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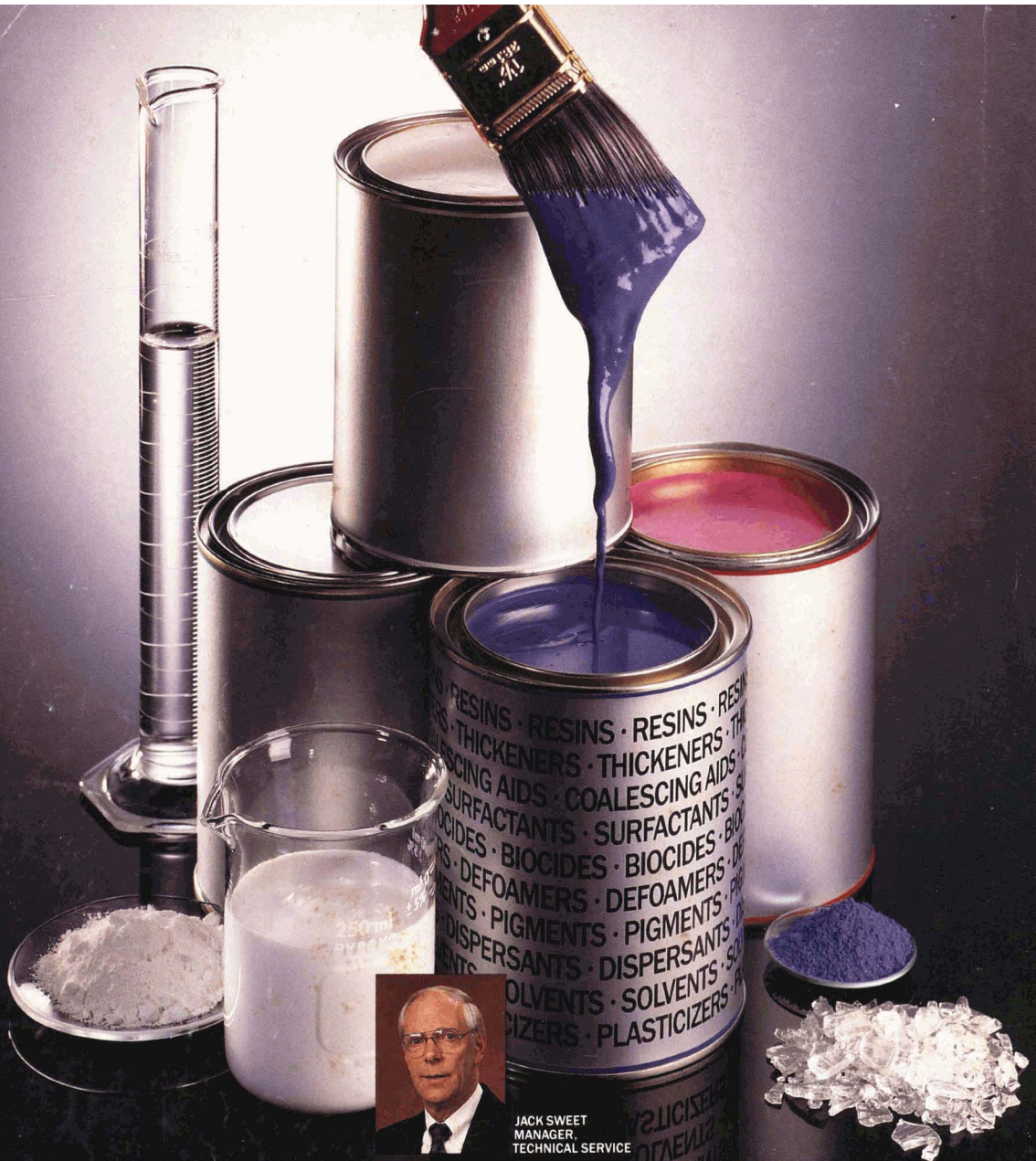
JOURNAL OF COATINGS TECHNOLOGY

January 1991

"A Decade of Decision: Preparing for the Year 2000."

1990 Washington D.C. Convention Wrap-Up.



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VOLUME 63 NUMBER 792

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VBPA

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JOURNAL OF COATINGS TECHNOLOGY

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

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

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Comment

A Rededication of Effort

Energy—*The capacity for doing work and for overcoming inertia.*

One may discuss synergism, innovation, or insight; expound on new philosophies in management or R&D; and speak about different marketing methods, production techniques, and all manner of distribution. These are all necessary for survival.

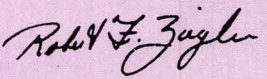
However, without one, special ingredient, none of the above is likely to occur. Of all the characteristics required by the coatings industry to succeed and prosper in today's (and tomorrow's) economy, none is more important than *energy*.

Energy gives form to emotions, proves or disproves theories, and brings to life ideas and concepts which would lie dormant without its power.

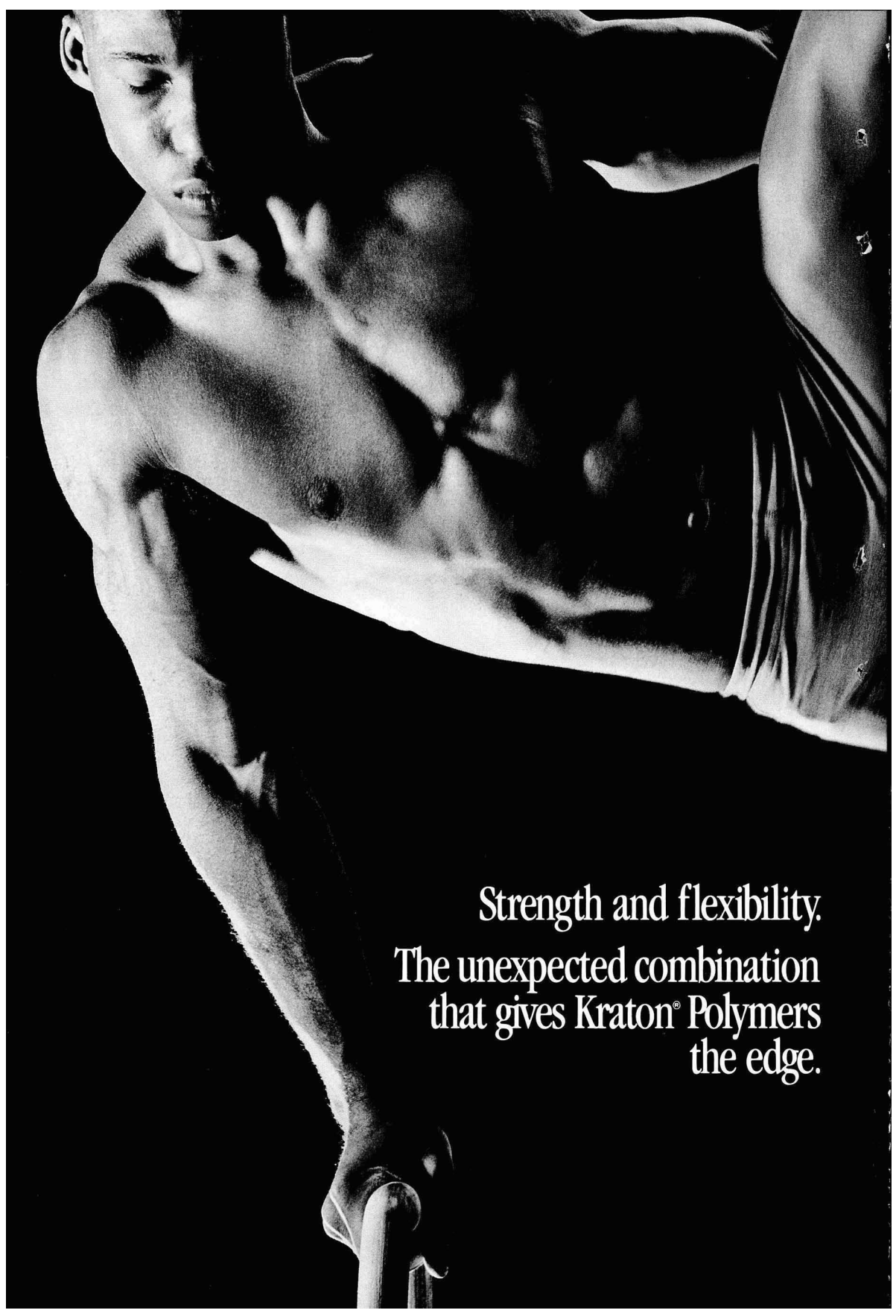
The need to survive is as strong an emotion as any in the human experience. And so it is, also, within the corporate structure of the coatings industry. Lethargy produces inertia and leads to failure. To be successful, both management and technical personnel must have the energy to cope with and, finally, overcome the problems facing the industry.

It is good to note here that many are facing these challenges and finding ways to gain footholds in a tightening marketplace. These are people who kept abreast of the challenge by focusing their energy on being informed—people who were part of the record-setting attendance at the Federation's 1990 Annual Meeting in Washington, who attend national seminars, read publications such as this, and regularly attend local Constituent Society events.

There is no special formula to succeed. It doesn't take magic; it takes energy.



Robert F. Ziegler
Executive Vice President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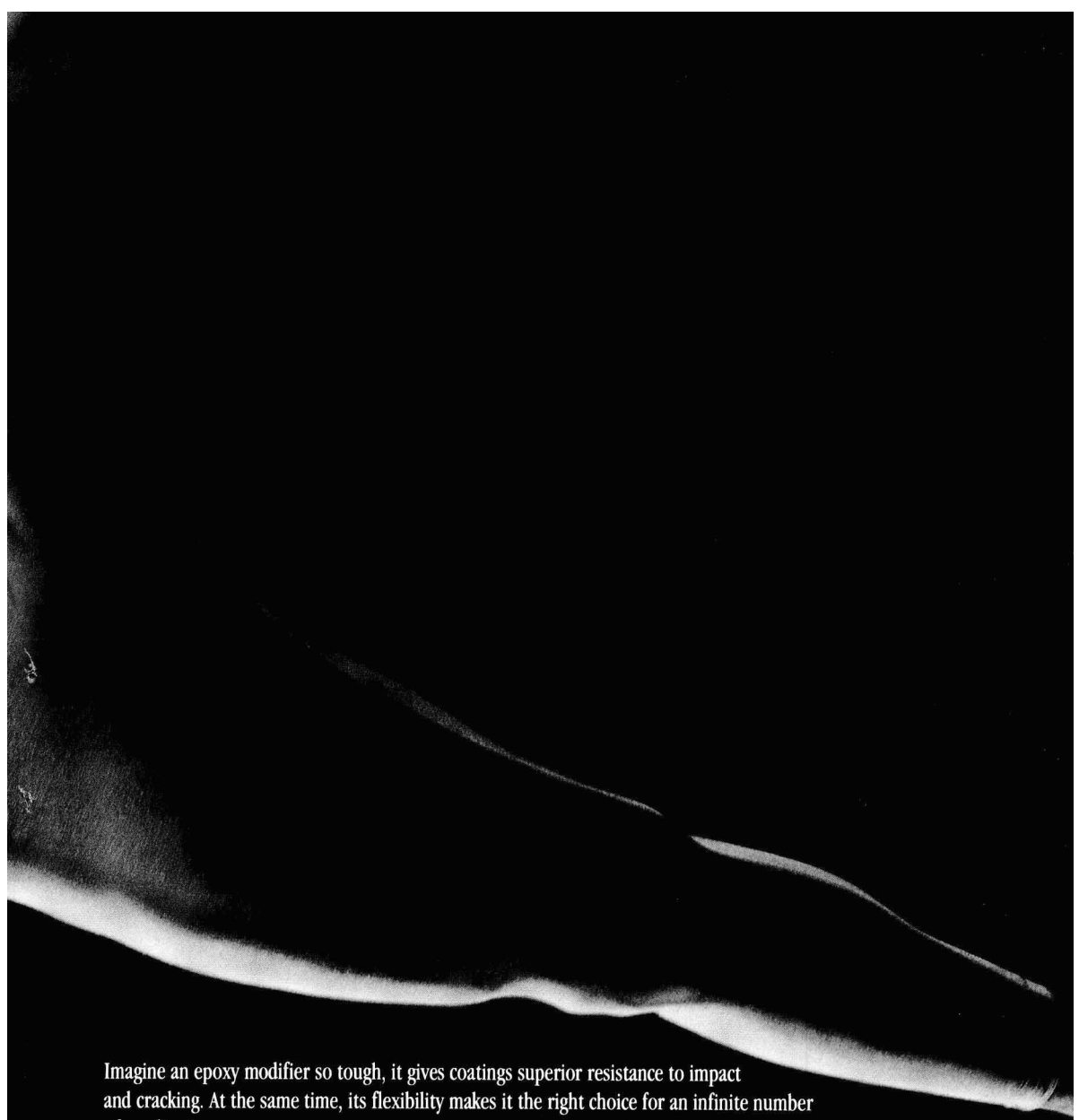

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Abstracts of Papers in This Issue

NOVEL ALTERNATIVE IN HIGH PERFORMANCE CLEAR COATS: MOLECULAR COMPOSITES UTILIZING ARYLSILANE ARAMIDS—G.J. Tregre, J.S. Reed, K.G. Malone, and S.F. Thames

Journal of Coatings Technology, 63, No. 792, 79 (Jan. 1991)

Novel arylsilane diacids were synthesized and polymerized to yield rigid yet soluble aramids. The aramids were incorporated into an elastomeric epoxy/Jeffamine® coating to yield soluble polymers which are easily cast into clear films with exceptional physical properties. For instance, when films are cast from the elastomeric epoxy control and compared to silicon containing composites, the composites exhibited tensile strength increases of more than six fold, hardness increases from 2H to 8H, and although elongation decreases of 50 fold were noted, film adhesion was excellent as no failures occurred even under a direct impact of 18.1+ J.

SORPTION OF MOISTURE ON EPOXY AND ALKYD FREE FILMS AND COATED STEEL PANELS—H.N. Rosen and J.W. Martin

Journal of Coatings Technology, 63, No. 792, 85 (Jan. 1991)

Sorption isotherm curves at 23°C were determined for alkyd and epoxy free films and coated steel panels as well as for alkyd "pocket" panels, consisting of an unadhered free film surrounding and enclosing the steel panel. The isotherms consist of an increasing linear portion to about 75% relative humidity (RH), followed by a rapidly rising nonlinear portion to 100% RH. A model assuming weak bonding forces between the paint film and water with microvoid condensation at high RH gave an excellent fit to the data. Transient sorption data on the approach to equilibrium conditions showed differences between alkyd and epoxy coatings. For alkyd films, surface boundary layer resistance was significant and sorption followed a Fickian model. For the epoxy coating, surface resistance was not significant and moisture movement was non-Fickian.

NOVEL APPROACH TO QUALITY ANALYSIS, OPTIMIZATION, AND CONTROL OF FILM COATING PROCESS—V.A. Skormin and R.J. Siciliano

Journal of Coatings Technology, 63, No. 792, 95 (Jan. 1991)

A novel approach based on statistical clustering is proposed for mathematical description of the film coating process. The approach provides a relationship between various quality outcomes of the product and particular regions in the operational space of coating variables. Combined with a regression quality model, the approach is used for the quality analysis and prediction, optimization, and stabilization of the process. A recursive version of the clustering procedure, suggested for on-line implementation, is presented.

FLOW AGENTS FOR HIGH SOLIDS COATINGS—M. Schnall

Journal of Coatings Technology, 63, No. 792, 103 (Jan. 1991)

Government restrictions on solvent emissions have forced coatings chemists to re-formulate solvent based coatings to higher solids types. As these new formulations have been developed, it became apparent that problems of poor flow were more prevalent than with the conventional solvent coatings. As a result, interest has increased in flow control additives for high solids coatings.

This paper reviews the theory involved in the flow of coatings, emphasizing the importance of surface tension effects. We then describe experimental work conducted with a number of commercial flow control additives in four basic types of high solids coatings: air-drying alkyd, baking alkyd, baking acrylic, and baking polyester.

The results indicated a correlation between the efficiency of the agent and its ability to reduce the surface tension of the coating. It was also noted that compatibility of the agent in the system was an important requirement.

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Federation News

Manuscript Entries Invited for 1990 Roon Awards Competition; Cash Prizes to Be Awarded Authors of Winning Papers

Prospective authors are invited to submit manuscript entries in the 1991 Roon Awards competition.

The Awards, sponsored by the Coatings Industry Education Fund (formerly the Paint Research Institute), were established in 1957 by the late Leo Roon, founder of Nuodex Products Co., and are supported by funds provided through the Roon Foundation. They are presented each year to the winning authors at the Annual Meeting of the Federation of Societies for Coatings Technology.

A total of $4,000 in cash prizes will be awarded for the top papers submitted for presentation at the 1991 Annual Meeting, to be held November 4-6, at the Metro Toronto Convention Centre, Toronto, Canada.

Papers submitted in the competition must: (1) Describe original work not previously published or presented; (2) Be directly related to the protective coatings industry; (3) Be of such a caliber that they reflect a step forward in real scientific contribution to the coatings industry; and (4) Be accompanied by clearance for publication.

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

Those wishing to enter the competition must send a letter of intent, along with the title of the proposed paper and a brief abstract (by March 1) to the Chairman of the Roon Awards Committee of the Federation: George R. Pilcher, Akzo Coatings, Inc., P.O. Box 147, Columbus, OH 43216.

1990 Winners of the Roon Competition

First Prize—"The Interactions of Associative Thickeners with Paint Components as Studied by the Use of a Fluorescently-Labeled Model Thickener"—Brough Richey, Andrea B. Kirk, Eric K. Eisenhart, Susan Fitzwater, and John W. Hook, Rohm and Haas Co., Spring House, PA.

Second Prize—"Specific Interactions and Adsorption of Film-Forming Polymers"—Henry P. Schreiber and Javier Lara A., Ecole Polytechnique l'Universite de Montreal, Montreal, Que., Canada.

Principles Governing the Roon Awards

The Awards, sponsored by the Coatings Industry Education Fund, were established in 1957 by the late Leo Roon, founder of Nuodex Products Co. Supported by funds provided through the Roon Foundation, they are for the best technical papers (other than those by a Constituent Society of the Federation) submitted for presentation at a Federation Annual Meeting.

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

The principles governing the awards are as follows:

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

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

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

(4) An Awards Committee, appointed by the President of the Federation, will judge the entries.

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

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

(7) Winning papers will be published in the Journal of Coatings Technology, which has prior rights to publication of all submitted papers.

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

(9) A 150 to 200 word abstract shall accompany the paper.

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

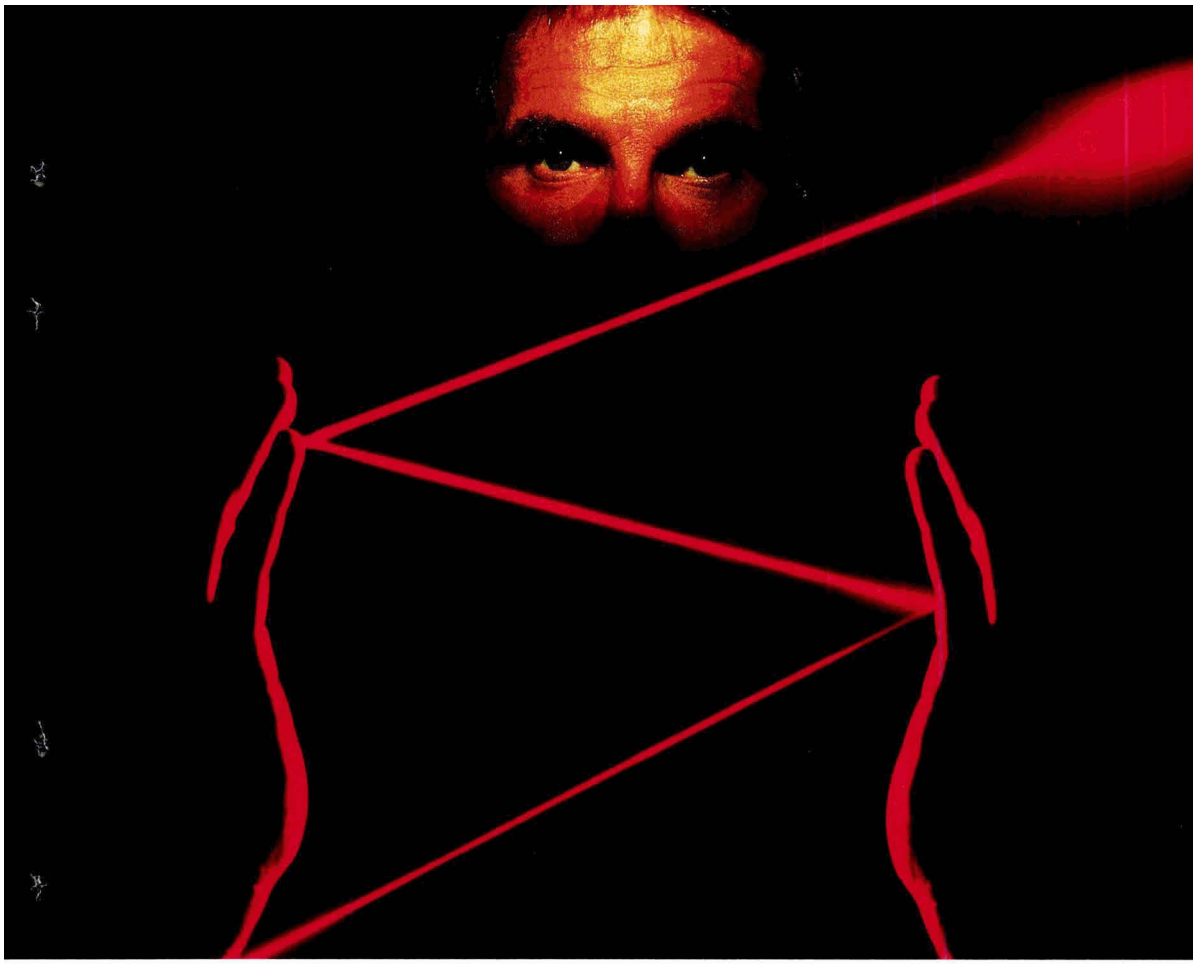
(11) The Awards will be open to anyone involved in study or engaged in work related to the protective coatings industries, including paint, varnish and lacquer manufacturers, raw materials suppliers, research laboratories, and universities. (The Committee, however, will not accept papers which involve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

(12) The Committee may award any number of prizes, the total of which is not to exceed $4,000.

(13) All papers must be accompanied by company or educational institutional clearance for publication.

(14) Those planning to submit a paper in 1990 must advise the Chairman (George R. Pilcher, Akzo Coatings, Inc., P.O. Box 147, Columbus, OH 43216) by March 1. He must have 10 publication manuscripts by May 1.

(15) The 1991 Awards and accompanying engraved plaques will be presented during the Annual Meeting in Toronto, Canada.



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Program Theme Announced, Papers Invited for 1991 FSCT Annual Meeting

The 1991 Annual Meeting of the Federation of Societies for Coatings Technology will have as its theme, "The International Coatings Environment: Today's Opportunity, Tomorrow's Challenge," it was announced by Program Chairman Gerry Parsons, of DeSoto Coatings Limited.

The Annual Meeting will be held November 4-6 at the Metro Convention Centre, Toronto, Canada, in conjunction with the Federation's Paint Industries' Show.

Today's global coatings environment requires pro-active marketing and technology stategies. An opportunity today will be a challenge tomorrow if it is not addressed in a timely and effective manner. To address this theme, programming will emphasize the international perspective and will focus on such areas as quality improvement, cutting edge technology, and environmentally and performance engineered products.

