.

• Pepper induces skin cancer in rats.

• Carrots contain myristicin, a carcinogen.

• Cabbage has goitrogens, compounds that interfere with the function of the thyroid gland.

And here, I've given up cholesterol! Well, back to the steak and martinis; I'm giving up carrots and cabbage!

From an old copy of the British magazine, *Executive Travel*, here are reasons to give travel a second thought:

• One traveler at Guangzhou, China, was told his delayed aircraft was "sick" and a second one would be substituted. Two hours later he was told, "New aircraft more sick than first one, so we will take the first one."

One U.S. carrier managed to double-book an entire 747. Not to be outdone, an airline in Nigeria booked one of its craft three times! The local police sorted this out by making all ticket holders run around the plane twice; those who ran the fastest got the seats.

A passenger from New York's La Guardia Airport to New Haven was asked to hold the door closed on his plane during takeoff and landing.

In Bangladesh, a flight was about to taxi down the runway when there was a frantic hammering on the door. After some delay, it was opened and the pilot got aboard.

As I write this during our glorious and colorful October in Vermont, I am shaken with the realization that as you will be reading this, THE HOLIDAYS will be coming on us, once again. Oh well, it is happier to celebrate than to berate the passing years. *A JOYOUS HOLIDAY SEASON TO ALL!!*

—Herb Hillman
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Choosing the <u>right</u> powder for slip and abrasion-resistance

Through the use of dedicated technology and sophisticated production equipment, Shamrock controls morphology, molecular weight and particle size distribution. The result? Creation of a wide range of unique PTFE products–each designed to solve a particular problem in a specific application.

Shown below are some coatings applications with performance characteristics desired, and... a *specific* Shamrock product recommended as the best solution.

When you need PTFE in your formulation, talk with our coatings-experienced staff. They'll make a recommendation, send you samples and data.

Coatings Application	Desired Performance Qualities	PTFE Product
Container, solvents	can mobility and spin-neck abrasion resistance	SST-3D
Container, water	can mobility and spin-neck abrasion resistance	SST-3H
Ultra-thin clears	abrasion resistance with clarity retention	FluoroLUBE-A
Coil, protective	corrosion inhibition and falling sand resistance	SST-2SP5
Coil, decorative	taber abrasion and metal-mark resistance	FluoroSLIP 515
Powder coating	durability	FluoroSLIP 525
General industrial	fabrication protection	SST-2
Printing inks	rub-resistance	SST-3
Cookware	non-stick	SST-Thermo

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