Prospective speakers are invited to present original papers on the theme and its various aspects, and are requested to submit abstracts (150 to 200 words) for review to: Gerry Parsons, DeSoto Coatings Limited, 895 Rangeview Road, Mississauga, Ontario L5E 3E7, Canada.

The deadline for receipt of abstracts is March 1.

Assisting Chairman Parsons in the program development is a Committee composed of: John Lanning (Vice-Chairman), Courtauds Coatings, Inc., Porter Paint Div., Louisville, KY; Mary G. Brodie, Strongsville, OH; Rob Deruiter, Reichhold Ltd., Toronto, Canada; John Hall, Tioxide, Inc., St. Laurent, Quebec, Canada; Peter Hiscocks, Ashland Chemicals, Mississauga, Canada; George R. Pilcher, Akzo Coatings, Inc., Columbus, OH; and Roger Woodhull, California Products Corp., Cambridge, MA.

1991 A.L. Hendry Award Competition Entries Invited

Prospective student authors are invited to submit manuscript entries in the 1991 Southern Society Alfred L. Hendry Award competition. The Award is a $1000 cash prize for the best paper on some aspect of coatings technology, authored by an undergraduate student currently enrolled in a college program.

Submitted papers must describe the results of original research on a subject related to coatings technology, or present a significantly insightful, comprehensive review of a field of coatings technology. Contributions based on original research may be co-authored by a faculty advisor, but the cash award for either type of paper will be presented only to the undergraduate student, who must be the principal author.

The Award is administered by the Educational Committee of the Federation; the Committee also judges the entries.

Those wishing to enter the competition must send a letter of intent, along with the title of the proposed paper, and a brief abstract, by March 15, to: Hendry Award Competition, c/o FSCT, 492 Norristown Rd., Blue Bell, PA 19422-2350. Deadline for receipt of manuscripts is July 1.

The Award, sponsored by the Southern Society for Coatings Technology, commemorates the industry contributions of the late Alfred L. Hendry, President of A.L. Hendry & Co., Tampa, FL, and a Past-President of the Southern Society. Presentation of the Award will be at the 1991 FSCT Annual Meeting, in Toronto, Canada, on November 4-6.

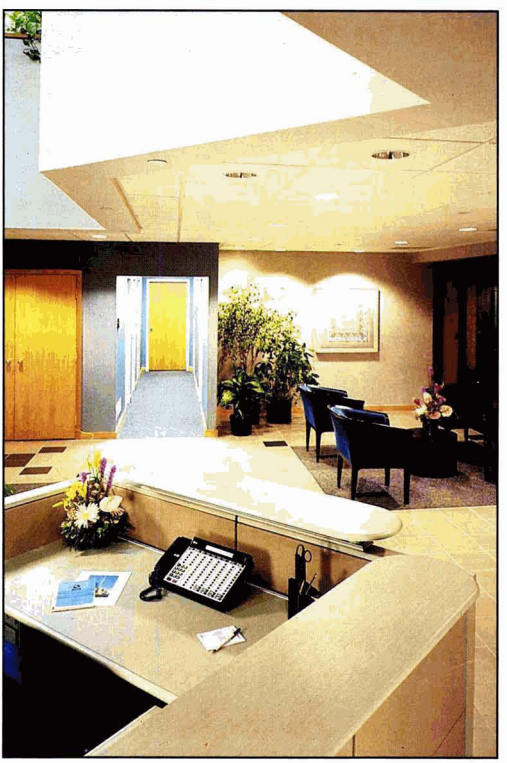
New Federation Headquarters

The FSCT at Blue Bell: Home at Last

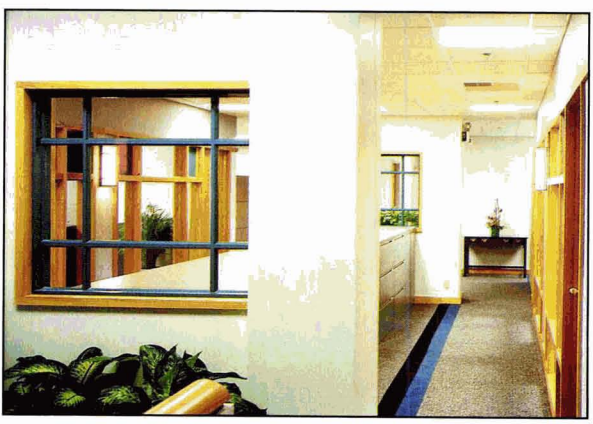
In October, 1988, the Federation's Board of Directors approved the acquisition of a Headquarters Building. This decision was based primarily on financial considerations, but it also reflected the desire to give the FSCT a permanent "home base" from which to operate. Over the next two years, an Ad Hoc Committee and Staff worked on the selection of a site, design of the building, gaining financing, and finally, construction. Presented here are the fruits of their labors: *your Federation Headquarters Building.*

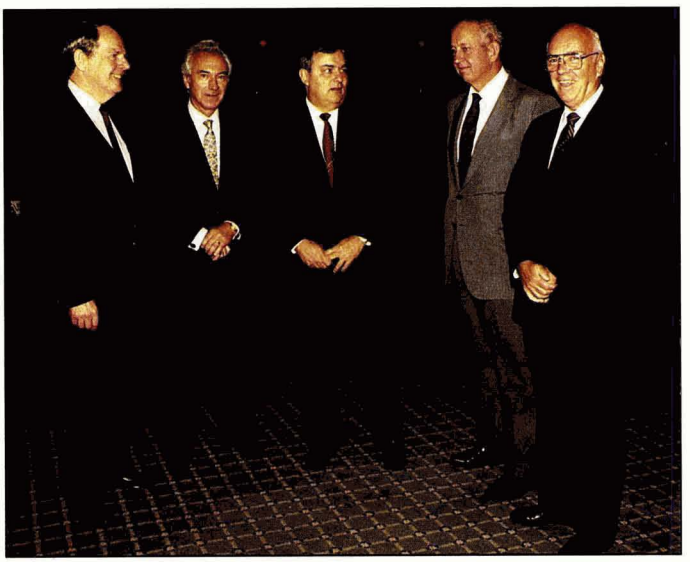
Located about 15 miles NW of Philadelphia in the suburban colonial-era community of Blue Bell, Pennsylvania, the FSCT Headquarters Building is part of an attractive six-building office park. Neatly landscaped, with generous parking, the park presents a relaxing atmosphere for both Staff and visitors alike.

At almost 10,000 square feet, the Headquarters Building allows more than enough office space for the current staff of 16 persons, with future growth being accommodated by 2,000 square feet of space which will be leased initially. The building's interior, designed and decorated by a professional office planning firm, utilizes light and space to give a pleasing appearance within a functional design. Inter-office communication is also enhanced by means of interior-windowed offices and a state-of-the-art telephone/intercom system.



Although an attractive appearance was a major goal, other, more utilitarian, features were also important. The two-story building is designed with on-grade access to both floors. A full, 5,000 square foot basement will provide storage for the many FSCT publications. And, with safety a concern, the Headquarters are fully-sprinklered and a security system gives 24-hour notice of intrusion and fire emergencies.





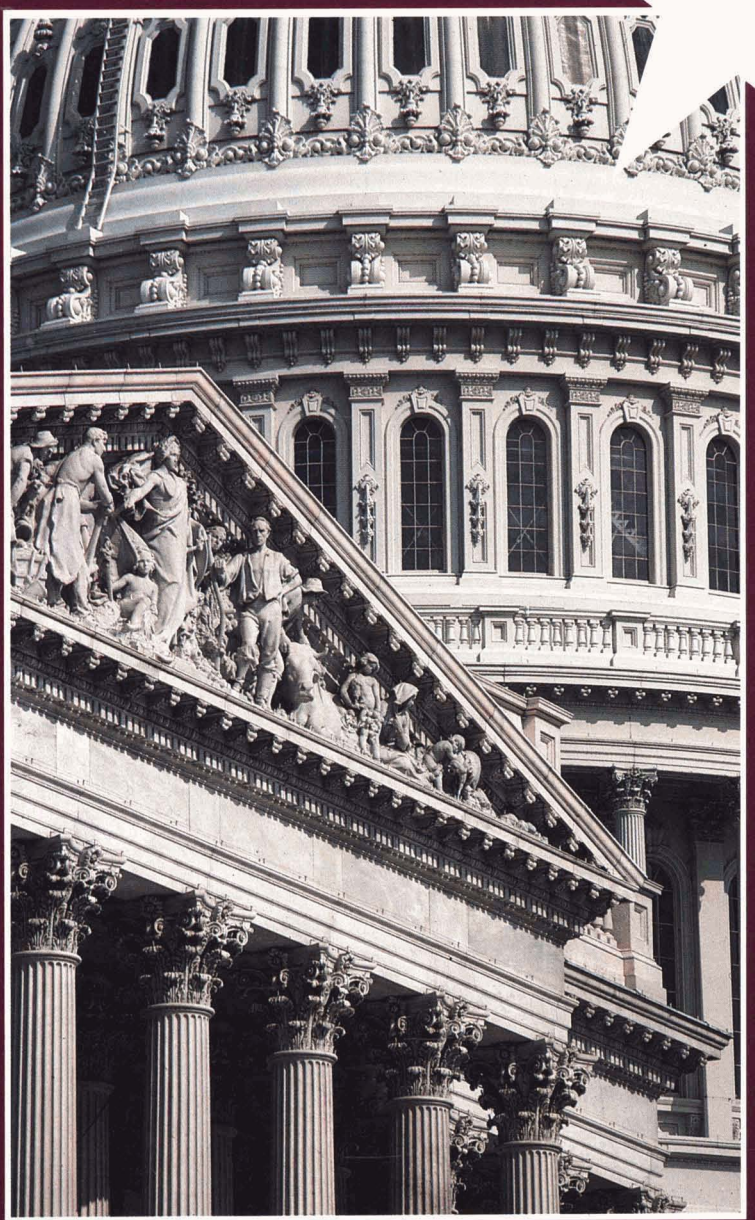
The Federation is indebted to the Ad Hoc Building Committee for its efforts in selecting the perfect site, developing the plans, and monitoring the progress of the Headquarters Building. Shown at left, the members of the Committee are: Deryk Pawsey (Pacific Northwest); James McCormick (Baltimore); James Geiger, *Chairman* (Southern); Colin Penny (Baltimore); and John Oates (New York). Due to the generous use of their time and expertise, the total costs for land acquisition and building construction will be below the budget of $1.6 million.

Through the foresight of the Board of Directors, the prodigious efforts of the Ad Hoc Building Committee, and the energy and the input of Staff, the Federation now owns and occupies a Headquarters in which every member can take great pride. The FSCT looks forward to many, many years of serving its members from its new home in Blue Bell,

—Robert F. Ziegler, Executive Vice President

Federation of Societies for Coatings Technology

68th Annual Meeting
55th Annual Paint Industries' Show
Annual Meeting & Paint Show Wrap-up



Washington Convention Center

Monday, Tuesday, Wednesday
October 29, 30, 31, 1990

Washington, D.C.

The 55th Paint Industries' Show opened as Judy Ballard performed the traditional ribbon-cutting ceremony. Shown from left to right: Secretary-Treasurer-Elect Colin D. and June Penny; Executive Vice President Robert F. and Elaine Ziegler; President John C. and Judy Ballard; President-Elect Kurt F. Weitz; and Jean and Secretary-Treasurer William F. Holmes

FSCT Annual Meeting and Paint Industries' Show Draws Over 8,600 Registrants to Washington, D.C.

The Federation Annual Meeting and Paint Industries' Show returned to Washington, D.C., October 29-31, and the three-day event drew a total of 8,693 registrants. The attendance topped the previous high of 8,414 registrants, set at the 1988 event in Chicago.

Geared to the theme of "A Decade of Decision: Preparing for the Year 2000," the technical program featured presentations on a variety of coatings topics, both theoretical and practical. From the dynamic Keynote Address by Lee Sherman Dreyfus, former Governor of Wisconsin, on through the thought-provoking Mattiello Memorial Lecture by Dr. Henry J. Leidheiser, Jr., retired Director of the Center for Surface and Coatings Research, Lehigh University, registrants were treated to a plentiful array of papers. The sessions were generally well attended throughout, and the high level of interest was reflected in the spirited question-and-answer periods which followed many of the presentations.

In the exhibit area, meanwhile, registrants toured the aisles of the largest Paint Show ever, to view the latest in products and equipment displayed by more than 280 supplier firms. Exhibitors expressed their pleasure with both the attendance and interest shown in the displays. And registrants were impressed with the number and quality of the exhibits—the latter again presenting the judging committee with difficult choices for selecting the outstanding booths (*see Awards story*).

At the closing luncheon, approximately 300 attendees were on hand to honor the various recipients of Federation awards, following which they were entertained by the commentary of Douglas Kiker, TV News Correspondent.

The many members of the Baltimore Society who served on the Host Committee under the direction of Chairman Richard Chodnicki are due much praise and appreciation for contributing their assistance. The Federation is indebted to them and to all who helped make the 1990 Annual Meeting and Paint Industries' Show such a success.

1991 Annual Meeting & Paint Show To Be Held November 4-6, in Toronto, Ontario, Canada

The 69th Annual Meeting and 56th Paint Industries' Show of the Federation of Societies for Coatings Technology is scheduled for November 4-6 at the Metro Convention Centre in Toronto, Ontario, Canada.

Chairman of the Annual Meeting Program Committee is Gerry Parsons, of DeSoto Coatings Ltd., Mississauga, Ont., Canada.

Members of the Toronto Society, under the direction of Chairman Larry Ham, of Stochem Inc., Brampton, Ont., Canada, will serve on the Host Committee.

For exhibit or attendance information, contact FSCT Headquarters, 492 Norristown Road, Blue Bell, Pennsylvania 19422, 215/940-0777, FAX: 215/940-0292.

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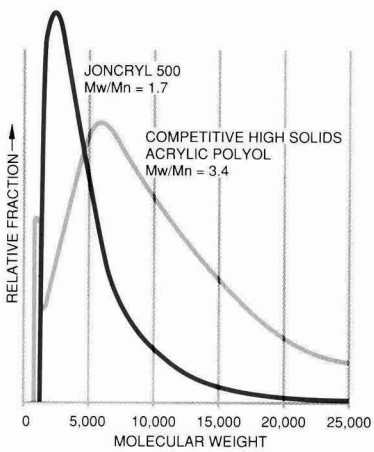
As a modifying resin for polyester and other acrylics, Joncryl high-solids oligomers can improve application properties and reduce film defects. Add these advantages to its broad compatibility with resins, solvents and additives and you'll find Joncryl high-solids oligomers to have far more versatility than other competitive products.



In the 90's, the paint market will turn to producers of low VOC coatings—so it is important now to take a good hard look at how you can best be prepared. Joncryl SGO technology can be your *best available control technology.* For more information, write to SC Johnson Wax, Specialty Chemicals, Racine, WI 53403. Or call **1-800-631-3920.**

SC Johnson wax
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John J. Oates, Receives 1990 George Baugh Heckel Award in Washington, D.C.

Other Annual Meeting Awards Presented

John J. Oates, retired from Troy Chemical, Newark, NJ, in 1988, was honored with the 1990 FSCT George Baugh Heckel Award for his outstanding service to the Federation.

The award was presented on October 31 during the Federation's Annual Meeting in Washington, D.C.

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.

John J. Oates was graduated with the B.Sc. Degree in Chemistry from the City College of New York, and has done graduate work in Chemistry at Brooklyn College. He began his career in a biochemistry laboratory, then joined the New York Testing Laboratory where he worked from 1948-51, becoming Assistant Chief Chemist.

From 1951-63, Mr. Oates was associated with Subox, Inc., Hackensack, NJ, where he specialized in the manufacture of lead suboxide pigment and in the development and production of a broad range of anticorrosion maintenance paints. He was appointed Chief Chemist of Subox in 1954, Technical Director in 1957, and Vice President of Manufacturing and Development in 1961.

His competence in the field of anticorrosion coatings has been recognized by invitations to lecture before numerous technical and engineering groups, including the Tennessee Valley Authority, the Pennsylvania Electric Association, the Houston Coatings Group, New York University, and others, whom he addressed on the subjects of metal surface preparation, painting, and maintenance of steel structures.

Mr. Oates was associated with Troy Chemical from 1963 until his retirement in 1988; first as Manager of Technical Sales and then as Vice President. His duties included responsibility for national and international technical service for Troy's line of paint additives and biocides.

He has authored and co-authored a number of technical papers on coatings technology, and has been a frequent speaker before technical groups in the U.S., Europe, and Pacific Rim countries.

John J. Oates (right) accepts the 1990 George Baugh Heckel Award from Neil S. Estrada, Chairman of the Heckel Award Committee

Mr. Oates joined the New York Paint and Varnish Production Club in 1951, and promptly became involved in Club activities as a member of the Publicity and Technical Committees. He was Chairman of Sub-Committee 53 when the committee presented the 1957 prize-winning paper, "Dispersion of Phthalocyanine Blue." In 1960, Mr. Oates was among the first group of recipients of the Society's Roy Kienle Award. After advancing through the chairs, he served as President of the New York Society for Coatings Technology in 1962. He also was presented with New York Society's PaVaC Award for his outstanding contributions to the advancement of coatings technology.

Mr. Oates has been a member of the Federation for 35 years and served as Federation President in 1977-78. He was a member of the Board of Directors for eight years and has chaired the Annual Meeting Host (1965), By-Laws (1968-69), Annual Meeting Program (1974), Finance (1978-79), and the Liaison (1979-80) Committees of the Federation. In addition, he has also served on the Annual Meeting Program, Educational, Annual Meeting Host, By-Laws, Liaison, Finance, Paint Show, Planning, Nominating, and Ad Hoc Building Committees. Mr. Oates was elected to Federation Honorary Membership in 1989.

John and Louise Oates reside in Midland Park, NJ.

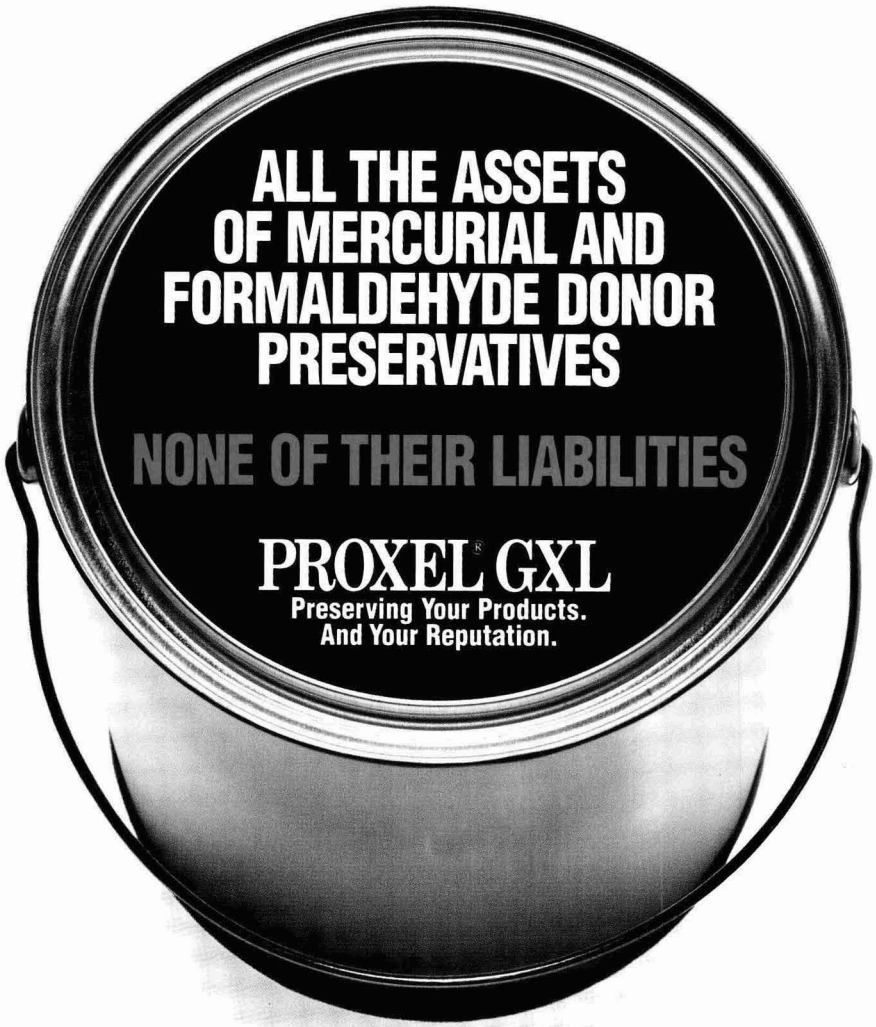
Distinguished Service Award

This award was presented to John C. Ballard, of the Louisville Society, in grateful recognition of his valuable contributions to the progress of the Federation while serving as President of the Federation in 1989-90. Mr. Ballard is Vice President/Manager—Technical Services, Kurfees Coatings, Louisville, KY.

Roon Foundation Awards

These cash awards and plaques, established by the late Leo Roon, and administered by the Coatings 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.

FIRST PRIZE ($3,000)—"The Interactions of Associative Thickeners with Paint Components as Studied by the Use of a Fluorescently-Labeled Model Thickener"—Brough Richey, Andrea B. Kirk, Eric K. Eisenhart,



With the August 20, 1990 banning of mercury in interior latex paints, and the questionable fate of formaldehyde donors, the outlook for in-can preservatives is changing rapidly. But for users of mercury-free, formaldehyde-free PROXEL GXL, it's business as usual.

PROXEL GXL antimicrobial from ICI Biocides is as effective an in-can preservative as any on the market. Proven in water-based paint formulations, PROXEL GXL has remained the biocide of choice for many raw materials suppliers for more than twenty years. Using PROXEL GXL provides all the "insurance" you expect from preservatives containing mercury or formaldehyde — *but without the mercury and formaldehyde.* And it's as cost effective to use as the more regulated alternatives.

Now is the time to seriously consider PROXEL GXL. ICI Biocides' experienced technical team will gladly expand upon the assets of PROXEL and show you how smooth the transition to this effective, safer biocide can be. At a time when your options for effective preservatives are becoming fewer, PROXEL GXL remains a product in which you can be confident.

For more information on PROXEL GXL, call ICI Biocides today. (800) 523-7391.

Specialty Chemicals

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A business unit of ICI Americas Inc.

Richard Landry (left), of Applied Color Systems, Inc., receives the Armin J. Bruning Award from presenter Don Hall, also of Applied Color Systems, Inc.

FSCT President-Elect Kurt Weitz (left) presents President John Ballard with the Distinguished Service Award

Susan Fitzwater, and John W. Hook, Rohm and Haas Co., Spring House, PA.

SECOND PRIZE ($1,000)—"Specific Interactions and Adsorption of Film-Forming Polymers"—Henry P. Schreiber and Javier Lara A., Ecole Polytechnique l'Universite de Montreal, Montreal, Quebec, Canada.

Armin J. Bruning Award

This award, established in 1962 in honor of color science pioneer Armin "Joe" Bruning, was presented to J.L. Richard Landry, of Applied Color Systems, Inc., for his "outstanding contributions to the science of color in the field of coatings technology."

As a Professor at the Philadelphia College of Textiles and Sciences during the 1950s, Mr. Landry taught the only course in spectrophotometry and colorimetry offered at the college level in the United States. From 1960 to the present, he has held management and technical positions at Davidson and Hemmendinger, Inc., Kollmorgan Corporation, and Applied Color Systems, Inc. Mr. Landry has been with Applied Color since 1978. He presently holds the position of Senior Technical Applications Advisor.

Mr. Landry has presented seminars and papers on the use of color science for industrial applications in more than 20 countries. Several of the papers were presented at the Detroit Colour Council; The New York Society for Paint Technology; The Colour Group of Great Britain; Paint and Lacquer Association of Sweden; and the ISCC-Williamsburg Technical Conference.

Mr. Landry received the B.S. Degree in Textile Chemistry from Philadelphia College of Textiles and Sciences and the M.S. Degree in Physical Chemistry from the University of Pennsylvania.

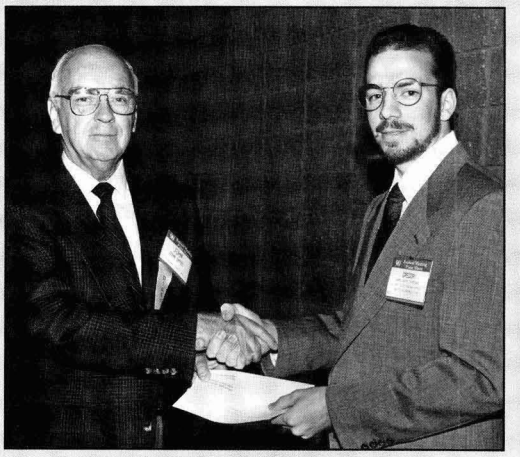
Alfred L. Hendry Award

Sponsored by a grant from the Southern Society of the FSCT, this award of $1,000, is for the best undergraduate student paper submitted for competition. The 1990 competition was won by Gregory Tregre and J. Shannon Reed, of University of Southern Mississippi, Hattiesburg, MS, for the paper "A Novel Alternative in High Performance Clear Coats: Molecular Composites Utilizing Arylsilane Aramids."

Roon Awards Chairman Richard Eley (left) presents the 1990 Roon Awards to winners: First Place—John W. Hook, Andrea B. Kirk, Brough Richey, and Susan Fitzwater; Second Place—Javier Lara A.

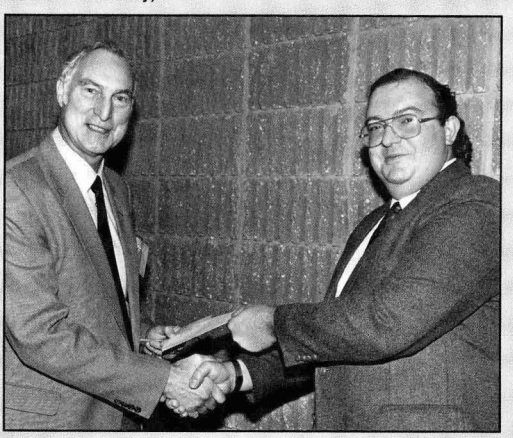
Jonathan W. Martin (left) receives Corrosion Committee Award from Committee Chairman Jay Austin

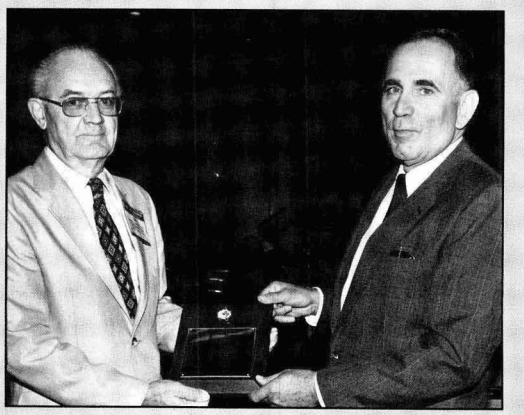
1990 Society Secretaries Awards were presented to Peter Kuzma (Philadelphia) and Sandra Dickinson (Los Angeles)



Educational Steering Committee Member John Oates congratulates the A.L. Hendry Award winner Gregory Tregre, of the University of Southern Mississippi

John Mitchell (left) presents Freidun Anwari (Cleveland Society) with the Second Place Prize in the Society Speakers Competition. (Missing from picture, First Place winner Mary Somerville, of Baltimore Society)





Ivan Quackenbush (left) accepts the Morehouse Golden Impeller Award for his outstanding achievement in dispersion technology, presented by Walter H. Stoufer, Sales and Marketing Manager, Morehouse Industries, Inc.

A.F. Voss/*American Paint & Coatings Journal* Awards are presented by Chairman Patricia Shaw (left). Representing the winning Societies are (left to right): First Place—Ben Carlozzo (Cleveland); Second Place—Freidun Anwari (Cleveland); and representing Third Place — Bob Athey (Golden Gate)

Society Secretary 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 ($250)—Peter Kuzma (VIP Products Corp.), Secretary of the Philadelphia Society.

SECOND PRIZE ($100)—Sandra Dickinson (McWhorter Co.), Secretary of the Los Angeles 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 fabrication.

FIRST PRIZE ($300)—"Changes in Hiding During Latex Film Formation. Part II. Pigment Packing Effects"—Cleveland Society (Ben J. Carlozzo).

SECOND PRIZE ($200)—"Changes in Hiding During Latex Film Formation III. Effect of Dispersant Level and Emulsion Properties"—Cleveland Society (Freidun Anwari, Chairman, Technical Committee).

THIRD PRIZE ($100)—"Statistical Modeling Drying of Coatings"—Golden Gate Society (Margaret Hartmann).

Society Speaker 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 ($250)—Mary Somerville (Bruning Paint Co.), Baltimore Society.

SECOND PRIZE ($100)—Freidun Anwari (Coatings Research Group, Inc.), Cleveland Society.

Corrosion Committee Publication Award

Presented for the best corrosion-related papers published in the JOURNAL OF COATINGS TECHNOLOGY.

FIRST PRIZE ($750)—"Mechanism of Cathodic Protection of Zinc-Rich Paints by Electrochemical Impedance Spectroscopy—Part I. Galvanic Stage" and "Part II. Barrier Stage"—S. Feliu, R. Barajas, J.M. Bastidas, and M. Morcillo, of Centro Nacional de Investigaciones Metalúrgicas, published in the August 1989 issue of the JCT.

SECOND PRIZE ($250)—"Detection and Quantitative Characterization of Blistering and Corrosion of Coatings on Steel Using Infrared Thermography"—Mary E. McKnight and Jonathan W. Martin, of National Institute of Standards and Technology, published in the August 1989 issue of the JCT.

Mattiello Lecture Committee Chairman John Ballard presents a check to Henry J. Leidheiser, Jr., who presented the Mattiello Lecture, "Electrochemical Techniques for Studying Protective Polymeric Coatings"

Golden Impeller Award

This annual award, offered by Morehouse Industries, Inc., for outstanding achievement in dispersion technology, was presented at the Annual Meeting to Ivan Quackenbush, of Quackenbush Co., Arlington Heights, IL.

Meeting of Members of the International Coordinating Committee Held During Annual Meeting and Paint Show, October 30

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); Surface Coating Association Australia (SCAA); Japan Society of Colour Materials (JSCM); and Federation of Scandinavian Paint and Varnish Technicians (SLF).

Present at the meeting held on October 30, 1990, during the FSCT Annual Meeting and Paint Show in Washington, D.C., and pictured above, were:

Standing (left to right): Secretary-Treasurer-Elect Colin Penny (FSCT); President-Elect Kurt Weitz (FSCT); Past-President Terryl Johnson (FSCT); Past-President Deryk Pawsey (FSCT); Mrs. Nicole Bourgery; Secretary-General Christian Bourgery (FATIPEC); Executive Vice President Robert Ziegler (FSCT); IUPAC Delegate Gerry Gough (FSCT); Secretary-Tresurer William Holmes (FSCT); Past-President Amleto Poluzzi (FATIPEC); Past-President Carlos Dorris (FSCT); Past-President Jacques Roire (FATIPEC); and Past-President James Geiger (FSCT).

Seated (left to right): President A. Graham North (OCCA-UK); Delegate Takeshi Amari (JSCM); President John Ballard (FSCT); President Annik Chauvel (FATIPEC); and Past-President Ted Saultry (SCAA).

The next meeting of ICCATCI will be held during the FATIPEC Congress in Stratford-upon-Avon, England, June 12-14, 1991.

"Women in Coatings" Host Fourth Annual Meeting

Members of the organization, "Women in Coatings," discussed the possibility of establishing more frequent regional meetings at their fourth annual meeting in Washington, D.C., on October 28. Chairperson of the meeting, Violet Stevens, of Dow Chemical, said coordinators will be needed for the establishment of such regional groups and meetings. Interested parties should contact Linda Hicks, Vice President, Subtropical Testing Services, 8290 S.W. 120th St., Miami, FL 33156, for more information.

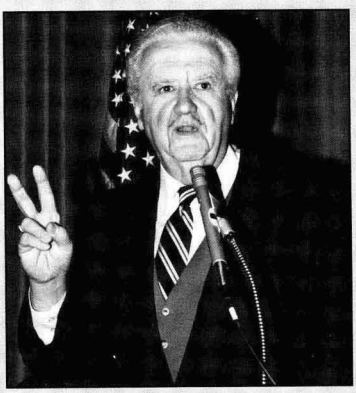
The next official gathering of the group will be February 18-20, 1991 at the Western Coatings Societies' 20th Biennial Symposium and Show in San Francisco, CA.

The attendees also discussed ongoing activities of the group and to honor those women who have received the 1990 Achievement Awards. Winners include: Communications—Marilyn Ludwig, of National Paint and Coatings Association; Management—Marie R. Nargiello, of Degussa Corp.; Marketing—Gail Pollano, of ICI Industries; Leadership—Linda Salem, of Carboline Corp.; and Scientific—Linda S. Smith, of Rohm and Haas Co.

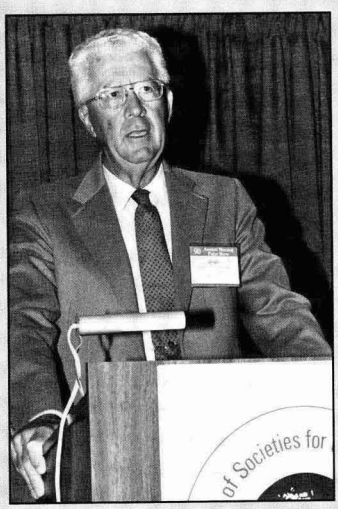
Recipients of the 1990 Women in Coatings Achievement Awards include: Linda S. Smith, of Rohm and Haas; Chairperson Violet Stevens; Linda Salem, of Carboline; and Marilyn Ludwig, of National Paint and Coatings Association

George Pilcher, Technical Director, of Akzo Coating, Inc., Columbus, OH, moderates a seminar on "Coating a Sound Foundation"

ANNUAL MEETING PROGRAM SESSIONS



The Keynote Address of the Annual Meeting was presented by former Governor of the State of Wisconsin Lee Sherman Dreyfus. His presentation was "A Generation of Eagles"



Dr. Henry J. Leidheiser, Jr., former Director of the Center for Surface and Coatings Research, Lehigh University, Bethlehem, PA, delivers the 1990 Mattiello Memorial Lecture

The Manufacturing Committee of the Federation presented a seminar entitled "Challenging Tradition"

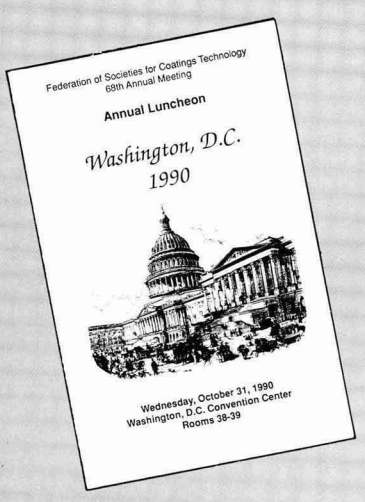
Incoming FSCT President Kurt F. Weitz (right) receives Presidential Gavel from Immediate Past-President John C. Ballard

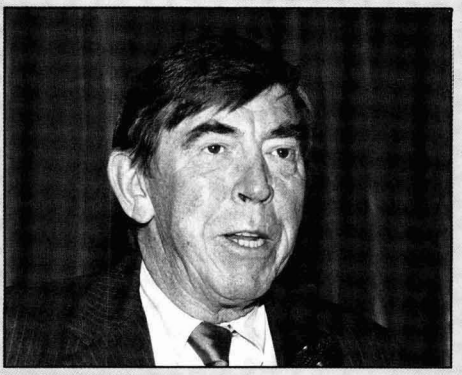
Executive Committee Members for 1990-91 are (standing, left to right): Richard M. Hille, Immediate Past-President John C. Ballard, and Joseph J. Giusto. Seated: President-Elect William F. Holmes, President Kurt F. Weitz, and Secretary-Treasurer Colin D. Penny. (Missing from photo: Jan P. Van Zelm)

FSCT OFFICERS

Past and Present

Federation Past-Presidents in attendance included (seated left to right): Carroll M. Scholle (1965-66); Hiram P. Ball (1951-52); John C. Ballard (1989-90); Eugene H. Ott (1960-61); Joseph W. Tomecko (1957-58); Michael W. Malaga (1973-74); and John J. Oates (1977-78). Standing: A. Clarke Boyce (1982-83); Joseph A. Bauer (1984-85); James E. Geiger (1988-89); James A. McCormick (1978-79); Neil S. Estrada (1976-77); William H. Ellis (1980-81); Carlos E. Dorris (1986-87); Deryk R. Pawsey (1987-88); William Mirick (1985-86); Terryl F. Johnson (1983-84); and Howard Jerome (1981-82)





Douglas Kiker, of "NBC News," was the featured speaker at the Federation's Annual Luncheon

Standing (left to right): John C. Weaver, and Marge and Carroll Scholle. Seated: George Selden, Joseph W. Tomecko, and Eugene and Betty Ott

Standing: Joseph and Sadie Cantor, and Dorothy and Sid Levinson. Seated: Ellie and Ben Chatzinoff, and Ed and Rose Wanderman

Standing: Carl Engelhardt, Johan Bjorksten, Lewis Larson, John Gordon, and Edmund Peterson. Seated: Ruth Engelhardt, Marian Larson, and Evelyn Gordon

FSCT 50-YEAR MEMBERS

WASHINGTON . . .
Here and There

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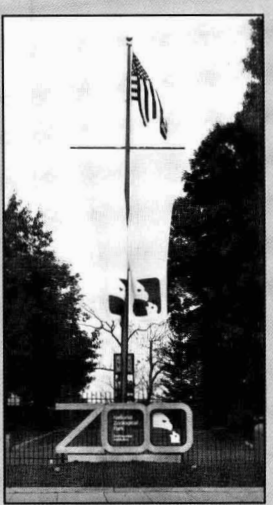

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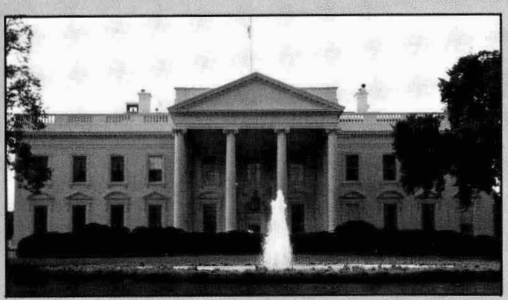

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Fourth Annual Paint Show 5000

Washington, D.C., Oct. 30—Washington, D.C., home of our nation's Capital, is the site of this year's Fourth Annual Paint Show 5000, a five kilometer run for fun and fitness. Serving as "official starter and welcomer" for the annual event is Dr. Matthew Guidry, Director of Community Services for the President's Council on Physical Fitness and Sports.

The temperature for this October 30 is a bit on the chilly side, somewhere in the 40's. Accompanying this slightly colder than normal air temperature is a swirling wind, which appears to be in the face of the runners at the start of the race, and at their backs at the finish. However, since this year's five kilometer race is run on a circular, gravel walkway, the wind seems to be coming from all angles.

At 7:00 a.m., 177 runners strong gather at the starting line on Madison Drive Walk, on the Mall. As the contestants ready for Dr. Guidry's, "runners take your mark," an outline of the Capitol is beginning to break through the early morning sky. Most of the runners have opted to challenge the weather and the course in full sweatsuits. Some runners have choosen to wear gloves. However, one brave male runner has decided to tackle the 3.1 mile run bare-chested, wearing just running shorts and shoes.

At the sound of the official starters' gun, the pack of runners sprint, seeming almost overjoyed at the opportunity of running into a headwind, knowing full well that Mother Nature will be to their advantage once they hit the inner walkway of the Mall. Once on the gravel inner walkway, the runners will set their sights on the Washington Monument and the completion of the first mile.

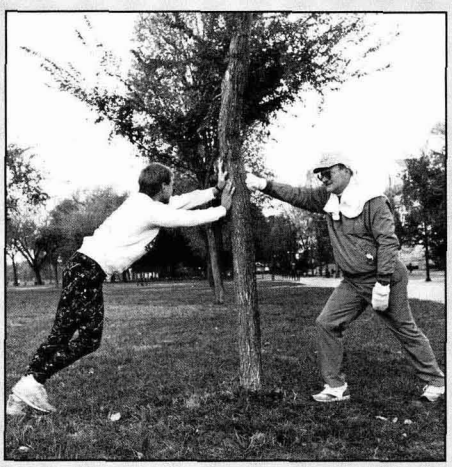
At the conclusion of the first one-third of the race, a leader is clearly established. The quick pace set by the leader at the onset is the difference, and now it is just a matter of how fast he will finish this 3.1 mile run. However, the second and third spots are up for grabs among a handful of fliers.

The leader effortly cruises through the second and third miles of this 5K contest. Gliding through the tape and winning this year's Fourth Annual Fun Run is Gary Wiesinger, of Red Devil, Inc., in a time of 17:33, just five seconds off of last year's record setting-time at New Orleans, LA. Considering the cold temperature and bone-chilling winds, the winning time is more than respectable. The duel for second place is won by Bud Bettler, of Du Pont Company, in 18:41, with third place going to Steve Schmidt, of W.R. Grace, Davison Division, in a time of 18:46.

Not to be forgotten is the brave effort put forth by the fitness run's first female finisher, Anita Taylor, also of W.R. Grace, Davision Division, with a time of 23:53.

The annual fitness run is sponsored by Troy Chemical Corporation, in cooperation with the Federation of Societies for Coatings Technology. A portion of the $5 registration proceeds is donated to the FSCT's Coatings Industry Education Fund. In addition, all registrants receive a free T-shirt and a memento of the 1990 event.

So, with the 1991 Paint Show only 10 months away, one thing is for certain, it's never too soon to train and get in shape for the Fifth Paint Show 5000 in Toronto, Ont., Canada.



Nine Exhibitors Win Awards In 1990 Paint Industries' Show

ACS-Data Color; Byk-Gardner, Inc.; CB Mills; The Carborundum Co.; J.M. Huber Corp.; S.C. Johnson Wax; Malvern Minerals Co.; Mixmor of Pennsylvania, Inc.; and Ronningen-Petter were recipients of the C. Homer Flynn Paint Show Awards at the 1990 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—The Carborundum Co., Niagara Falls, NY. (Two years in Show).

Double-Booth Exhibit—Malvern Minerals Co., Hot Springs, AR (Five years).

Three-to-Five Booth Exhibit—J.M. Huber Corp., Edison, NJ (25 years).

Six-or-More-Booth Exhibit—S.C. Johnson Wax, Racine, WI (Nine years).

PRODUCTION EQUIPMENT MANUFACTURERS:

Single-Booth Exhibit—Ronningen-Petter, Portage, MI (One year).

Double-Booth Exhibit—Mixmor of Pennsylvania, Inc., King of Prussia, PA (One year).

Three-or-More-Booth Exhibit—CB Mills, Buffalo Grove, IL (31 years).

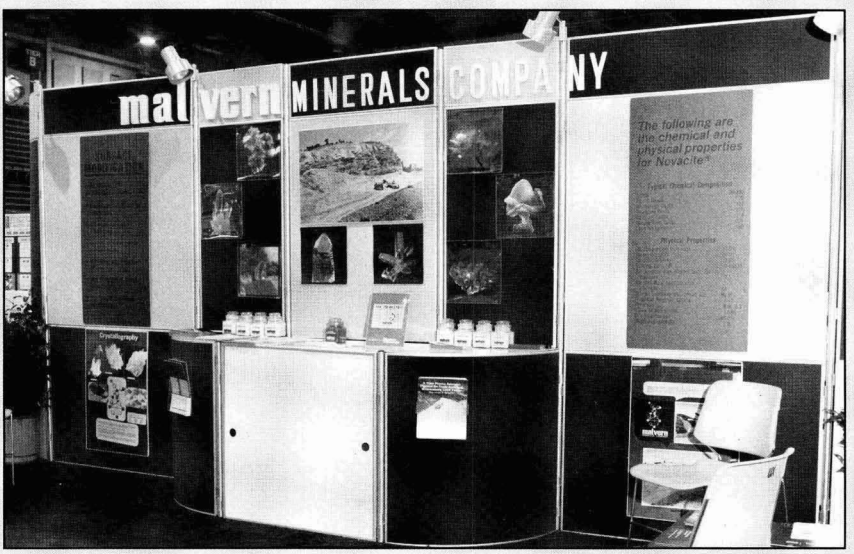
SERVICE INDUSTRIES: ACS-Datacolor, Princeton, NJ (21 years).

LABORATORY AND TESTING EQUIPMENT MANUFACTURERS: Byk-Gardner, Inc., Silver Spring, MD (37 years).

Paint Industries' Show Committee Chairman Ken Hyde (standing, first from the left) presents plaques to the winners of the C. Homer Flynn Awards for outstanding exhibits at the Paint Industries' Show. Representing the winning companies are (standing, left to right): Margery Wirtner (The Carborundum Co.); Hewitt Harlow (Malvern Minerals Co.); Gary Coupen (J.M. Huber Corp.); and James Sperelakis (S.C. Johnson Wax). Seated: Thomas Mabon (Byk-Gardner, Inc.); Don Hall (ACS/DataColor); Howard Andrus (Ronningen-Petter); William Preston (Mixmor, Inc.); and Denny Stidham (CB Mills, Inc.)

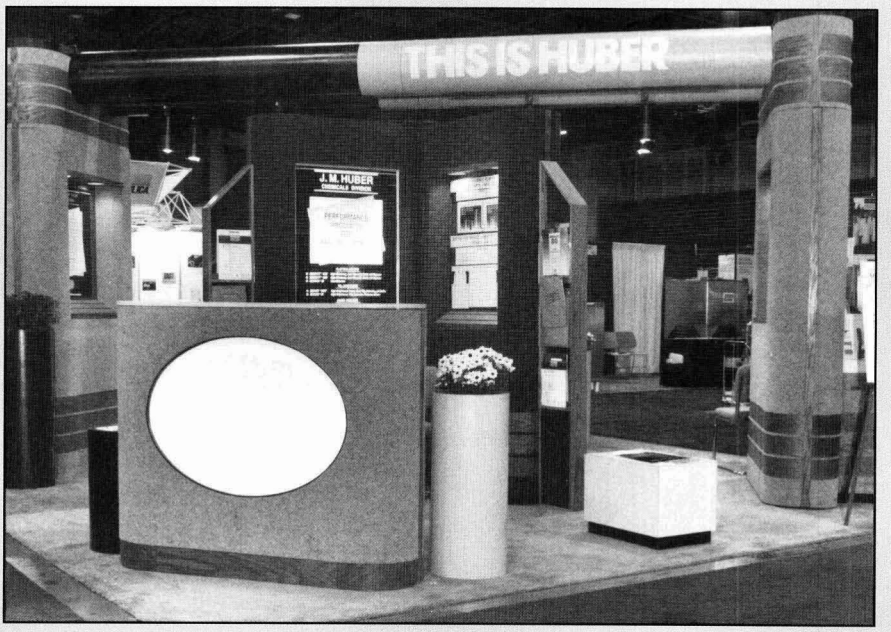
RAW MATERIALS SUPPLIERS

The Carborundum Co., Fibers Div., Niagara Falls, NY



Malvern Minerals Co., Hot Springs, AR

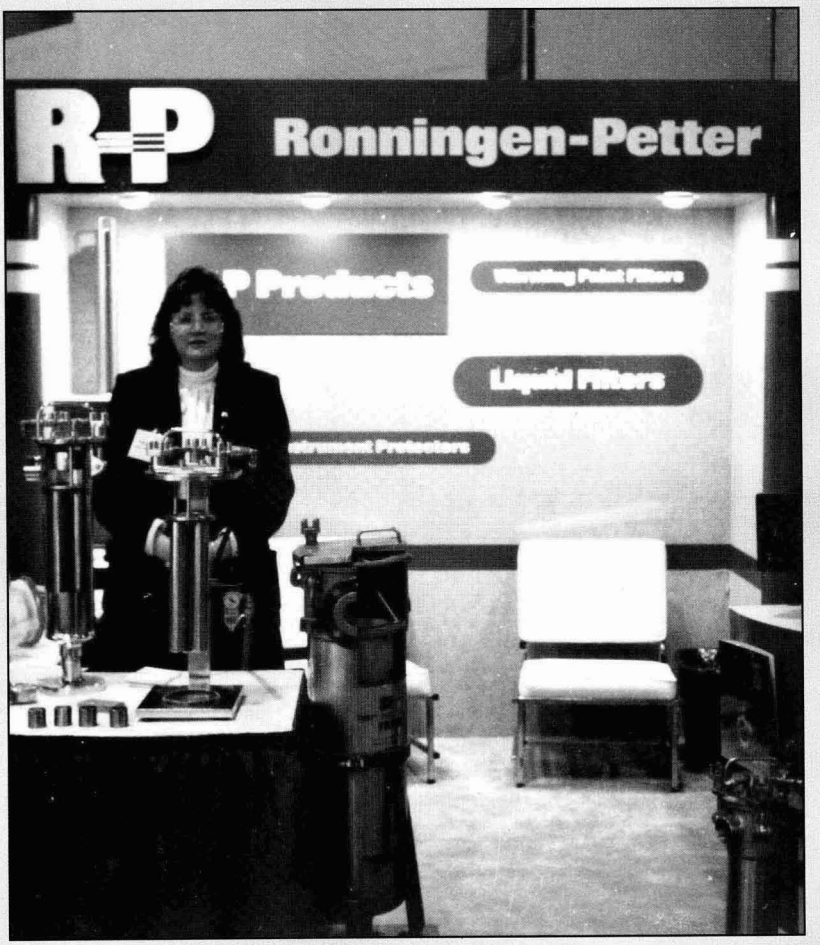
WINNERS



J.M. Huber Co., Edison, NJ

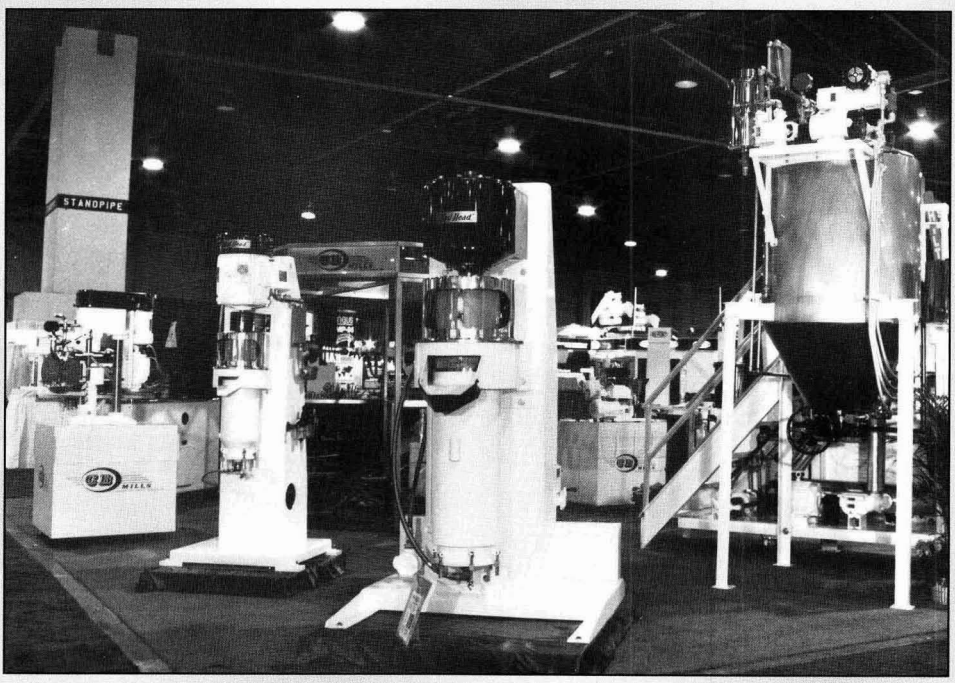
S.C. Johnson Wax, Racine, WI

PRODUCTION EQUIPMENT MANUFACTURERS



Ronningen-Petter, Portage, MI

Mixmor, Inc., King of Prussia, PA

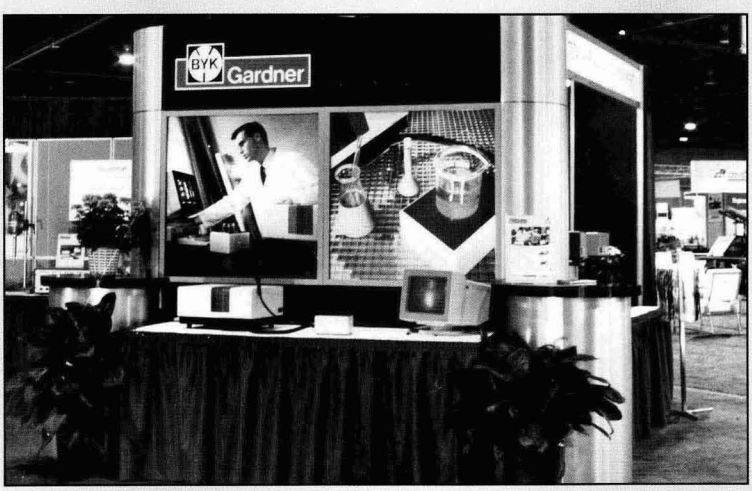


CB Mills, Inc., Buffalo Grove, IL

SERVICE INDUSTRIES

ACS-Datacolor, Princeton, NJ

EQUIPMENT MANUFACTURERS



Byk-Gardner, Inc., Silver Spring, MD

1990 Paint Show Exhibits

The 1990 Paint Industries Show of the Federation of Societies for Coatings Technology was held at the Washington Convention Center, Washington, DC, on October 28-30. The 281 exhibitors took part in the largest ever Paint Show (82,090 square feet).

As a continuing service to JCT readers, we present (in the following pages) a description of the products and services which highlighted the booths of the 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 (492 Norristown Rd., Blue Bell, PA 19422). All inquiries will be forwarded.—*Ed.*

ACCURATE INDUSTRIES
Williamstown, NJ 08094

Accurate Industries is a manufacturer of solid waste, sludge handling and drum disposal equipment.

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.

ACS-DATACOLOR
Princeton, NJ 08543

ACS-Datacolor exhibits its 2018 Color Control System with CHROMA-SENSOR CS-5 highlighting a new CHROMA-CALC paint software package which features a unique gloss compensation program, the ACS Decorator System, offering phototype presentations, and the metallics-measuring head MMK 111.

ADVANCED COATING TECHNOLOGIES
Hillsdale, MI 49242

New test panels include low-cost, phosphated steel; various plastics; cast metals; coil-coated aluminum; and styling panels. Standard panels of various metals and shapes are also displayed with capabilities of ACT's accredited independent testing lab.

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 & CHEMICALS, INC.
Allentown, PA 18195

Highlighted are Flexbond® 380 EXP, a new vinyl-acrylic general-purpose paint emulsion; wetting agents, defoamers, pigment grind aids and catalysts for water-based coatings; and a line of low viscosity, monomer-free polyurethane prepolymers for coatings.

ALAR ENGINEERING CORP.
Mokena, IL 60448

ALCAN-TOYO AMERICA, INC.
Naperville, IL 60563

Alcan-Toyo America features a complete line of aluminum pigments for automotive finishes, industrial coatings, powder coatings, maintenance coatings, graphic arts and water-based systems. Literature is available for our full line of products. Technical staff is available to answer any questions you may have regarding aluminum pigments.

ALLIED-SIGNAL INC.
Morristown, NJ 07962

Two businesses of Allied-Signal are represented: AC Additives is offering low molecular A-C polyethylene for abrasion resistance and antiblocking in water and solvent borne coatings. New products include alcohol functional polyethylene and terepolymers. The Specialty Oximes business is the only U.S. manufacturer of methyl ethyl ketoxime, used in the coatings industry as an antiskinning agent. Several new oximes are offered in lower temperature cure blocked urethane applications, as well as developmental products based on oxime blocked TMI.®.

AMBROSE CO.
Arlington, WA 98223

Featured are the Model DF5500BF automatic electronic 55 gallon drum filler with automatic bung finder; the Model 914 fully automatic, 4-nozzle, one gallon volumetric filler with auto check weight system; and the Model 1934 4-nozzle, fully automatic, electronic weight filler. All of the above are equipped with the firm's SPC Report software and diagnostic system.

AMERICAN CYANAMID CO.
Wayne, NJ 07470

American Cyanamid Co. exhibits its complete line of CYMEL® and BEETLE® crosslinking agents; TMI®, TMXDI®, and CYTHANE® isocyanate resins; POWDERLINK® powder coating resins. Also shown is the American Cyanamid line of light stabilizers and antistatic agents.

AMERICAN INSTITUTE OF CHEMISTS
Bethesda, MD 30824

American Institute of Chemists, 7313 Wisconsin Ave., Bethedsa, MD 30824, (301) 652-2447. Stop by to discuss A.I.C. membership and certification. Activities include the Gold Medal Award, Pioneer of Chemistry Awards, Student Awards, Certification and Code of Ethics.

AMERICAN IRON & STEEL INSTITUTE
Washington, DC 20005

The American Iron and Steel Institute (AISI) presents "Steel Trek." Through a multi media and live presentation, Captain Steel and Lt. Laura Logic demonstrate the safety, economic, and environmental advantages of packaging various coatings and flammable liquids in steel. For additional information and literature, visit the AISI booth.

AMOCO CHEMICAL CO
Chicago, IL 60601

Featured are chemical intermediates Amoco® isophthalic acid (IPA), Amoco® trimellitic anhydride (TMA), Amoco® terephthalic acid (TA), and Amoco Resin 18™ poly-alpha-methylsytrene. Applications include high solids coatings, waterborne coatings, powder coatings, coil coatings, coatings for plastics, and emulsions.

ANGUS CHEMICAL CO.
Northbrook, IL 60062

When formulators hear the name ANGUS, they think of AMP-95™, a multifunctional additive for latex paint. But ANGUS has so much more to offer—biocides, surfactants and solvents. Visit our booth and pick up your Formulators Guide which describes ANGUS' product-improving additives.

ANKER USA INC.
Tarpon Springs, FL 34689

ANKER USA displays the Variant KD automatic labeler for five (5) and two (2) gallon pails, round or conical with bails. ANKER also shows a Variant K labeling system for drums or cases.

AQUALON CO.
Wilmington, DE 19850

Water-soluble cellulose ethers, as thickeners and rheology modifiers for latex paints and as thickeners for nonmethylene chloride paint removers; low VOC nitrocellulose emulsions for wood finishes; ethylcellulose; and pentaerythritol for alkyd resins and intumescent paints are featured.

ARCO CHEMICAL CO.
Newtown Square, PA 19073

ARCO Chemical Co. features its complete line of high performance, low toxicity solvents including ARCOSOLV® propylene glycol-based solvents, n-methyl pyrrolidone (NMP), ARCONATE™ propylene carbonate, and other specialty chemicals for the paint and coatings industry. The Arcocomp Solvent Selector, a computer program to aid in reformation, is demonstrated.

ARIES SOFTWARE CORP.
Louisville, KY 40207

Aries Software Corp. demonstrates the operation, capabilities, and features of Aries Epic, the multi-user software system designed for the paint and coatings industry. Aries Epic integrates company-wide functions, including SARA tracking, production, laboratory formulation, regulatory compliance, sales and financial management.

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

Ashland Chemical's IC&S Division exhibits a full range of solvents, silicones, defoamers, strippers, inorganic chemicals, acids, prepaint cleaners, surface dyes, and sealers to formulators of paints and coatings. Other services available include a nationwide chemical waste service, recycling, custom solvent blending, solvent reformulation guidance and technical service.

ATLAS ELECTRIC DEVICES CO.
Chicago, IL 60613

Atlas displays the Ci35A Controlled Irradiance Xenon Arc Weather-Ometer® and the AtlaSoft™ control and monitoring system. AtlaSoft controls test cycling and monitors instrument operation from a personal computer. The SF 850 Corrosive Fog Exposure System is shown. South Florida Test Service staff are available to discuss natural and accelerated weathering tests, updates on methods and specifications. Brochures describing our services at locations in Miami, FL; Wittmann, AZ; Lochem, Holland; and the new North Sea Corrosion Test Center, are available. Custom Scientific Instruments Div. demonstrates their Falling Weight Impact Tester (tests the cracking resistance of coatings). The CS-196 Two Foot Flame Tunnel is displayed.

ATOCHEM NORTH AMERICA
Malvern, PA 19355

Atochem North America features three high performance paint additives; POLY BD®, SMA®, and ORGASOL. Formulation data on coil coating, maintenance primers, epoxy liquid, and powder coatings is available. In addition, there are technical people staffing the booth to discuss formulation problems and their solutions.

ATOCHEM NORTH AMERICA, LUCIDOL
Buffalo, NY 14240

B&P ENVIRONMENTAL RESOURCES, INC.
Oakland, NJ 07436

B&P Environmental Resources, Inc., as a certified analytical lab and waste company, offers the following services: RCRA analysis including TCLP, ECRA analysis, technical field personnel for lab packing or site remediation disposal of hazardous waste from lab packs to bulk liquids and or solids, incineration, asbestos removal, decontamination and reinsulation.

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

Super Sack® flexible intermediate bulk containers, available in a variety of sizes, are featured. Bags are used for storing and shipping dry powders and pigments. Also available is a ™Wetsack container for handling liquids.

BASF CORP.
Parsippany, NJ 07054

The BASF booth provides information about the company's full range of performance products, from acrylates to urethanes, designed to formulate quality paints and coatings regardless of the systems used—aqueous, low VOC, high solids or powder coatings.

BILT-RITE CORP.
Everett, WA 98205

BLACKMER PUMP
Grand Rapids, MI 49509

Blackmer Pump exhibits its full line of rotary vane pumps specially designed for handling abrasive fluids, nonlubricating solvents and heavy pastes or resins. Cutaway and working pump models are featured. Capacity range — 2 to 600 gpm.

BOHLIN REOLOGI, INC.
Cranbury, NJ 08512

Introduced: the Controlled Stress Rheometer, ideal for characterization of creep response & elastic recovery on coatings, paints, inks. Provides direct measurement of elastic yield stress. Measurements are quick & easy with PC control. Available: multitasking software in conjunction with Microsoft Windows 386. Operate several rheometers simultaneously. Ideal for QC and R&D .

BROOKFIELD ENGINEERING LABORATORIES, INC.
Stoughton, MA 02072

Featured is instrumentation for the measurement and control of viscosity and consistency including digital viscometers, viscometers with computer interface and programmable viscometers. Introduced is the DV-III "Stand-alone" Rheometer, suited for viscosity quality control and research applications.

BROOKHAVEN INSTRUMENTS CORP.
Holtsville, NY 11742

Precision instruments for particle characterization are featured: the versatile BI-90 submicron particle sizer for fast, repetitive measurement and the unique BI-DCP for high resolution, detailed size distribution information; new BI-EKA for zeta potential measurement of fibres and films.

BUCKMAN LABORATORIES, INC.
Memphis, TN 38108

An island booth, new this year for Buckman Laboratories, will exhibit Buckman's wood preservatives, corrosion inhibitors, and other additives for the coatings industry.

BUHLER INC.
Minneapolis, MN 55440

The Buhler staff demonstrates the ease of operation and process control features which will enhance your statistical process control system. A three roll mill and a vertical bead mill are shown in operation. Our newest 20 liter horizontal ring chamber bead mill, type BOA-251 to process low to medium viscosity heat sensitive products, is also exhibited.

BULK CONNECTION, INC.
Belchertown, MA 01007

Bulk Connection, Inc. is a licensed and bonded transportation broker specializing in the distribution of raw materials and finished products for the paint and coatings industry. The firm offers customized cost effective van and tank transportation services.

BULK LIFT INTERNATIONAL, INC.
Carpentersville, IL 60110

Bulk Lift features its full line of flexible bulk containers (FIBCs) made from woven polypropylene. The bags, capable of holding 500-8000# of product are used for a wide variety of products related to the paint industry. Information on its static dissipator bag and filling and discharging equipment is also available.

BURGESS PIGMENT CO.
Sandersville, GA 31082

Expansion allows for new product. Not only will a new calciner provide additional OPTIWHITE and OPTIWHITE P, but OPTIMAX will be joining the Thermo-optic series of TiO_2 extenders. Formulation techniques unique to the 90's are presented in gloss and flat coatings.

BYK-CHEMIE USA
Wallingford, CT 06492

Highlighted this year is a new line of catalysts to complement BYK® 451. The new wetting agent for aqueous systems, Disperbyk® 182, is also featured, as is the new silicone levelling agent BYK 331. Advantages of the tried and true BYK® P104S and BYK® 052 are shown. Adjacent to our booth, BYK Gardner is displaying the latest instrumentation for paint technology.

BYK-GARDNER, INC.
Silver Spring, MD 20910

BYK-Gardner offers a complete line of instruments for color and appearance measurement and features displays for color and gloss QC measurement, physical test equipment, consumer color products (point-of-sale) computer color matching systems, and applications products and services.

C B MILLS
Div. Chicago Boiler Co.
Buffalo Grove, IL 60089

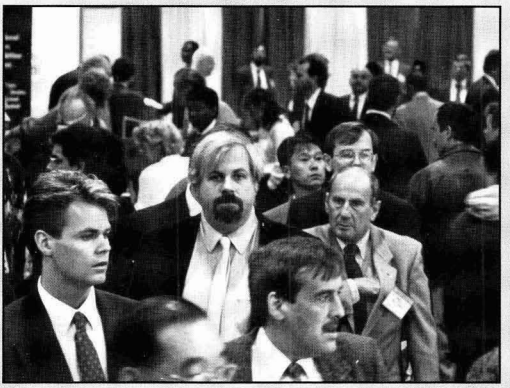
CB Mills Div. Chicago Boiler Co. exhibits small media dispersion mills, the Red Head vertical and the Horizontal Dyno-Mill. Also, a new solvent recovery system and tank wash are exhibited.

CR MINERALS CORP.
Golden, CO 80401

CR Minerals introduces DiaFil—an amorphous diatomite flatting pigment. Photos, data sheets, and sales literature are on display to describe this new approach to eliminating the crystalline silica problem.

CSC PUBLISHING INC.
Minneapolis, MN 55423

Powder Coating is the only magazine in North America that focuses exclusively on powder coatings. Free subscriptions are available in this booth.



CABOT CORP.
CAB-O-SIL Div.
Tuscola, IL 61953

Featured are CAB-O-SIL® treated fumed silicas for improved water resistance in coatings and for free flow in powder coatings. Also featured are Cabot carbon blacks including the new tinting grades MONARCH® 156 and 280.

CALGON CORP.
Pittsburgh, PA 15230

Featured is Calgon's line of biocides which are safe and effective replacements for mercurials. These include: BIOCHEK 240, TEKTAMER 38 and METASOL TK-100. Our technical experts are on hand to help with your specific biocide needs.

THE CARBORUNDUM CO.
Niagara Falls, NY 14302

Exhibited are Fiberfrax® alumina-silica ceramic fibers. Included are Fiberfrax HSA™ fibers, a structural thixotrope for resinous and water-based systems. Fiberfrax HSA fibers provide high viscosity at low loadings, reinforcement, viscosity stability over time, excellent moisture resistance, superior wear resistance, and improved corrosion resistance.

CARDOLITE CORP.
Newark, NJ 07105

Low viscosity materials for VOC compliant coatings are featured at the Cardolite booth. Cardolite Corporation manufactures specialty diluents, flexibilizers, and curing agents for low temperature curing, surface tolerant, water resistant epoxy coatings.

CARGILL, INC.
Minneapolis, MN 55440

This year's Cargill exhibit presents several low VOC architectural resins for consumer use. For industrial markets, Cargill offers new, fast-dry, chain stopped, VOC compliant architectural resins, new aliphatic blocked urethane with lower unblocking temperature and other new developments.

CASCHEM, INC.
Bayonne, NJ 07008

CATALYST RESOURCES, INC.
Houston, TX 77018

Azetc® high purity initiators including alkyd peroxyesters, diacyl peroxides, dialkyl peroxide perexyketals, alkyd hydroperoxides, blends and custom formulations, are featured.

CELLIER CORP.
Natick, MA 01760

Cellier's engineering expertise in plant automation, dispersion, blending, formulating, dispensing and materials handling for coatings manufacturing plants is displayed. Featured is an automatic dispensing system developed by INKMAKER SRL of Torino, Italy.

CHARLES ROSS & SON CO.
Hauppauge, NY 11788

The company features mixing, blending and dispersion equipment for the process industries.

CHEM - TEL, INC.
Temple Terrance, FL 33617

Twenty-four hour emergency response center for companies transporting hazardous materials and affected by the new Federal DOT Regulation 49 CFR Part 172.604.

CHEMICAL & ENGINEERING NEWS
American Chemical Society
Washington, DC 20036

The American Chemical Society, a leading science publisher since 1879, is exhibiting a selection of periodicals including *Chemical & Engineering News*; *Chemistry of Materials*; *Today's Chemist*; *Macromolecules*; *Organometallics* and *Langmuir*—a journal devoted to surface and colloid chemistry. Books, software programs, audio-visual courses are also featured.

CHEMICAL MARKETING REPORTER
New York, NY 10004

Representatives from *Chemical Business*, *Chemical Marketing Reporter* and *OPD Chemical Buyers Directory* will discuss these chemical publications.

CHEMICAL WEEK
New York, NY 10019

Chemical Week reports and interprets the news for business and technical management of the chemical process industries. This week's issue features our annual coverage of the Paint Show. This in-depth special report covers all aspects of the industry. For this report and subscription information, visit our booth.

CIBA-GEIGY CORP.
Hawthorne, NY 10532

Tinuvin® 123 light stabilizer is a novel light stabilizer based on hindered amine technology. It is a high performance stabilizer that does not interfere with the action of other components in the coating. Irgazin® DDP Red BO is a new chemical entity with high chroma, high opacity and outstanding rheological properties.

CLAWSON TANK CO.
Clarkston, MI 48346

Featured are jumbo portable shipping and storage containers—DOT approved for hazardous materials—constructed in stainless steel, carbon steel, aluminum, and polyethylene. Come see the Sta-Brite Finish.

COATINGS MAGAZINE
Kay Publishing Co. Ltd.
Oakville, Ont., Canada L6K 3G5

Coatings magazine is the only publication serving Canada's billion dollar paint and coatings manufacturing and industrial product finishing industries. Sample copies, including the Paint Show Preview issue, are available at the booth. Members of the editorial and advertising staff are available to discuss the unique features of the Canadian marketplace with companies interested in selling to it.

COLLOIDS INC.
Marietta, GA 30061

See booth description under Rhone-Poulenc Inc.

COLOR CORP. OF AMERICA
Rockford, IL 61104

Sales and technical people are available for discussions on the following colorants: Customatic Universal trade sales, OptiColor high performance industrial, Tint Eze aqueous and Tint Eze PG in plant, ExacTint inplant alkyd, T-75 medium alkyd and PTC trade sales contractor.

COLORES HISPANIA, S.A.
Barcelona, Spain

The firm shows evidence on the anticorrosive performance of their nontoxic ACTIROX and HISPAFOS pigments; with special attention devoted to solving customer's questions about how to formulate them into cost effective paints.

COLORGEN, INC.
Billerica, MA 01821

Colorgen is exhibiting the DCM1100 Computer Color Matching System that incorporates Colorgen's own dual beam spectrophotometer, an IBM compatible computer, and software for color formulation and analysis, quality control, and color matching. Colorgen's system provides solutions to quality control and color formulation problems in both laboratory and manufacturing environments.

COLUMBIAN CHEMICALS CO.
Atlanta, GA 30339

Columbian Chemicals features its Raven carbon blacks for color application and Conductex carbon blacks for conductive applications. The Mapico Division is exhibiting its full line of synthetic iron oxides.

CONSOLIDATED RESEARCH, INC.
Mt. Prospect, IL 60056

Consolidated Research offers high level coatings and polymer consulting services in addition to expert witness, color, patent law, regulations, and mergers and acquisitions capability. Also featured are comprehensive technical/marketing reports on focused markets and artificial intelligence systems.

COOKSON PIGMENTS, INC.
Newark, NJ 07114

Cookson Pigments displays two new Copper Phthalocyanine Blues for OEM coatings. Also exhibited are three new Naphthol Reds and a Monoazo Yellow for industrial finishes and traffic striping.

COULTER ELECTRONICS, INC.
Hialeah, FL 33012

Featured is the Delsa 440, the only analyzer providing simultaneous multi-angle electrophoretic mobility distributions, conductivity zeta potential calculations, and hydrodynamic size. Also shown: the N4 Submicron Analyzer (uses photon correlating spectroscopy); the Multisizer; and the LS Series (provides particle size distribution .1-800 micrometers in liquid and dry states by volume or surface area).

CPI PURCHASING MAGAZINE
Newtown, MA 02158

CPI Purchasing is written for buyers and managers with purchasing responsibilities for buying in the chemical/process industries. It provides various information including buying strategies, quality improvement ideas, price/availability forcasts, leadtimes, and pricing.

CRAY VALLEY PRODUCTS, INC.
Stuyvesant, NY 12173

Three new products are featured: CRAYVALLAC SUPER thixotropic additive for low VOC coatings, SYNOCURE "user friendly" two-pack acrylics for machinery and transportation finishes, and LANCOWAX micronized waxes for water-based coatings.

CROSSFIELD CHEMICALS, INC.
Joliet, IL 60435

Featured is the Crosfield HP200 Series—a new generation of high efficiency, easy dispersing silica flatting agents. On display are Crosfield silicas specifically designed for and incorporated into high solids, water borne, radiation curable systems and powder coatings. Also highlighted is the groundbreaking for Crosfield's new micronized silica plant in Joliet, Illinois.

CUNO, INC.
Meriden, CT 06450

Cuno provides filtration products for superior quality paints and coatings. Betapure® and Micro-Klean® depth filters and innovative housing designs are featured.

CUSTOM SCIENTIFIC INSTRUMENTS
Cedar Knolls, NJ 07927

See booth description under Atlas Electric Devices.

CYPRUS INDUSTRIAL MINERALS
Englewood, CO 80112

Cyprus is a fully integrated world wide producer of the finely milled specialty mineral pigments talc, barytes and chlorite. The exhibit features Cyprus' new White Barytes line, and platy mineral pigments for TiO_2 spacing and low VOC applications.

D/L LABORATORIES
New York, NY 10003

The firm provides a broad range of consulting and testing services to the coatings, sealants and plastics industries. Services include testing, evaluation, formulation, market surveys, VOC determinations, QPL Testing, personnel training and legal assistance.

DANIEL PRODUCTS CO.
Jersey City, NJ 07304

Tint-Ayd "PC" dry powdered pigment dispersions for low VOC and solvent-free coatings and "WD" dispersions for water-thinned industrial coatings are featured. Daniel's support service includes computer color matching and new Tint-Ayd industrial tinting system color deck. Also shown are high performance additives for all latest technology coatings.

DANTCO MIXERS CORP.
Paterson, NJ 07501

DAVIES CAN CO.
Solon, OH 44139

In Booth #1927, get a first-hand look at Davies Can Company's Trim Rim™ can as it makes its debut in our industry. Davies' also features a full complement of its general line containers.

DAY-GLO COLOR CORP.
Cleveland, OH 44103

The booth highlights the Day-Glo® fluorescent pigment, Nalco® coatings additives, and Day-Glo® pigment dispersions/colorants. Display panels illustrate practical applications.

DEGUSSA CORP.
Ridgefield Park, NJ 07660

The exhibit features Aerosil®, both hydrophobic and hydrophilic types for thixotropy, anti-settling, corrosion resistance and anti-sag in coatings. Also exhibited are flatting agents for efficient flatting of clear and pigmented coatings, including both solvent and water-based. Shown at the booth are channel-type blacks such as FW200 for automotive coatings and furnace black Printex XE2 for conductivity.

UNIVERSITY OF DETROIT
Detroit, MI 48221

The educational program in the Paint Technology Seminars and Research Program, including contracted research at University of Detroit and Polymer Technologies, Inc., is highlighted.

DIANO COLOR PRODUCTS
Rochester, NY 14625

DOMINION COLOUR CORP.
Toronto, Ont., Canada M8W 4X9

Dominion Colour Corp. shows, for the first time, its new range of encapsulated lead chromate pigments, ONCOR® anticorrosive pigments, and a new organic yellow for traffic marking. DCC personnel and distributor representatives are available to discuss these products and DCC's range of organic and inorganic pigments.

THE DOW CHEMICAL CO.
Midland, MI 48674

Featured are resins and monomers for powder, automotive, can and coil, industrial, protective and marine coatings. Dow offers a new HBA monomer for automotive topcoats, two new D.E.R.* solid epoxy resins, and one D.E.H.* epoxy hardener for high-flow and flexible powder coatings. Dow features its DOWANOL* PnB and DPnB glycol ethers. Emulsion polymers are highlighted.

* Trademark of The Dow Chemical Company.

DOW CORNING CORP.
Midland, MI 48686

Featured are high-performance resins for high temperatures, weather, corrosion, and chemical resistance; silicone additives for foam control, mar & water resistance, flowout, and adhesion improvement; silicone intermediates for gloss and color retention, chalk resistance, and film life.

DRAISWERKE, INC.
Allendale, NJ 07401

Featured is wet grinding and dispersing equipment including the DRAIS PM-DCP Perl Mill with double cylinder pinned rotor/stator grinding chamber. The new DRAIS Laboratory Perl Mill Type PML-H/V is designed to operate in either horizontal or vertical arrangement.

DREW INDUSTRIAL DIV.
Boonton, NJ 07005

Featured are defoamers for high gloss and low VOC coatings. Drew introduces four: DREWPLUS® defoamers L-435, L-403, L-407, and DREWFAX® S-600. These cover a broad spectrum of waterbased, high gloss applications and give a choice of nonsilicone and silicone containing defoamers. Also, for viscous, high solid, solvent based, low VOC coatings are two deaerators, DREWPLUS® S-688 and S-689 and one defoamer DREWPLUS® S-684. Emphasis is placed on Drew's regulatory and Responsible Care policies of safety and environmental compliance.

DSA CONSULTING, INC.
Mission, KS 66222

DSA Consulting, Inc. exhibits the Desk Top Laboratory which includes computer programs for formulation of color, hide, gloss, dispersion, viscosity, stoichiometry, blend systems and bulking. These window driven programs are available for either PC or Mainframe computers.

DSET LABORATORIES, INC.
Phoenix, AZ 85027

DSET is exhibiting equipment and services for materials testing and evaluation. Both the SUNTEST CPS and XENOTEST® 1200 CPS are on display. In addition, information is available on our expanded range of outdoor weathering services in Fla. and Arizona.

DU PONT CO.
Wilmington, DE 19898

Du Pont Coatings Resource Network combines high quality products, services and resources for the paint and coatings industry. The network is a resource for resins, solvents, titanium dioxide, many additives for special coating properties, and specialty products including propellants. In addition, the network offers services for solving business related problems such as environmental, technological, business operation, and engineering.

EAGLE-PICHER MINERALS, INC.
Reno, NV 89510

Eagle-Picher Minerals, Inc. offers a new, reliable source of diatomaceous earth for all your paint formulation needs. The new grades offer varying degrees of fineness, bulk density, and absorptive capacity.

EAGLE ZINC CO.
New York, NY 10112

Eagle Zinc Co. manufactures American process Zinc Oxide at the former Eagle-Picher Co. plant in Hillsboro, IL. For improved stability, durability and color retention, use our grades 414W, 417W, and 427W. Meadowbrook Co., our sister plant, manufactures zinc dust to your specifications and packaging requirements.

EASTERN MICHIGAN UNIVERSITY
Ypsilanti, MI 48197

Eastern Michigan University dispenses information regarding polymer and coatings technology BS and MS degree programs. Details are presented on Paint Odor Emission Evaluation Center, National Science Foundation Research Center, and Coatings Research Institute designed for industrial contract research.

EASTMAN CHEMICAL PRODUCTS, INC.
Kingsport, TN 37662

Featured are solvents, resin intermediates and coatings additives for use in high solids, waterborne, and low VOC and architectural coatings. Newly commercialized and new developmental products plus well established products are included.

EBONEX CORP.
Melvindale, MI 48122

Display of products manufactured by use of bone black pigments is featured. Bone Black as a filter for removing heavy metals from water is introduced.

ECC AMERICA
Atlanta, GA 30342

Featured are the ECC America calcium products filler and extender pigments including Atomite, Snowflake White, Drikalite, Duramite and Supermite. Also featured is Southern Clay Products line of specialty thixotropes including the Claytone organoclays and the Flowtone series of castor rheological additives.

EIGER MACHINERY, INC.
Mundelein, IL 60060

Shown are examples from the firm's range of Lab and Production Horizontal Bead Mills. Included is the patented "MINI" Mill, proven to be an excellent lab mill for producing samples as small as 50 milliliters rapidly, with minimum cleanup. Production mills available from 50 to 250 liter chamber capacity.

ELCOMETER, INC.
Rochester Hills, MI 48309

Elcometer shows exciting new products for the first time along with their full range of coating thickness gages from the world famous "Inspector" to the award-winning electronic Elcometer 256 and 300. Also shown is a wide range of related equipment in the coating thickness field.

ELDERS RESOURCES CHEMICALS, INC.
Columbia, MD 21046

Elders Resources Chemicals is your international chemical source. The worldwide Elders Group features specialty catalysts for electrodeposition and topcoat systems. Curing agents plus specialty metals and salts are also featured, as well as pentaerythritol, lithopone and zinc chemicals.

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

Exhibited are portable, nondestructive coating thickness testing instruments, featuring the PENTEST and MIKROTEST gauges and the MINITEST digital series instruments.

ELMAR INDUSTRIES, INC.
Depew, NY 14043

Elmar displays the new Model RPE-514 (GQI (7+7) 14 station rotary piston filler for filling paint and related products. Features include 7 stations for filling gallon cans and alternating 7 stations for filling quart paint cans. This allows filling gallons from a batch and finishing the batch with quarts with little changeover time.

EM INDUSTRIES, INC.
Hawthorne, NY 10532

The many colors and particle size variations of Afflair® Lustre Pigments are featured. Although nonmetallic, they can be used to achieve metal effects without this disadvantages of metal pigments. Gold, silver, copper and aluminum effects can be simulated. Uses include automotive OEM, refinishing, metal deco, coil coatings, and powder coatings.

ENGELHARD CORP.
Edison, NJ 08818

Engelhard presents its broad line of ASP® and Satintone® specialty TiO_2 extenders, Attagel® thixotropes, and Harshaw® color pigments and dispersions. New products featured include new lines of Meteors® plus color pigments for coil and powder coatings pigments and Mindust™ low dust cadmium pigments.

ENSCO, INC.
Tampa, FL 33607

ENSCO provides integrated hazardous waste management services to private industry, public utilities and government entities. These services include chemical analysis, collection, transportation, processing and incineration of hazardous waste.

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

Featured is the very latest technology in media dispersion mills, including a new closed, continuous process small media mill. Batch process mills are also on display, as well as a complete selection of large and small grinding media. Samples of each type of media are available.

ETNA PRODUCTS INC.
Chagrin Falls, OH 44022

The firm features high solid polyester resins for VOC compliant industrial coatings. These products are oil-free, saturated resins for baking or ambient-cured (isocyanate) systems. Personnel are on hand to review our state-of-the-art commercial resin line, custom resin design and toll manufacturing capabilities.

EUROPEAN COATINGS JOURNAL
Curt R. Vincentz Verlag
Hannover D-3000, FRG

Curt R. Vincentz Verlag is exhibiting the international bilingual (E/F) magazine *European Coatings Journal*, for the paint and coatings, printing inks, adhesives and sealant manufacturing industries. It is also launching the new comprehensive 4-language special dictionary by Daniel Burghardt: COATINGS.

EXXON CHEMICAL CO.
Houston, TX 77079

This year, Exxon Chemical Co. offers their unique approach to solving the challenges of coatings professionals. Our "Solvent Systems" approach includes personalized technical and customer service assistance, the CO-ACT^{SM} computer program (used to optimize solvent/resin formulations), cleaners/degreasers for surface preparation, and reactive diluents and resin building blocks. Plus, a variety of distinctive oxygenated, hydrocarbon and other viscosity modifiers are featured.

FAWCETT CO., INC.
Richfield, OH 44286

On-display is the Fawcett Company's complete line of air and electric driven mixing equipment.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
Blue Bell, PA 19422

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*, the Paint/Coatings Dictionary, and FSCT slide/tape training programs. Information on upcoming Federation sponsored seminars is available. The 1991 Paint Industries Show floor plan is on display and applications for exhibit space are available. The 1991 show is in Toronto, Canada.

FILTER SPECIALISTS, INC.
Michigan City, IN 46360

Featured are bags, cartridges, equipment and accessories for filtering paints, chemicals, resins and other paint related liquids. Technical personnel are on hand to answer questions.

FMC CORP.
Philadelphia, PA 19103

FMC is introducing its new product, Lattice™ microcrystalline cellulose to the latex paint industry. Lattice is a thickener which reduces roller splattering and improves leveling and brushability. It delivers excellent suspension properties over a wide temperature range. Lattice interacts with HEC to produce improved, cost-effective formulations.

FMJ INTERNATIONAL PUBLICATIONS LTD.
Paint & Chemical Div.
Redhill, Surrey, England RH1 1QS

International publishers and exhibition organizers for the paint, printing ink, adhesive, specialty chemicals, and pharmaceutical industries. Publications include *Paint & Ink International* and *Polymers Paint Colour Journal.*

FREEMAN POLYMERS DIV.
Cook Composites & Polymers
Port Washington, WI 53074

The Freeman Polymers Division of CCP presents the newly merged line of Chempol® and Coroc® coatings resins and additives. Featured are the Chempol® peroxide curable plural component resins for low VOC compliance and Coroc® additives. New product literature is presented.

FRYMA, INC.
Edison, NJ 08817

Featured is CoBall Mill—advanced technology for high quality wet milling and dispersion of pigment, vacuum deaeration and defoaming of product without additives, toothed colloid mills for dispersion and pre-milling.

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

H.B. Fuller Co. announces its new high-solids, all acrylic latex for exterior house paint, PD-0449. Also featured are vinyl-acrylic, styrene-acrylic and all-acrylic latexes for interior and exterior paints, floor and deck coatings and wood stain coatings.

GAF CHEMICALS CORP.
Wayne, NJ 07470

GAF offers unique monomers and solvents that provide coating companies with formulation latitude. Our solvents, M-PYROL®, BLO®, and 2-PYROL® are low in toxicity and have excellent solvency characteristics. V-PYROL®, RAPI-CURE®'s DVE-3 and CHVE are reactive monomers/diluents for radiation curable compositions.

GAF SURFACTANTS
Cranbury, NJ 08512-7500

See booth description under Rhone-Poulenc Inc.

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

GARDCO's one stop source of paint testers on display. See the new automatic EZ Viscosity Cups in operation. See the new powerful, sturdy model "D" Washability Machine in action. Se habla Espanol.

GEORGIA KAOLIN CO., INC.
Union, NJ 07083

Georgia Kaolin Company is exhibiting its complete line of kaolin clay and specialty fillers and extenders for the coatings industry. Particular emphasis is given to Altowhite titanium dioxide extender pigments as well as Koamer clay fillers meeting Hegman Grind specifications.

GOODYEAR CHEMICAL DIV.
Akron, OH 44316

Goodyear's exhibit features Pliolite water-borne resins for use in corrosion-resistant coatings that are VOC compliant. Included are new resins that exhibit elongation greater than 500%, as well as the Plioway resins requiring low odor solvent systems.

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

W.R. Grace & Co. features their silica flatting agents for VOC-compliant (waterborne and high-solids) coatings.

GUER-TIN BROS. POLYMERS
Winnipeg, Man., Canada R2J OR9

Revolutionary, patent pending polymers are featured. The Super-Shield® family of polymers are unique isocyanate-free urethanes. Uses are automotive, maintenance and industrial, on metal, plastic and wood.

HAAKE/FISONS INSTRUMENTS
Valencia, CA 91355

HAAKE is exhibiting the RV20 Rheometer with the CV20 Covette Measuring System which provides complete measurement capabilities for the viscoelastic properties of paints and coatings; and the VT500 Viscometer for routine viscosity measurements of low, medium and high viscosity fluids.

HALOGENATED SOLVENTS INDUSTRY ALLIANCE
Washington, DC 20036

Get the latest information on regulatory/legislative initiatives, health effects and safe handling of chlorinated cleaning solvents—methylene chloride, perchloroethylene, trichloroethylene and 1,1,1-trichloroethane (methyl chloroform), the impacts of the new Clean Air Act and state regulatory programs, and results of international negotiations to protect stratospheric ozone (the Montreal Protocol).

HALOX PIGMENTS
Hammond, IN 46320

HALOX unveils its latest addition to their line of quality corrosion inhibiting pigments. Also featured is HALOX Pigment's SQP (Service-Quality-Performance) approach to solving corrosion and tannin stain problems incorporating their complete line of nontoxic inhibitors.

HARCROS PIGMENTS INC.
Easton, PA 18042

Harcros Pigments Inc. (formerly Pfizer Pigments Inc.) features its broad range of iron oxide, chromium oxide, barium sulfate, and carbon black pigments. The domestic and worldwide distribution network is highlighted.

HENKEL CORP.,Coatings & Inks Div.
LaGrange, IL 60525

Featured are Henkel high solid systems for epoxies, urethanes, and radiation cured systems; epoxy curing agents; rheology modifiers; defoamers; fungicides; and dispersants.

HEUCOTECH LTD.
Fairless Hills, PA 19030

HeucoTech Ltd., a Heubach Company, demonstrates the advantages of their Aquis product lines which are technologically advanced pigment dispersions for the coatings industry. New Heucophos nontoxic anticorrosive pigments designed to meet the environmental needs of the 90's are introduced.

HI-TEK POLYMERS
Louisville, KY 40299

See booth description under Rhone-Poulenc Inc.

HILTON-DAVIS CO.
Cincinnati, OH 45237

Hilton Davis has available a new color brochure "The Source for Dispersed and Flushed Pigments for the Coatings Industry." Management and technical personnel are available.

HITOX CORP. OF AMERICA
Corpus Christi, TX 78403

Showcased are the firm's line of innovative pigments and extenders. HITOX Buff-Colored titanium dioxide, BARTEX barium sulfates, OSO iron oxides and HALTEX alumina trihydrates are featured. Information and technical advice are available.

HOCKMEYER EQUIPMENT CORP.
Harrison, NJ 07029

Hockmeyer Equipment exhibits its full line of mixing technology including single shaft dispersers, multi-shaft mixers, rotostators and agitators. Featured equipment includes the CMX-100 tank/tote cleaner which is operational for customer evaluation.

HOECHST CELANESE CORP.
Coventry, RI 02816

Hoechst Celanese, a leading supplier of organic pigments for coatings, features their ever expanding line of organic replacements for lead and heavy metal pigments. Special emphasis is placed on Hoechst Celanese pigments for powder coatings and traffic paint.

HOECHST CELANESE CORP.
Waxes & Lubricants Group
Somerville, NJ 08876

Hoechst Celanese Corporation is exhibiting its full line of Ceridust® micronized waxes used in powder and water based products as well as standard coatings and printing inks. Emulsifiable waxes for water reducibles are also featured.

HORIBA INSTRUMENTS, INC.
Irvine, CA 92714

Horiba displays particle size distribution analyzers of the centrifugal sedimentation type as well as laser diffraction. The CAPA-700 centrifugal analyzer with new applications software is shown. The improved LA-500 with expanded range capabilities is demonstrated.

J.M. HUBER CORP.
Edison, NJ 08818

The J.M. Huber Corporation booth promotes products produced for the paint and coatings industry by Huber's Clay, Chemicals and Calcium Carbonate Divisions. New products for a wide range of paint and coatings applications are the primary focus of the booth.

HULS AMERICA INC.
Piscataway, NJ 08855

Huls America features its 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, fungicides, preservatives, thickening agents and defoamers.

HUNGALU HUNGARIAN ALUMINIUM CORP.
Budapest H-1388 Hungary

Featured are Alukon aluminum pastes for all application areas: leafing and nonleafing grades for paint industry; net types with more brightness and whiteness for roof coatings. Solvent and water-based aluminum pigments in various grades are shown. Features include less aromatics and more gas stability for paint producers, and water dispersible pastes for gas concrete industry.

HUNTERLAB
Reston, VA 22090

HunterLab fetures MiniScan, a completely portable hand-held color measurement system. Also on display is MatchMaker, a color formulation system with HunterLab performance. Visit and see Specware, HunterLab's newest software for our spectrocolorimeters.

ICI AMERICAS, INC.
Wilmington, DE 19810

Featured are SOLSPERSE® Hyperdispersants; pigments for paints; nitrocellulose grades including isopropanol, plasticizer; water wet; PROXEL® antimicrobials for preservation of paints and coatings.

ICI RESINS U.S.
Wilmington, MA 01887

Featured are low VOC, compliant resins for the wood, automotive metal market with highlights for architectural coatings. Focus also includes compliant technology.

IDEAL MANUFACTURING AND SALES CORP.
Madison, WI 53704

On display is an electronic weight filler, the PRISM 5M, for quart to 5 gallon and Universal Lid Placer for metal or plastic lids 1/2 pint to 5 gallon. Also featured is a volumetric measuring cylinder with a six-position turret for preset volumes, making changeover fast and easy.

INDUSMIN INC.
Worthington, OH 43235

Featured is MINSPAR from Spruce Pine, NC, a low viscosity mineral filler for use in paint, plastics, rubber and adhesives.

INDUSTRIAL FINISHING MAGAZINE
Carol Stream, IL 60188

Current issues of *Industrial Finishing* Magazine are distributed. Subscription qualification forms for publication are available.

INTERFIBE CORP.
Cleveland, OH 44122

Interfibe cellulose fibers are characterized by exceptional viscosity building and reinforcing qualities. For products as diverse as asphalt and latex-based coatings, butyl, silicone and oil-based sealants, epoxy adhesives, and urethane foams, Interfibe is ideal.

ITT MARLOW PUMPS
Midland Park, NJ 07432

Pumps to handle a wide variety of liquids are featured. Air-operated diaphragm pumps are demonstrated.

J&L INSTRUMENTS CORP.
Norristown, PA 19403

The Irvine-Park Falling Needle Viscometer with computer interface is featured. It measures viscosity, density and sedimentation phenomena of Newtonian and non-Newtonian fluids, and is useful for measuring viscosities of undisturbed samples of highly thixotropic fluids. Viscosity range of 0.5 to 2mil cPs at a better than 1% accuracy and repeatability without calibration. New products: disposable systems and high pressure system up to 2000 psi.

JAYGO, INC.
Mahwah, NJ 07430

Featured is an ERV deaerator on casters, a planitery mixer, a high speed disperser and a three roll mill, table top size.

S.C. JOHNSON WAX
Racine, WI 53406

S.C. Johnson Wax features the Joncryl line of rheology controlled acrylic emulsions and acrylic polyols for high solids solventborne and powder coatings. The acrylic emulsions have utility in a variety of industrial and architectural finishes, including wood stains, sealers, and topcoats, high gloss brushing enamels, and high performance architectural modifiers. The VOC compliant acrylic polyols are utilized in baking enamels, two-component acrylic urethanes, and powder coatings.

KEMIRA OY
SF-28840 Pori, Finland

From the versatile application areas of Flonac are shown decorative wood paints, coatings of metal and colorful plastic films and buttons. From Kemira Inc., a broad range of Unitane® TiO_2 and Uniti® chemical compounds are presented.

KENRICH PETROCHEMICALS, INC.
Bayonne, NJ 07002

The exhibit features Ken-React® titanate, zirconate and aluminate coupling agents for high performance and corrosion resistance in solvent and water based coatings. Technical papers explaining coupling agents use in coatings are available.

KENT STATE UNIVERSITY
Kent, OH 44242

Coatings activities of the Chemistry Department, including research performed by students while engaged in pursuit of their degrees; coatings continuing eduction programs; the analytical instrumentation facility; and the cooperative eduction program are presented.

KING INDUSTRIES, INC.
Norwalk, CT 06852

KRONOS, INC
Hightstown, NJ 08520

KRONOS, Inc. is introducing KRONOS ® 2310 titanium dioxide pigment, a new grade that offers superior optical properties and high scattering power. KRONOS is also featuring its full line of titanium dioxide pigments, including KRONOS 2160, a multipurpose pigment with excellent chalk resistance and gloss retention.

KTA-TATOR, INC.
Pittsburgh, PA 15275

The firm features the KTA Envirotest®, an innovative laboratory test chamber designed to accelerate the weathering of coating materials. The corporate coatings evaluation services and complete line of inspection instruments are highlighted.

LANGSTON COMPANIES, INC.
Memphis, TN 38111

LEEDS & NORTHRUP
North Wales, PA 19454

The firm is exhibiting the new 9200-Series MICROTRAC Particle Analyzers for measuring .005 to 700 microns in one modular, laser-based system with enhanced data management and VGA color graphics; also featured are automated, self-calibrating, self-zeroing surface area analyzers.

LIQUID CONTROLS CORP.
North Chicago, IL 60064

Showcased are positive displacement meters for accurate measurement of liquids in process control or custody transfer application, including batch processing, continuous blending, receiving raw materials into storage or loading bulk trucks and rail cars with finished products.

THE LUBRIZOL CORP.
Wickliffe, OH 44092

Ircogel® rheology control additives and AMPS® specialty monomers are featured. Pigment dispersants for use in solvent based color concentrates, coatings and inks, adhesion promoters based on free acids of phosphate esters, and catalysts for use in melamine systems are highlighted.

3M 1837
St. Paul, MN 55144

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. Technical personnel are on hand. A new 12-page paint and coatings brochure is offered.

MACBETH
Div. of Kollmorgen Corp.
Newburgh, NY 12551

Featured are laboratory-size SpectraLight®/portable (The Judge™) color viewing booths; Color-Eye® 3000 and 7000 spectrophotometers/5010 goniospectrophotometer; Optimatch™ and Optiview™ color matching/formulation systems; glossmeters; Munsell Color line of physical standards and companion products.

MAGNESIUM ELEKTRON, INC.
Flemington, NJ 08822

Magnesium Elektron, Inc., is exhibiting its full line of reactive zirconium chemicals and conductive powders. Featured is a new zirconium silica hydrogel used as a TiO_2 pigment extender and functional filler in certain paint systems. Zirconium chemicals are used as crosslinkers in inks, paint, adhesives and other systems where improved water resistivity, heat resistivity and adhesion is desired.

MALVERN INSTRUMENTS, INC.
Southborough, MA 01772

Particle size analysers for pigments, fillers, dry powders, emulsions, and sprays, in the range 0.001 to 2000 microns, are featured. Systems for on-line process control, the quality lab or research lab, are also highlighted.

MALVERN MINERALS CO.
Hot Springs, AR 71901

Malvern Minerals is a supplier of very pure, finely divided, microcrystalline silica. This is a naturally occurring material that is sold under the tradename NOVACITE®. Malvern Minerals is also a world leader in the surface modification of inorganics. Ask about using a surface modified inorganic to attain low VOC.

MANCHEM, INC.
Princeton, NJ 08540

See booth description under Rhone-Poulenc Inc.

MANVILLE SALES CORP.
Lompoc, CA 93436

Learn how our efficient CELITE® flatting agents and extender pigments can help improve your formulations performance and cost.

MATEC APPLIED SCIENCES
Hopkinton, MA 01748

Innovative instrumentation for particle characterization is featured. The ESA-8000 for determining the elektrokinetic properties of concentrated dispersions; and the CHDF-1100 for determining the size and high resolution size distribution of submicron particles.

THE MEARL CORP.
New York, NY 10017

The Mearl Corporation is exhibiting a complete line of Pearlescent and Iridescent Luster Pigments under the Mearlin and Mearlite trade names. Of special interest are new grades of metallic-like gold pigments, as well as new exterior pigments called Mearlin Blue-Russet and Mearlin Red-Russet.

MICHELMAN, INC.
Cincinnati, OH 45236

Presented are water based additive products for the paint and coatings industry. Highlighted is the Ultrabead® line of water beading and water resistant products. Also being presented are the complete lines of carnauba, paraffin, microcrystalline and other wax emulsions.

MICROMERITICS INSTRUMENT CORP.
Norcross, GA 30093

Micromeritics exhibits analytical instruments for measuring the physical characteristics of powders and solids. These instruments include: Particle Size Analyzers, BET Gas Adsorption Surface Area Analyzers, Mercury Porosimeters and Gas Pycnometers.

MICRO POWDERS, INC.
Tarrytown, NY 10591

Micro Powders, Inc. is exhibiting its full line of specialized waxes for paints and coatings. MICROPRO 440W, a new micronized polypropylene wax specifically designed for water-reducible paints and coatings, is featured. A new product brochure is available. Technical and sales representatives are available.

MICRON, INC.
Wilmington, DE 19805

Analyze methods for characterization, morphology, chemistry and structure of material utilizing electron and x-ray spectroscopy.

MID-STATES ENG. & MFG. CO., INC.
Milton, IA 52570

Tanks, liquid and dry, for shipping and storage from 178 to 644 gallons and 10 to 150 cubic feet, are featured. Containers are stainless steel or mild steel and have the D.O.T. Spec. 57 and 56 option.

MILLER ENGINEERING, INC.
Bothell, WA 98011

Manufacturer of pneumatic filling and sealing machines for liquid products, from 1/2 pint to 5 gallon containers in either metric or US measure. Designed for the environment in which the machine must operate and the people who must use and maintain it.

MILLER MANUFACTURING CO.
Addison, IL 60101

Miller Manufacturing displays the latest advances in the Accutinter line of dispensing systems. Accutinters are computer controlled high speed/highly accurate automated dispensing equipment for colorants and similar fluids. Also displayed are gyroscopic mixers that complete mixing in one third to one half the time of oscillating mixers.

MILLIPORE CORP
Bedford, MA 01730

Millipore exhibits a full line of Polygard™ filters and a variety of stainless steel housings for the clarification and prefiltration of coatings and feedwater.

MILTON ROY CO
Rochester, NY 14625

Milton Roy is displaying the latest advancements in quality spectrophotometers and software for your color matching requirements. True spectrophotometers with industry specific software are designed to solve YOUR problems. Stop by to see the Color Mate HDS, Color Graph, Match Scan II and new SPC software.

MiniFIBERS, INC.
Johnson City, TN 37615

MiniFIBERS displays its complete line of SHORT STUFF® Polyethylene fibers for reinforcing specialty coatings and adhesives. Also introduced is SHORT STUFF® Polypropylene. Sales personnel staff the exhibit.

MINOLTA CORP.
Ramsey, NJ 07446

Minolta Corp. displays its complete line of color and appearance measurement instrumentation including the CM-1000 Spectrophotometer, CR series tristimulus colorimeters, CS-100 noncontact colorimeter, CR-241 Micro colorimeter and GM-060 Gloss Meter.

MISSISSIPPI LIME CO.
Alton, IL 62002

Mississippi Lime Co. features their Precipitated Calcium Carbonate (PCC) products. PCCs are excellent, low cost TiO_2 extenders and cost effective calcined clay substitutes. Mississippi Lime offers both dry and slurry PCC.

UNIVERSITY OF MISSOURI-ROLLA
Rolla, MO 65401

The exhibit features a pictorial view of the Coatings and Polymer Science Program at UMR. It shows the research, educational programs, and the short courses program. Faculty is at the booth and there will be vitae from the students.

MITECH CORP.
Twinsburg, OH 44087

The firm is exhibiting Carri-Med Controlled Stress Rheometer, (CSL). Stress ramping, constant stress (creep and relaxation), oscillatory shear, equilibrium flow and controlled rate flow tests can be performed. Data analysis to fit model equations is included in the software. Easy to operate, provides precise rheological information, uses range from product R&D through production QC labs.

MIXING EQUIPMENT CO., INC.
Livington, NY 14414

Learn about high viscosity mixing provided by impellers such as the Lightnin A-320; high shear mixing provided by the Lightnin R-500 impeller; and cost effective Quick-Connect™ mixers for paint and coatings storage tanks. Lightnin® Lab Master™ series benchtop mixers are featured. They provide precise laboratory mixing and data acquisition for experiment repeatability and direct scale-up.

MIXMOR OF PENNSYLVANIA, INC.
King of Prussia, PA 19406

Highlighted are heavy duty industrial portable, top entering, side entering and turbine mixers.

MOBAY CORP.
Pittsburgh, PA 15205

Information on raw materials for polyurethane coatings systems, organic and inorganic pigments, and industrial hygiene is presented via end-use applications in key paint industry markets.

MODERN PAINT & COATINGS
Atlanta, GA 30328

Complimentary copies of the October Show Issue are being distributed at the booth. The *Paint Red Book*, the only directory in the paint and coatings field, is on display, as is *Adhesives Age Directory* and *Rubber Red Book*.

MONSANTO CO.
St. Louis, MO 63167

Monsanto's 1989 award-winning booth features coating performance materials that address market needs of the 90's. Focus is on Resimene and Santolink crosslinkers plus Modaflow flow additives, Butvar polyvinyl butyral, and styrene allyl alcohol resins.

MOREHOUSE INDUSTRIES, INC.
Fullerton, CA 92633

The display features "Safety in Dispersion," horsepower and critical speed analysis through computer programs, a Molteni A.G. Planitary High Viscosity Laboratory Unit, and the numerous impeller options available for dispersion needs.

MOUNTAIN MINERALS CO. LTD.
Lethbridge, Alberta, Canada T1J 3Z6

Mountain Minerals Co. Ltd. exhibits its complete line of naturally white Barium Sulfates (Barytes) for filler and extender applications. Particular emphasis is given to the new grade high purity (99%) fine material Sparwite W-5 HB.

MYERS ENGINEERING
Bell, CA 90201

Laboratory size high speed disperser Model #LB775 and production size disperser 800 Series, 30 HP, are presented.

NAMETRE CO.
Metuchen, NJ 08840

Nametre features the new microprocessor enhanced Viscoliner®. The unique, patented design has been proven with 11 years of service to the coatings and materials industries. Viscosity measurements are continuous, precise and the sensor requires little, if any, maintenance.

NETZSCH INCORPORATED
Exton, PA 19341

Shown is the firm's made in the U.S.A. Series the LMC60 with chamber removal cart. For the first time the LMC as a John Mill, the LMC14J with dynamic cartridge media separator with chamber removal cart, the RM50GK Vertical Milling System with automated controls and computer system, and the new lab size 50 liter PMD Netzsch Mastermix unit to take over where conventional systems leave off for making of dispersions of paints, inks, adhesives.

NEUPAK, INC.
Burnsville, MN 55337

The company's new high speed four head filling machine is on display. This machine is available filling by weight or by volume. An automatic 5 gal pail filler with lid placer, a twin head gallon and quart pneumatically operated volumetric filler, and a drum filling system are also on display.

NEUTRONICS, INC.
Exton, PA 19341

Neutronics' Inerting Control Systems (ICS) prevent fires and explosions in flammable paint and coatings vessels, while reducing VOC emissions. The ICS continuously controls vessel oxygen

below flammable levels, and currently protects thousands of flammable processes worldwide.

NEW WAY PACKAGING MACHINERY, INC.
Hanover, PA 17331

The latest of New Way technology is displayed on the Model E5 Labeler for wrap around labels. Included is the New Way hydraulic drive and label feed system for new and in-field conversion, including continuous label feed, and pressure lap system.

NICOLET INSTRUMENT CORPORATION
Madison, WI 53711

Nicolet Instrument Corporation offers low cost FT-IR instrumentation including 8210 Liquid Analyzer and Model 205 for use in production and QA/QC. Our FT-IR databases include polymers, coatings and a variety of industrial materials.

NORTH DAKOTA STATE UNIVERSITY
Fargo, ND 58105

Coatings education and research programs at North Dakota State University are featured. Preliminary information about 1991 Short Courses in Coatings Science is available.

NYCO
Willsboro, NY 12996

NYCO's 10 WOLLASTOKUP® engineered pigments offer a new approach to solving your VOC, toxicity, corrosion resistance and water reducibility problems in today's industrial and marine coatings systems. The pigments are a series of chemically engineered products which define the pigment's critical role in establishing the physical properties of the in-service coating system.

OAK PRINTING CO.
Cleveland, OH 44136

Paint label specialists since 1922, Oak Printing's capabilities include label printing, imprinting and color coding. Experts in the production of paper, foil, and hot stamped labels. Warehousing and distribution services are available.

OBRON ATLANTIC CORP.
Painesville, OH 44077

Obron Atlantic, a leader in metallic pigments, introduces its Hydrolac series of products. These are passivated aluminum pastes for use in water-borne coatings. They provide greater compatibility and stability.

ORB INDUSTRIES, INC.
Upland, PA 19015

ORB Industries, 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, Ont., Canada L5K 1B3

ORTECH International is an 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 specification testing for industry and government.

PQ CORP.
Valley Forge, PA 19482

Our booth display includes a complete line of fillers ranging from lightweight hollow glass and ceramic microspheres to highly conductive silver-clad products for use in EMI/RFI shielding applications. Emphasis is on our conductive AgClad and Metalite products and on our Extendospheres SG-white hollow microspheres for use in paints, coatings, caulks, and sealants.

PACIFIC ANCHOR CHEMICAL CORP.
Los Angeles, CA 90040

Pacific Anchor Chemical Corp., a company of Air Products, features its Casamid® line of water-dispersible curing agents for aqueous and low-VOC coatings and PACM cycloaliphatic amine-based curing agents.

PACIFIC MICRO SOFTWARE ENGINEERING
Long Beach, CA 90803

Pacific Mirco demonstrates the new features of BatchMaster PLUS+ Version 2.3 and previews the upcoming BatchMaster PLUS+ Version 3. The modular packaging improves manufacturing productivity by handling inventory, production, product costing and formulating, hazardous material compliance, product labeling, accounting, and much more.

PAINT & COATINGS INDUSTRY MAGAZINE
Laguna Hills, CA 92654

Magazines for the paint, coatings and adhesives industries are featured.

PEN KEM, INC.
Bedford Hills, NY 10507

Pen Kem exhibits zeta potential and rheological instruments which characterize filler retention, paint leveling and other coating processes over a wide range of concentrations and shear rates. Instruments on display include the Model 501, System 7000, the HVA-6 and the Vilastic 3.

PENN COLOR, INC.
Doylestown, PA 18901

A broad spectrum of cost effective concentrated pigment dispersions for a wide latitude of applications is featured. As a custom dispersion manufacturer, products for nearly every generic vehicle system ranging from UV and waterborne resins to solvent, high solids and powder coating systems are available.

PFIZER INC
Easton, PA 18042

PHILIPS CONTAINER CO.
Cleveland, OH 44110

PHILLIPS 66 CO.
Bartlesville, OK 74004

Phillips 66 features low order, high-purity chemicals for the paint and coatings industry including hydrocarbon solvents, hydrocarbon propellants and chemical intermediates.

PIONEER PACKAGING
Travelers Res, SC 29690

See booth description under Ambrose.

POLY-RESYN, INC.
West Dundee, IL 60118

Poly-Resyn features a complete line of rheological additives for solvent based paints, including new pourable anti-settling agents, #202-X, Suspeno and #202-T, Suspeno. The newest addition to the product line is a 100% solids anti-settling agent, Polythix A-100.

PPG INDUSTRIES
Silica Products
Pittsburgh, PA 15272

PPG Industries, Chemicals Group, exhibits their Lo-Vel® brand of flatting agents and Hi-Sil® brand of thixotropes, which are precipitated silicas designed for use in a variety of coatings, adhesives and sealants. Lo-Vel HSF is a low viscosity flatting agent for low VOC coatings. New this year is Hi-Sil T-700: a state-of-the-art precipitated silica which is the most efficient thixotrope available.

PRA LABORATORIES, INC.
Ypsilanti, MI 48197

The PRA is an association of forward-looking coating manufacturers sharing in the benefits of co-operative research and development programs. The roster of PRA member companies includes some of the most respected domestic and foreign names in the coatings industry. Information regarding the PRA is available at the booth.

PREMIER MILL CORP.
Reading, PA 19606

Premier Mill is exhibiting a Duplex EHP Supermill, a model CSD 20/10 rs twin shaft disperser with rotor/stator arrangement, a newly redesigned version of the industry standard series 2000 laboratory disperser, a newly designed dynamic screen arrangement for their Supermill media mills that allows the use of micromedia, and a 4" Ultra Shear homogenizer. Also, an industry first, is the introduction of Premier's new blanket service program which is called Mastercare. Information on our new systems engineering division, PSE, is available.

PROGRESSIVE RECOVERY, INC.
Columbia, IL 62236

PRI displays a small batch type solvent distillation unit. In addition, literature and technical assistance are available on large continuous liquid solvent recovery systems and fully integrated closed-loop automatic wash systems with solvent recovery.

PYOSA, S.A. DE C.V.
Monterrey, Nuevo Leon 64000 Mexico

Featured are the company lines of yellow and orange inorganic pigments, phthalocyanine blue and green pigments, and the red and yellow lines of organic pigments, used in paints, inks and plastics.

Q-CIM
Princeton, NJ 08540

The firm presents proven process industry manufacturing software solutions. "Discover the Q-CIM Advantage" of process product traceability and formula management with integration of data on inventories. System includes product specificiations, quality targets/results, customer requirements, MRP, distribution and MSDS/SARA requirements. Learn how our world class customers are keeping their competitive leadership with Q-CIM.

Q-PANEL CO.
Westlake, OH 44145

The company is exhibiting its Q-U-V Weathering Tester and Standard Test Panels. The Q-U-V Accelerated Weathering Tester recreates the damage caused by sunlight, rain and dew. A choice of lamps, cycles and temperatures can be programmed to reproduce different climates and conditions. Also on display is the firm's full line of standard steel and aluminum substrates.

QUANTACHROME CORP.
Syosset, NY 11791

On display is the MONOSORB, the first automated direct-reading dynamic flow single point BET surface area analyzer; the QUANTASORB, dynamic flow gas sorption analyzer; the AUTOSORB-1, 6, completely automatic static volumetric gas sorption analyzers; the MICROSCAN II, particle size analyzer; the MULTIPYCNOMETER and PENTAPYNCOMETER to measure the true density of powders or bulk solids.

RAABE CORP.
Milwaukee, WI 53223

Raabe Corp. is a formulator of exact matching touch-up paints and a packager of customer furnished material. Custom filling is available in aerosol, bulk or brush-in-cap touch-up containers.

RED DEVIL INC.
Union, NJ 07083

Featured is the firm's line of paint mixing and tinting equipment, with emphasis on the newly designed computer controlled AUTO TINT 2001™ automatic colorant dispenser. Easy to operate and maintain, it eliminates mistint errors and provides fast, accurate tinting. It tints in every size container from quarts to 5 gallon pails.

REICHHOLD CHEMICALS, INC.
Durham, NC 27713

Reichhold is located in booth 337. We are presenting our products in four main categories; industrial, specialty, architectural and automotive. Highlighted in these categories are Kelsol 3990, Bisphenol-F based expoxies, Beckosol 092 and Spenlite P5210/P5211 urethane system.

RHEOMETRICS, INC.
Piscataway, NJ 08854

Instruments for complete rheological characterization of fluids systems are featured. The new Fluids Extensional Analyzer (RFX), measures the extensional viscosity of fluids over a wide range, and the Fluids Spectrometer (RFS II) measures viscoelasticity of fluids in shear.

RHEOX, INC.
Hightstown, NJ 08520

RHEOX, Inc. is introducing several new products, including 100% solids RHEOLATE™ 205 and 208 urethane associative thickeners for waterbased systems and M-P-A® 3000 MS antisettling additive, dispersed in mineral spirits. Also featured is NALZIN® 2 nontoxic, anticorrosive pigment.

RHONE-POULENC INC.
Princeton, NJ 08843

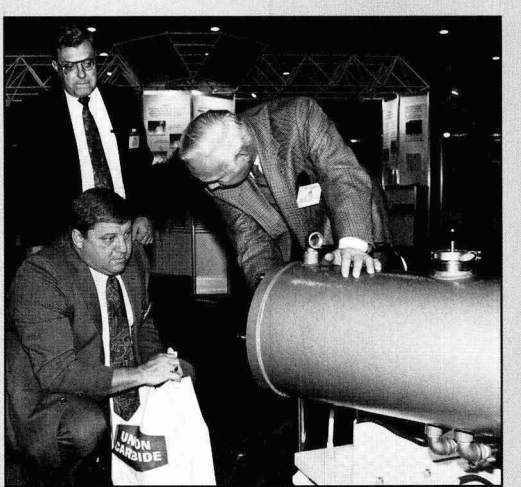
The display encompasses products from several recent acquisitions as well as Tolonate® aliphatic polyisocyanates. With the addition of GAF Surfactants and Alcolac, the booth reflects the firm's burgeoning growth in surfactants. The Performance Resins and Coatings Div. features a variety of high performance epoxy resins including Epi-Rez® epoxy, Poly-Tex™ acrylic resins, and Epi-Cure® amine curing agents. Colloid defoamers, dispersants and surfactants are offered by this division, incorporating products from Colloids Inc. and Hi-Tek Polymers. From the Organic Chemicals Div. comes Alusec® aluminum complexing agents, Manchem® zircoaluminate coupling agents, and Manalox® water repellents.

ROHM AND HAAS CO.
Philadelphia, PA 19105

Rohm and Haas displays products of interest to formulators of architectural, industrial and maintenance coatings. Developers of coatings will quickly find products meeting their specific interests. The most appropriate binders and additives for each paint type are suggested. The company line includes Rhoplex®, Rovace®, Acryloid®, and Maincote® resins together with Ropaque® hiding additive, Acrysol® rheology modifiers, Tamol® dispersants, Kathon® preservative, and Skane® M-8 mildewicide.

RONNINGEN-PETTER
Portage, MI 49081

Ronningen-Petter features two recent products: a Vibrating Paint Filter utilizing suspension, pneumatic vibration, bottom-to-top, outside-to-inside flow, permanent media, longer run cycles, and 175 to 25 micron media, and a Pressure Instrument Protector, a device to eliminate continual replacement of pressure gauges in paint pressure lines.



ROSEDALE PRODUCTS, INC.
Ann Arbor, MI 48106

Rosedale Products, Inc.features bag type filters, basket strainers, vibrating paint filters, wire mesh cartidges, duplex filters and strainers, multiplex systems, and filter bags. New this year is the addition of a pleated filter bag series. These bags will provide six times the surface area of standard bags.

RUSSELL FINEX INC.
Mount Vernon, NY 10550

Russell Finex introduces two new patented machines for the coatings industry: the Super Finex High Speed Strainer and the Russell In Line Strainer. Visit the Russell Finex booth to see our equipment in action.

SANDOZ CHEMICALS CORP.
Charlotte, NC 28205

The Sandoz Chemicals exhibit features new innovative products resulting from the firm's research efforts. Notable are the new Sandorin pigments recommended for automotive and industrial coatings, and new products within the Sanduvor range of UV stabilizers.

SANNCOR INDUSTRIES, INC.
Leominster, MA 01453

SANNCOR manufactures a complete line of solvent based and waterborne urethane polymers, both aliphatic and aromatic. Our wide range of SANCURE waterborne urethanes meet the most stringent VOC requirements. A series of co-solvent free, waterborne urethane polymers is available with VOC levels as low as 31 grams per liter.

SCHERING BERLIN POLYMERS INC.
Dublin, OH 43017

Newly formed Schering Berlin Polymers Inc. features epoxy curing agents, reactive diluents, civil engineering applications and a line of products based on m-xylene diamine. Technical and marketing personnel from the United States and the parent company, Schering AG, are available for consultation. Stop by the Schering Berlin Polymers booth.

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

The Air-Pallet® system for completely closed, dust-free powder handling is featured. Display includes Air-Pallet® container; Air-Cone® fluidized hopper for free flowing discharge; ejector mixer for powder slurrying; components and hardware for other types of discharge.

SERAC, INC.
Addison, IL 60101

Liquid filling and capping ranging in size from semi-automatic to automatic rotary systems are featured. Gross weight and net weight technology is displayed.

SHAMROCK TECHNOLOGIES, INC.
NEWARK, NJ 07114

Meet the tribologists—specialists in the control of friction and wear! Shamrock 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 as well as other properties to your coatings. New products are exhibited—come by to see them!

SHEEN INSTRUMENTS LTD.
Teddington, Middesex, England TW11 8LD

SHELL CHEMICAL CO.
Houston, TX 77252

Shell's exhibit includes three lines of products for paint and coatings manufacturers: EPON® epoxy resins, KRATON® elastomers and Shell solvents. A new rubber modified epoxy resin is introduced, Improved Quality (IQ) EPON epoxy resins, and low aromatic hydrocarbon solvents are also featured.

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 pure zinc molybdate pigments are now available.

SHIMADZU SCIENTIFIC INSTRUMENTS, INC.
Columbia, MD 21046

Particle size analyzers—SA-CP4 and SALD-1100; Thermal Analyzers, TGA-50; Balances—AEU-210 and EB-W Series Top Loaders; UV-Vis-Nir, 3101PC.

SILBERLINE MANUFACTURING CO., INC.
TAMAQUA, PA 18252

What's new?!? New aluminum pigments for aqueous and higher solids formulations...new aluminum pigments for powder coatings...new SSP, AQUA PASTE™, and Flicker Flake grades, and more! This year booth 1017 is an absolute must!

SINO-AMERICAN METALS AND MINERALS (S.F.), INC.
EMERYVILLE, CA 94608

Sino-American Metals and Minerals is a California corporation in Joint Venture with several advanced Chinese Mainland paint and coatings raw-material manufacturers. Western scientific technology and production equipment are exchanged for exclusive marketing of Venture partners superior grade Pigments, Additives and Dyes through our North and South American Distributor Network.

SIVA INTERNATIONAL, INC.
S. San Francisco, CA 95129

Recyclene/Disti on-site solvent recovery systems with a full range of capacities and with new advanced solid-state controls with fiberoptic interfacing and low voltage, intrinsically safe circuitry are shown.

SOUTH FLORIDA TEST SERVICE, INC.
Chicago, IL 60613

See booth description under Atlas Electric Devices

UNIVERSITY OF SOUTHERN MISSISSIPPI
Department of Polymer Science
Hattiesburg, MS 39406

The University of Southern Mississippi exhibit features the final technical program of the upcoming Water-Borne, High-Solids, and Powder Coatings Symposium, and related short course offer-

ings, to be held Feb. 4-8, 1991, in New Orleans, LA. The exhibit also offers information concerning undergraduate and graduate degree programs in polymer science, and it also highlights current coatings research by the Dept. of Polymer Science.

SPARTAN COLOR CORP.
Houston, TX 77087

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

STARTEX CHEMICAL INC.
Conroe, TX 77305

The exhibit features specialty thinners, lacquer thinner blends, and solvent blends for the paint and coatings industry. The comput is a package oriented solvent supplier. Private label business is a specialty.

STEEL STRUCTURES PAINTING COUNCIL
Pittsburgh, PA 15213

SSPC, the technical association for the maintenance and marine coatings industry, will display the current *Journal of Protective Coatings & Linings*, research reports, new standards, other publications, and videotapes.

STELFAB NIAGARA LIMITED
Niagara Falls, Ont., Canada L2E 6X8

Steltight medium bulk steel containers for paint and coatings products are featured. They are D.O.T. 57 certified, with capacities from 200 to 420 gallons, and they are available in carbon or stainless steel construction.

SUB-TROPICAL TESTING SERVICE
Miami, FL 33156

Sub-Tropical Testing Service displays their new Freckle™ device for concentrated sunlight exposure. Technical personnel are on hand to answer any questions concerning your weathering program.

SUN CHEMICAL CORP.
CINCINNATI, OH 45232

Keeping with the trend established over the last two years Sun Chemical's booth features an exciting car finished with *Sunfast*® high performance organic pigments. The theme for 1990 is centered around quality, with Sun's "Certificate of Color Analysis" being used as the backdrop for the booth. The booth is staffed by technical and sales representatives. A wide range of product data and color chip brochures are available.

SYSTECH ENVIRONMENTAL CORP.
XENIA, OH 45385

Systech converts waste into fuel for powering cement kilns with the technology of "co-processing." Waste fuel replaces nonrenewable fossil fuels normally burned in the kilns (such natural resources as coal) and helps produce cement.

TBMA EUROPE B.V.
Noorwijkerhout, The Netherlands

TEGO CHEMIE SERVICE USA
Member of Goldschmidt Group
Hopewell, VA 23860

Tego® Foamex antifoams, Tego® Airex deaerators and Tego® Glide mar and slip agents for waterbased and high solids systems are featured. Also, Silikophen® P40/W silicone resin emulsion for waterbased VOC compliant high heat coatings is highlighted.

TEXACO CHEMICAL CO.
HOUSTON, TX 77056

Featured are TEXSOLVE® solvents, TEXACAR® carbonates, JEFFAMINE® polyetheramine curing agents, SURFONIC® surface active agents, TEXACAT® urethane catalyst, glycols, amines and TEXSELECT (TM) solvent selector computer program.

THIELE ENGINEERING CO.
Minneapolis, MN 55439

Thiele shows a new generation standard twin head quart and gallon paint filling machine featuring new fill heads, single and double acting pumps (gravity or pressure fed), new conveyor design and streamlined lid placer. Also on display is a new design fully versatile low cost articulating arm drum filler for paint and chemicals and a fully mobile easily adjustable 5-gallon net weight filler.

THE TINTOMETER CO.
WILLIAMSBURG, VA 23185

Displayed is Colormet®, a portable spectrocolorimeter for surface reflectance, which has the capability of linking to a PC for spectrophotometer abilities. Powered by battery or main supply, the Colormet® provides color readings in L*a*b, Hunter Lab or L*C*h* with varied illuminants. Unit is available with flat window face or fiber-optic penetration probe.

TIOXIDE INC.
St. Laurent, PQ, Canada H4M 2X5

Tioxide features TIOXIDE TR92, the first World Standard titanium dioxide pigment. Other grades featured are TIOXIDE TR50 for latex paint and printing ink, TIOXIDE R-TC4 for powder coatings, TIOXIDE TR63 for super durable applications, and Ultrafine TiO_2 for novel effects in automotive coatings.

THE TRIPLEX GROUP, INC.
New Hope, PA 18938

Exhibited is the Port-A-Wash automatic tank cleaning system, a low-cost machine for cleaning mixing tanks, "totes," and drums with minimal solvent loss or emissions. Custom designs available for specialized applications.

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 featured activities of our Paint Show Booth.

TURBOMIXER CORP.
NEWARK, DE 19711

Turbomixer represents a recently discovered fluid dynamics principle which mixes, blends, and disperses most materials better and faster than conventional impellers. Industrial users report 50% to 90% mixing time reduction while improving product quality. Turbomixers are available from test tube to 1000 gallon tank sizes.

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

Featured are U.S. Silica's specialty products for the paint and coatings industry: MIN-U-SIL and SIL-CO-SIL fine ground silicas, SNOW*TEX calcined kaolin, IMVITONE and IMVISPERSE organoclays, and MIN-U-GEL and SEPIOGEL colloidal attapulgite/sepiolite clays.

U.S. STONEWARE CORP.
Mahwah, NJ 07430

Highlighted are the 753 RMV jar mill, the 801 CVM jar mill, the 784 AVM two jar capacity mill and a CTV mixer. Various jars are featured including the size 00, one liter, #773 high alumina grinding jar; the size 0 (1.8 liter) #612R ROALOX lined steel grinding jar; the size 0 (1.8 liter) size 000 (.3 liter) and size 4 (17.6 liter) #774 ROALOX alumina fortified. Also shown is an assortment of media including burundum cylindrical grinding media, zirconia, and high density alumina spheres.

ULTRA FILTER SYSTEMS
Brooklyn Center, MN 55430

Ultra Filter Systems manufactures "Quick-Connect" in-line disposable filter assemblies, custom designed to accept 2" to 40" filter cartridges. The design, in addition to low cost (under $10), removes the risk of operator contact with toxic or undesirable process liquids.

UNIMIN SPECIALTY MINERALS INC.
New Canaan, CT 06840

Unimin Specialty Minerals Inc. features starting formulations for its line of micronized and microcrystalline silica fillers, mica and whole grain silica products. Featured brandnames, IMSIL, Silver Bond, Gold Bond, TAMSIL, SNOW WHITE, and GRANUSIL.

UNION CARBIDE CHEMICALS AND PLASTICS COMPANY INC.
DANBURY, CT 06817

Exhibit features expanded line of UCAR® solvents for new and conventional coatings; UCAR® resins and intermediates for superior high-performance coatings; UCAR® acrylics and latexes for trade paints, industrial finishes and weather-barrier coatings; UNICARB™ system for spray coatings; a variety of thickeners; and additives for coatings applications. The Captain's 25th Putting Contest is being held.

UNION PROCESS INC.
AKRON, OH 44313

Featured are the latest developments in dry grinding, including the new series of HSA High Speed Attritors for continuous dry grinding, in addition to our full line of equipment for grinding and dispersing pigments, inks, paint and coating applications, etc., wet or dry.

UNITED CATALYSTS, INC.
Louisville, KY 40210

In addition to our full line of rheological additives for the coatings industry, we are promoting a new group of maximum performance organoclays. Our southern talc group is promoting new products for the coatings industry. Visit the United Catalysts personnel.

UNITED MINERAL & CHEMICAL CORP.
LYNDHURST, NJ 07071

UMC displays a new line of fluorescent pigments especially suitable for textile printing, ink, coating, and paint applications. In addition, phosphorescent and other organic pigments are shown.

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

Testing services are discussed and literature distributed including analytical capabilities, performance testing, physical property measurements, VOC, etc., on paints and coatings.

UNIVERSAL COLOR DISPERSIONS
MORTON INTERNATIONAL, INC.
Lansing, IL 60438

Morton International UCDs are color systems for manufacturing and/or tinting industrial paints. These consist of acrylic resins and dispersions used in the manufacturing of chemical coatings for industrial applications with solvent, aqueous and solvent free systems.

UNOCAL CHEMICALS DIV.
Schaumburg, IL 60196

The Polymer Group features 76 RES 6033, a new high performance acrylic for wood coating, and 76 RES 3037, a new high performance interior copolymer. Exterior acrylics and styrene acrylics for elastomeric and specialty applications are displayed. Chemicals Distribution displays its computerized product database, illustrating easy access to tank data and ability to analyze data statistically. UNOCAL Chemicals staff are on hand to discuss their products and your problems.

VAN WATERS & ROGERS
SEATTLE, WA 98104

From a theme of "Chemicals & Solutions," Van Waters & Rogers highlights its broad line of coating raw materials with special emphasis on solvents and ChemCare, it's specialized hazardous waste disposal service. A subsidiary of Univar, Van Waters & Rogers has over 100 stocking locations in the United States.

R.T. VANDERBILT CO., INC.
NORWALK, CT 06856

The firm features ACTIV 8. This product offers the paint chemist a low color drier accelerator and stabilizer currently unavailable, and is being produced at Vanderbilt's new plant in Murray, KY. Information is also provided on Vanderbilt's other mineral and chemical products.

VELSICOL CHEMICAL CORP.
Rosemont, IL 60018

Velsicol Chemical Corp. features Velate 262 coalescing aid and benzophenone, a UV photoiniator. Benzoic acid and sucrose benzoate uses in the paint and coatings industry are also highlighted.

VERSA-MATIC TOOL, INC.
Export, PA 15632

Versa-Matic air-driven, double diaphragm pumps designed to pump most any liquid handling application are shown. Extremely versatile in pumping viscous slurries and abrasives to latex paints, pigments, solvents, and resins with gentle, nonshearing action.

VIKING PUMP, INC.
Cedar Falls, IA 50613

Viking Pump, Inc., exhibits various types of pumps, like the Mag Drive Pump, a "sealess" pump for pumping hazardous or

expensive liquids. Their Vane Mag Pump, with nominal capacities to 400 GPM; and an abrasive liquid pump with nominal capacities 34 to 140 GPM.

VORTI-SIV DIV
M M Industries, Inc.
Salem, OH 44460

Displayed are three (3) models of the VORTI-SIV line of gyratory sieving and straining equipment manufactured by the VORTI-SIV Division of MM Industries, Inc. in Salem, Ohio. Models shown are laboratory, pilot, and productions sizes. All units gyrate at flywheel speeds from 800 to 3450 RPM.

WACKER SILICONES CORP.
Adrian, MI 49221

Featured is Wacker's expanding line of VOC compliant, high-temperature resins, and a complete line of silanes and ethyl silicates, silicone intermediates, resins, paint additives and mansonry water repellents. Wacker Chemicals (USA) is also represented in the booth with hydrophobic and hydrophilic fumed silica.

WARREN RUPP, INC.
A UNIT OF IDEX
Mansfield, OH 44901

Warren Rupp displays its line of SandPIPER Pumps. SandPIPERs are air-operated, double diaphragm pumps designed for industrial use pumping abrasive slurries, corrosives, viscous, and hazardous materials. The SandPIPER line ranges in size from 1/2 through 3", and offers metallic and nonmetallic models.

WILDEN PUMP AND ENGINEERING CO.
COLTON, CA 92324

On display are working, cutaway models of Wilden's complete line of air-operated, double diaphragm, positive displacement pumps designed to handle very thick and very abrasive products. The pumps handle up to 90% solids to over 250 foot heads in permanent, submerged and self-priming operations. Due to low internal velocities and the straight flow through design, it is shear sensitive and handles very thin material applications to very thick sludges.

WITCO CORP.
New York, NY 10022

Witco, Sonneborn Div., demonstrates its SACI® 8000 rust preventive bases. The Organics Div. features Witcobond® aqueous polyurethane dispersions for formulating protective coatings; surfactants and metallic stearates. The Humko Chemical Div. highlights its oleochemical specialty additives.

WSI ENGINEERING CO.
Springfield, MI 65805

WSI Engineering, a division of Wastech Systems, has recently developed a portable shipping tank testing device referred to as the D.O.T. Vader Tester. This system tests tanks in accordance with Federal regulations 56 and 57 of the Department of Transportation. It is shown along with a complete tank accounting program and related testing chemicals and supplies. Also recently designed is a system to economically clean 1 to 5 gallon buckets for disposal or reuse. This system is fully air operated to be explosion proof as well as compact and portable.

X-RITE, INC.
Grandville, MI 49418

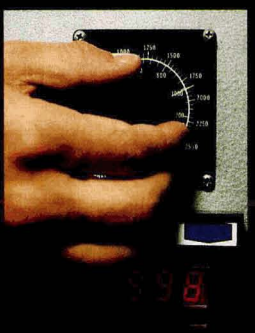
The company is exhibiting the new X-Rite 968 SpectroPhotometer and the X-Rite 948 SpectroColorimeter with their accompanying software programs. Also displayed is the X-Rite 918 Tristimulus Reflection Colorimeter.

ZEELAN INDUSTRIES, INC.
St. Paul, MN 55101

Zeelan's exhibit demonstrates the use of two types of ceramic microspheres (fine particle size, high strength ZEEOSPHERES® and larger particle size, low density Z•LIGHT SPHERES®) to increase solids, control gloss, improve flow, and enhance abrasion, chemical, corrosion and burnish resistance in a variety of coating systems.

ZIRCON CORP.
Collierville, TN 38017

Specialty resins and additives for the coatings industry are featured.



We're turning up the heat on our high-performance resins.

High-performance silicone resins have become a hot topic at Dow Corning.

After all, we've increased our production capacity by more than 50%. We've instituted a rigid process control system. And we've established a 95% on-time delivery program which we're working hard to beat.

Some might be satisfied with all that. Not us. We're intensifying our efforts, especially in product quality.

We're finding technologies that significantly extend – in many cases double – the shelf life of our resins. We're developing new high-performance resins with lower volatile organic content. And, as always, we're looking for ways to improve your paint and coating weatherability, durability, and temperature resistance.

It's an all-out effort spearheaded by the most experienced staff in silicone resin chemistry.

Find out how our dedication can benefit you.

Call 1-800-637-5377, Ext. 8241.

DOW CORNING

Fall 1990
Board of Directors Meeting

Thirty-five members and 33 guests attended the Fall Meeting of the Board of Directors of the Federation of Societies for Coatings Technology on October 28, 1990, in Washington, D.C.

The following were in attendance:

Officers

President ..... John C. Ballard
President-Elect ..... Kurt F. Weitz
Secretary-Treasurer ..... William F. Holmes

Society Representatives

Baltimore ..... Joseph D. Giusto
Birmingham ..... Gerry Gough
C-D-I-C ..... Lloyd J. Reindl
Chicago ..... Richard M. Hille
Cleveland ..... Fred B. Schwab
Dallas ..... Van G. Falcone
Detroit ..... William W. Passeno
Golden Gate ..... Timothy Donlin
Houston ..... Charles Lundquist
Kansas City ..... Norman A. Hon
Los Angeles ..... Jan P. Van Zelm
Louisville ..... James A. Hoeck
Mexico ..... Antonio Pina
Montreal ..... Horace S. Philipp
New England ..... Maureen Lein
New York ..... Richard J. Himics
Northwestern ..... Larry Brandenburger
Pacific Northwest ..... William Shackelford
Philadelphia ..... Wayne Kraus
Piedmont ..... James E. Husted
Pittsburgh ..... Raymond C. Uhlig
Rocky Mountain ..... John Delmonico
St. Louis ..... John Folkerts
Southern ..... Dan Dixon
Toronto ..... Arthur K. Hagopian
Western New York ..... Thomas Hill

Other Members

Carlos Dorris ..... Dallas
James E. Geiger ..... Southern
John Lanning ..... Louisville
John J. Oates ..... New York
Colin Penny ..... Baltimore
George Pilcher ..... C-D-I-C
Patricia Shaw ..... Golden Gate

Guests

Graham North, President of the Oil & Colour Chemists' Association—UK.

Ted Saultry, Past-President of the Surface Coatings Association Australia.

Annik Chauvel, President, Jacques Roire and Amleto Poluzzi, Past-Presidents, and Christian Bourgery, Secretary General, of the Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe (FATIPEC).

Federation Past-Presidents Hiram Ball, Joseph Bauer, Frank J. Borrelle (Honorary), Clarke Boyce, William Dunn, William Ellis, Neil S. Estrada, Howard Jerome, Terryl F. Johnson, Michael Malaga, James McCormick, William Mirick, Deryk Pawsey, Eugene Ott, Carroll Scholle, and Joseph Tomecko. (Board Members Carlos Dorris, James Geiger, and John Oates are also Past-Presidents of the Federation.)

Federation Committee Chairmen Sidney Lauren (Educational), David Penrice (Society Speakers Awards), and Sidney Rubin (Environmental Affairs).

Chuck Reitter, Editor/Vice President, *American Paint & Coatings Journal*.

Other guests included: Gerardo del Rio, President of the Mexico Society, and incoming Board Members Arturo Ita (Mexico) and Berger Justen (Southern).

Staff

Rosemary Falvey, Director of Meetings and Conventions; Victoria Graves, Meetings Coordinator; Thomas A. Kocis, Director of Field Services; Patricia D. Viola, Director of Publications; and Robert F. Ziegler, Executive Vice President.

The report of the Spring 1990 Board of Directors Meeting was approved as published in the August 1990 JOURNAL OF COATINGS TECHNOLOGY.

Reports of the Officers And Staff

PRESIDENT BALLARD

A most important and difficult project, the move to the Federation's new headquarters building, is completed. Certainly the Federation Staff and the Building Committee have done a phenomenal job in orchestrating a difficult situation with numerous inherent problems. With the press of business and the Paint Show arriving, the move was completed just a few short weeks from our Annual Meeting and Paint Show.

Since the Spring Week meeting, Judy and I attended the joint meeting of the St. Louis and Kansas City Societies held in the Lake of the Ozarks, which included timely and informative technical presentations on waste management and VOC.

I presided at the Host Committee Meeting on September 6, in Washington D.C., and along with the staff and committee members, made final preparations for the Annual Meeting and Paint Show. Along with this, we had a lengthy Executive Committee meeting to update progress on specific projects.

On September 11, Judy and I left for Birmingham, England, to attend the Executive Committee Meeting of the Birmingham Society. This was held at the Strathallan Hotel in Birmingham. Judy and I also hosted a dinner for the Executive Committee members and their wives. We then proceeded from Birmingham to the FATIPEC Congress in Nice, France held from the 16th to the 27th. I made a presentation during the opening session and attended several meetings during our visit.

The past year has been a most rewarding experience as our Federation shows its inherent strength in its committees and most especially in the Staff and their diligent activities under a year of change. The entire technical community has had a resurgence of activity concerning various disciplines both in technical and manufacturing. I feel certain that one of the finest timely technical programs has been assembled for the Annual Meeting and Paint Show.

JOHN C. BALLARD,
President

President-Elect Kurt Weitz (Toronto) and Montreal Society Representative Horace Phillip

PRESIDENT-ELECT WEITZ

The appointment of Federation Committee Chairpersons for 1991 has been completed. It is strongly recommended that these appointments be made shortly after Federation Spring Week to be concluded before the end of June and the onset of summer holidays.

Travels on Federation business have included, September 6—FSCT Quarterly Executive Committee Meeting, Sheraton, Washington D.C.;

September 13-16—1990 CPCA Convention, Canadian Paint & Coatings Association, Sheraton, Winnipeg MB; and,

September 20-23—1990 ANAFAPYT Convention, Mexican Paint & Coatings Association, Hotel Fiesta Americana, Cancun, Mexico.

KURT F. WEITZ,
President-Elect

SECRETARY-TREASURER HOLMES

Since the last report made at the Spring Meeting, the travel schedule for the office of Secretary-Treasurer has slowed, with the following events attended: West Coast Societies Meeting—Monterey, CA, on August 4; and, Host and Executive Committee Meeting—Washington, D.C. on September 6.

The financial picture of the Federation continues to be in good shape: receipts for the Paint Show are up, as are the expenses. It appears this should be another good year financially for the Federation.

WILLIAM F. HOLMES,
Secretary-Treasurer

EXECUTIVE VICE PRESIDENT ZIEGLER

1990 FINANCIAL STATEMENT

The 1990 third quarter financial report has been sent to the Board. The numbers are extremely positive and reflect the overall success of operations during the year. Third Quarter figures are: Income—$2,183,092 (vs. $1,918,595 for 3rd Quarter 1989); Expense—$1,605,765 (vs. $1,621,546 for 1989). With few exceptions, all figures are within the annual budget of $2,501,800. With the acquisition of the new headquarters, the Balance Sheet shows assets of $3,732,647 (vs. $2,812,608 for 1989 YTD). The recent increases in airline travel costs are of concern. We strongly request that all travel be arranged to gain the best price available.

PUBLICATIONS

JCT—A very positive note is the strong resurgence in advertising during the year. This, together with an increase in technical articles and Federation-related news pages, gives readers an extremely useful publication. We sincerely thank the Publications Committee and Editorial Review Board (Dr. Thomas J. Miranda, Chairman) for their continuing efforts in providing assistance.

Total distribution of the JCT is 9,750 compared with 9,776 in 1989, and 9,731 in 1988. A breakdown of distribution is: Members—7,373; Non-Members—2,078; U.S.—6,991; Canada—951; Europe—795; Other Countries—1,031.

Year Book—Reminders have been sent to all Society Treasurers notifying them of the November 15 deadline for receipt of membership rosters.

Series Units—The 15th addition to the *Federation Series on Coatings Technology*, "Aerospace and Aircraft Coatings," was published during 1990 and the 16th monograph, "Introduction to Coatings Technology," will be published by the Annual Meeting. Monographs on "Cationic Radiation Curing" and "Rheology" are being prepared for publication early next year. The remainder of the 15 additional booklets are in various stages of completion and we thank the Series Editors (Drs. Thomas J. Miranda and Darlene Brezinski) for their work in securing these excellent booklets.

Revised IR Atlas—The publication of the new, revised and expanded *Infrared Spectroscopy Atlas* is slated for early 1991. Although it had been hoped that this volume would be ready by the Annual Meeting, recent committee decisions to ensure the best possible spectra have delayed publication. The final, published volume will be worth the wait. Over 2,500 spectra with revised text will be available to the industry, and the digitized software (being produced by Nicolet Instrument Corp.) will revolutionize search and comparison.

Membership

Although corporate consolidations continue to be of concern, the Federation's total membership (prior to the November update) shows little loss—7,373 vs. 7,406 in 1989 and 7,311 in 1988. Discussions between staff and Membership Services Chairman Brenda Carr toward implementing a Federation-wide membership drive have been successful, and it is hoped that the drive (to come in Spring 1991) will be fruitful.

Annual Meeting and Paint Show

The Annual Meeting and Paint Industries' Show steps into the 1990s with the theme, "A Decade of Decision: Preparing for the Year 2000." Program Chairman Gary Gardner and his committee have developed an exceptional list of over 60 program presentations. Beginning with the Keynote Address by Lee Sherman Dreyfus during the Opening Session (at which there will be a special FSCT update presentation) and continuing through three days of meetings—ending with the Mattiello Lecture by the renowned Dr. Henry Leidheiser—the program will highlight both the changes happening in the industry and the technology to make things happen in the decade to come.

The Paint Show, always a highlight, will again be bigger and better than ever. Over 280 exhibiting companies in more than 82,000 net square feet of booth space (both records) will be on-hand to discuss the raw materials, equipment and services complementing the technical sessions. Held in the beautiful Washington Convention Center, the events will be hosted by the Baltimore Society, and we thank Richard Chodnicki and his committee for their assistance at the 1990 Annual Meeting and Paint Show.

Spring Week

The seventh annual "Spring Week" was held May 16-19 in Louisville, KY. Hosted by the Louisville Society, which developed the program for the seminar, "Coatings Technology in the 1990s," the week's events were well-attended throughout.

The 1991 Spring Week is scheduled for May 13-17 at Philadelphia's Society Hill Sheraton. The Seminar, being developed by the Philadelphia Society, will be held on Monday and Tuesday, May 13-14; the Board of Directors Meeting will be held on Wednesday, May 15; and the Incoming Society Officers Meeting will be held on Thursday, May 16. Highlighting the week will be a reception held at the FSCT headquarters office in Blue Bell. Scheduled for Tuesday, May 14, both Board Members and Society Officers will be invited to attend.

From left: Executive Vice President Robert Ziegler and President John Ballard (Louisville)

Office/Staff Visits

Visits since the last report have been made to the Joint St. Louis/Kansas City Societies Meeting, West Coast Societies Board Meeting, and a meeting with the 1990 Host Committee.

Summary

If ever a year would test the mettle of individuals, then 1990 will stand out as *the* year for the Federation staff. In addition to dealing with the busy normal course of events, such as planning for and hosting numerous meetings and seminars (detailed in Tom Kocis' report), including a record-setting Annual Meeting and Paint Show, the staff was involved in monitoring and supervising the construction and relocation of the Federation headquarters office. With move-in a bare seven weeks prior to the Annual Meeting, these 15 people performed admirably. I commend each one for their fortitude, patience, and persistence in "getting the job done."

They are: Director of Field Services—Thomas Kocis; Director of Meetings and Conventions—Rosemary Falvey; Director of Publications—Patricia Viola; Controller—Charles Schmidt; Meetings Coordinator—Victoria Graves; JCT Associate Editor—Sam Amicone; JCT Assistant Editor—Kathleen Wikiera; Advertising Services—Lorraine Ledford; JCT Subscription Fulfillment Manager—Audrey Boozer; JCT Desktop Publishing Operator—Linda Madden; Orders Department—Meryl Cohen; Secretaries—Dorothy Kwiatkowski, Mary Sorbello, Lisa Torrens; and Receptionist—Marie Wikiera.

On behalf of the staff, I sincerely thank President John Ballard and Judy, President-Elect Kurt Weitz, and Secretary-Treasurer William Holmes and Jean, and the Executive Committee, Board, and Committee Chairmen for their efforts during this year.

Robert F. Ziegler,
Executive Vice President

DIRECTOR OF FIELD SERVICES KOCIS

Committee Liaison

Program — All arrangements have been accommodated for the Annual Meeting programming, which has as its theme, "A Decade of Decision: Preparing for the Year 2000." Included in the presentations are four sessions developed by the Program Committee, Society papers, entries in the Roon Awards competition, papers from overseas organizations, contributions from the Corrosion, Manufacturing, and Professional Development Committees, and the Mattiello Lecture.

Arrangements, meanwhile, are underway for next year's programming. Committee will hold organizational meeting in conjunction with 1990 Annual Meeting to discuss development of a theme and suggestions for session presentations at the 1991 event in Toronto. Further discussions will be held at subsequent full-day meeting.

Professional Development — Committee met on May 17-18 in Louisville, and again on August 7-8 in Cleveland.

Baltimore Society Representative Joseph Giusto and FSCT Secretary-Treasurer William Holmes (Dallas)

Membership survey generated over 50% response; review of data has been completed and report is being prepared for publication in *JCT*.

Another round of Statistical Process Control seminars is planned for next year. Proposed schedule would include Level I and II seminars, supplemented by additional module focusing on practical examples of implementing SPC.

Sponsoring dual sessions at Annual Meeting: "Testing: The Key to the Quality Revolution"; and "Advanced Topics in Coatings Research."

Planning underway for two-day seminar on "Coatings Applications: Methods and Techniques."

Educational — Steering Committee met in Minneapolis on June 2 with Educational Committee representatives from 15 Societies.

In addition to Society reports on educational activities, major discussion items were scholarship support and suggested programs to enrich educational efforts. Tabulation of funds contributed by Societies to subsidize educational-related programs has been compiled for publication in *JCT*.

Steering Committee reviewed entries in Southern Society A. L. Hendry Award competition and selected winning student-authored manuscript. Award will be presented at Annual Meeting.

Scholarship reports from participating schools being prepared for review by Steering Committee and subsequent funding recommendations for 1991-92 academic year.

Corrosion — Committee met at Federation headquarters on June 5 and again on August 9. Modified report of Committee-sponsored "Survey of Accelerated Test Methods for Anti-Corrosive Coating Performance" was published in August *JCT*. Complete report has been reviewed and edited, and submitted to the Federation office, to be reproduced and offered for sale.

Recipients of 1990 Corrosion Publication Award were selected for best corrosion-related papers published in *JCT*. Presentation will be made at the Annual Meeting during the Committee-sponsored symposium on "Anti-Corrosive Coatings: The Next Generation."

Planning symposium on "Coatings for Corrosion Control of Non-Ferrous Substrates" for 1991 Annual Meeting in Toronto.

Committee is developing programming for 1992 FSCT Spring Seminar. Initial planning has begun for the event, which will have as its theme, "Understanding Corrosion Protection."

Manufacturing — Sponsoring seminar at Annual Meeting on "Challenging Tradition," which will focus on new and unique manufacturing concepts.

Committee-nominated candidate to receive 1990 Golden Impeller Award for distinguished achievement in dispersion technology has been approved by Morehouse Industries, who will make presentation at Annual Meeting, during the manufacturing seminar.

Technical Advisory — Committee met in Atlanta on September 12-13, with Technical Committee representatives from 17 Societies. Discussions focused on work underway and planned, along with suggestions for future projects.

In conjunction with the meeting, attendees toured The Glidden Co.'s Gainesville plant; at post-dinner presentation, plant representatives discussed various aspects of the Gainesville operation.

Technical Advisory Committee monitoring activities of the Federation-sponsored Laboratory Proficiency Testing Program, providing guidance in selecting test methods and recommending paint samples.

Joint Coatings/Forest Products — Committee met in Chicago on September 18.

Final review of revised National Forest Products Association booklet, "How to Paint Your Wood House," nearing completion; NFPA plans to publish new edition by year-end.

Monographs on several coatings/wood substrate-related topics (eight in all) are in various stages of development. "Effects of Acidic Deposition on Painted Wood" has been completed and is scheduled for publication in early issue of *JCT*. Four others are in final stages of completion: Prevention of Extractive Discoloration; Painting Recommendations for Pre-Primed Medium Density Hardboard Siding; Finishability of CCA Pressure-Treated Wood; and Application Recommendations for Smooth, Embossed and Saw-Textured Surfaces.

Symposium on Color and Appearance Instrumentation (SCAI)

This event, sponsored in conjunction with the Inter-Society Color Council (ISCC), was held in Cleveland, April 25-26.

Total attendance was 216. Included among the attendees were representatives from Canada, Europe, and the Far East.

The Symposium had as its theme, "Combining Color and Appearance," and focused on discussions of new instruments, optical models, and computer simulation techniques which are opening the door to a better understanding of the complex appearance phenomenon. Featured were "hands-on" instrumentation displays of 10 supplier firms.

Comments expressed throughout the event, and reported in the critique sheets returned by the attendees, confirm that the Symposium was well received and that participants were pleased with the programming.

Ralph Stanziola, who chairs the Federation's ISCC Committee, was in charge of the event, assisted by Committee member Romesh Kumar. Both did an excellent job and the success of the Symposium reflects their good work.

A generous surplus of income over expenses accrues to the Federation, which absorbed preliminary expenses and handled arrangements for the promotion, registration, housing, and on-site meeting needs.

Miscellaneous

Annual update of "Talks Available for Constituent Societies" was completed and distributed; a total of 98 presentations are offered for the 1990-91 meeting season . . . Liaison and staff support provided

Fred Schwab (Cleveland) and Richard Hille (Chicago)

for activities of Roon and *American Paint & Coatings Journal* Committees, as well as Advisory Board for Series on Coatings Technology.

THOMAS A. KOCIS,
Director of Field Services

Coatings Industry Education Fund

George Pilcher, President of the CIEF Board of Trustees, reported that no meeting of the Board had been held since the Spring Meeting. He indicated that the Trustees would meet during the Annual Meeting and a report to the stockholders would be forthcoming.

Review of Actions Of Executive Committee

(One of the duties of the Board of Directors is to approve or disapprove the actions of the Executive Committee.

The actions of the Executive Committee of May 19 and September 6 were included with the minutes mailed previously to the Board Members. The actions of October 27, 1990 were distributed at the meeting.)

MAY 19, 1990

That the request of the Kansas City Society to reimburse Federation Past-Presidents for their hotel expenses at the Annual Meeting be respectfully declined.

That the Federation support the publication of the Pacific Northwest Society's Manufacturing Newsletter and that it be published in the JOURNAL OF COATINGS TECHNOLOGY.

That a suggestion to develop an award for the best idea for waste reduction/waste disposal be referred to the Manufacturing Committee for consideration.

(On a motion by Mr. Passeno, seconded by Ms. Lein, the actions of the Executive Committee for May 19, 1990 were unanimously approved.)

SEPTEMBER 6, 1990

That the nomination by the Cleveland Society for Federation Honorary Membership for one of its members be respectfully declined.

That the proposal by the Publications Committee regarding publication of a collection of "Humbug from Hillman" columns be provisionally accepted and that staff be directed to investigate and report back with ways and means for final consideration.

That the request of Prof. Gerald Mattson, of the University of Southern Mississippi, to represent the Federation during a proposed trip to the Soviet Union be accepted.

That non-member subscription rates for the JOURNAL OF COATINGS TECHNOLOGY be increased by approximately 10%, effective January 1, 1991.

That the By-Laws Committee be requested to develop appropriate revisions to the Standing Rules (Art. VIII, Sect. B (Educational Committee)) to incorporate the Steering Committee into the description of the Educational Committee.

That attendees to the National Association of Printing Ink Manufacturers Conference in Washington be admitted to the 1990 Paint Industries' Show at a reduced one-day rate of $20.

Maureen Lein (New England) and Richard Himics (New York)

(On a motion by Mr. Philipp, seconded by Mr. Dixon, the actions of the Executive Committee for September 6, 1990 were unanimously approved.)

OCTOBER 27, 1990

That the employee relocation policy drafted by staff be approved as amended.

That the following annual Motions of Policy be approved:

(1) That Dr. Thomas J. Miranda be retained as Technical Editor of the *JCT* for 1991;

(2) That, for administrative purposes, the First Quarter 1991 budget be set at the same figure as the First Quarter 1990 budget.

(3) That Past-Presidents be reimbursed for transportation expenses to the Annual Meeting; and,

(4) That Officers, their Spouses, and the Executive Committee be reimbursed their travel expenses.

That, for administrative purposes, 1990-91 committee appropriations be set at the 1989-90 figure, with final appropriations being approved in January 1991.

That staff investigate a proposal to co-sponsor the development of guide specifications for lead-based paint testing and abatement by the National Institute of Building Sciences and report back to the Executive Committee.

That the Professional Development Committee's proposal to sponsor Statistical Process Control Seminars in Chicago, March 1991, be approved.

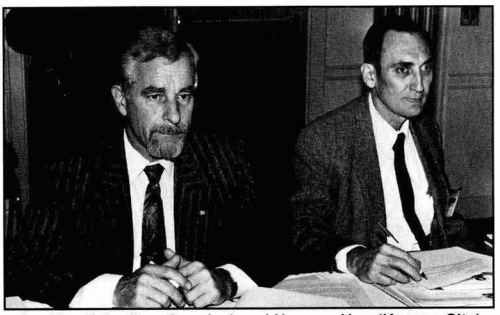
(On a motion by Mr. Himics, seconded by Mr. Van Zelm, the actions of the Executive Committee for October 27, 1990 were unanimously approved.)

By-Laws

Proposed Amendment: Retired Membership

FIRST READING

The Board of Directors requested that the By-Laws Committee consider a proposal to extend to a retired member all of the rights and privileges to which the member had been entitled at the time of retirement. This would extend the eligibility for serving as a Federation Officer, Board Member, Society Representative, or Committee Chairman to a retiree who was in an eligible class of membership at the time he or she retired.



Jan Van Zelm (Los Angeles) and Norman Hon (Kansas City)

After due consideration, the By-Laws Committee proposed the following amendment for the first reading at the Fall 1990 Board of Directors meeting:

Be it RESOLVED that:

By-Laws Article III, Section D, Paragraph (4) RETIRED MEMBERSHIP be amended as follows:

Add the Following Paragraph:

"A Retired Member shall be entitled to exercise all rights and privileges to which such member was entitled based on his or her class of membership at the time of retirement."

Note: The By-Laws Committee makes no recommendation.

FRED G. SCHWAB,
Chairman

Report of the Ad Hoc Office Building Committee

In his verbal report to the Board, Chairman James Geiger thanked the members for their cooperation and announced that construction has been completed and that the offices have been relocated to the new headquarters. Costs were held within the approved budget of $1,600,000.

He also reported that although a mechanic's lien had been placed against the property, it is now currently removed through recent court decision in the Federation's favor.

Mr. Geiger thanked his committee members for their diligent efforts. They are: Past Presidents James McCormick, John Oates, and Deryk Pawsey, and Planning Committee Chairman Colin Penny.

(Following Mr Geiger's report, Mr. Ziegler presented a slide show of the completed building, both interior and exterior, and announced that the Federation would host a reception in the new headquarters office during the 1991 Spring Week Meeting.)

JAMES E. GEIGER,
Chairman

Elections

The following slate of candidates for Federation Office (1990-91) was presented by the Nominating Committee at the Spring 1990 Meeting. Chairman Geiger, noting that there were no nominations from the floor or by mail ballot, presented the slate for election:

President-Elect: William F. Holmes, of Dallas Society (National Pigments & Chemicals, Inc.). One-year term. He is currently Secretary-Treasurer.

Secretary-Treasurer: Colin D. Penny, of the Baltimore Society (Hampton Paint Manufacturing Co., Inc.). One-year term.

Executive Committee: Jan P. Van Zelm, Los Angeles Society (Byk Chemie USA). Three-year term; and Joseph D. Guisto, Baltimore Society (Lenmar, Inc.). One-year term to fulfill term of Thomas Hill.

Board of Directors (Members-at-Large): Berger G. Justen, Southern Society (Ribelin Sales, Inc.); Thad T. Broome, Southern Society (J.M. Huber Co.). Two to be elected; Two-year terms each. Louis F. Holtzknecht, Louisville Society (Devoe Marine Coatings Co.). One-year term to fulfill term of Secretary-Treasurer nominee Penny.

Board of Directors (Past-President Member): Deryk R. Pawsey, Pacific Northwest Society (Rohm and Haas Canada Inc.). Two-year term.

On a motion made by Mr. Hagopian, seconded by Mr. Schwab, the slate, as proposed by the Nominating Committee, was unanimously elected by the Board.

JAMES E. GEIGER,
Chairman

Society Business

Toronto—Mr. Hagopian noted that the 1991 Annual Meeting and Paint Industries' Show will take place in Toronto, and extended an invitation to all present to attend and enjoy the hospitality of his city.

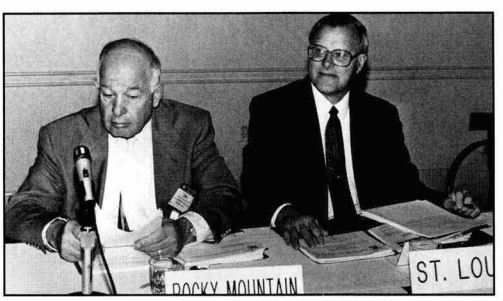
New Business

AWARDS TO SOCIETY MEMBERSHIP CHAIRMEN

President Ballard announced that awards of appreciation for exemplary increases in membership during the year 1989-90 were garnered by the Membership Chairmen of the Mexico, Philadelphia, and Pittsburgh Societies. The Mexico Society increased its membership by 11.5%, Philadelphia by 13.3%, and Pittsburgh by 13.7%. He congratulated these Societies and presented Certificates of Appreciation to their representatives attending the meeting.

ELECTION TO HONORARY MEMBERSHIP

Neil S. Estrada, a Past-President of the Federation and Honorary Member of the Golden Gate Society, was proposed by the Society



John Delmonico (Rocky Mountain) and John Folkerts (St. Louis)

for Federation Honorary Membership. As specified in the Standing Rules II (D), the Secretary of each Society and the Board of Directors were advised of the nomination.

(On a motion by Mr. Donlin, seconded by Mr. Hon, the Board elected Mr. Estrada a Federation Honorary Member by secret ballot.)

Committee Reports

A.F. VOSS/AMERICAN PAINT & COATINGS JOURNAL AWARDS

Four Societies have entered five papers in the A. F. Voss/*American Paint & Coatings Journal* Awards competition this year. They are:

Baltimore—"The Effects of the Degree of Dispersion on the Properties of Trade Sales (Architectural) Coatings"

Cleveland—"Changes in Hiding during Latex Film Formation. Part II. Particle Size and Pigment Packing Effects"

Cleveland—"Changes in Hiding during Latex Film Formation. Part III. Effect of Coalescent Level and Latex Properties"

Golden Gate—"Statistical Modeling Drying of Coatings"

Toronto—"Correlation of Hardness in Coating Films Using Koenig and Sward Pendulum Hardness Testers"

The Voss Awards Committee (R. Brown—Southern Society, J. Flack—Toronto Society, L. Haanstra—Los Angeles Society, R. Johnson—Northwest Society, M. Lein—New England Society, G. Pilcher—CDIC Society, Patricia Shaw—Golden Gate Society) is evaluating the entries.

Awards for the best paper(s) will be presented at the Annual Meeting in Washington, D.C.

PATRICIA SHAW,
Chairman

ANNUAL MEETING PROGRAM

The 1990 Annual Meeting Program consists of 14 sessions containing 62 talks. Four of these sessions, "Coating a Sound Foundation," developed by George Pilcher; "Coating History in the Making: A Technological Profile Part I" developed by Mary Brodie, and "Part II" developed by Gerry Parsons, and "Regulatory Affairs in the '90s" developed by Bob Brady are Program Committees' sessions that specifically address the 1990 theme: "A Decade of Decision: Preparing for the Year 2000."

These theme sessions will provide valuable information on substrates, curing mechanisms, resin technologies and regulations, and thereby provide attendees with knowledge that allows them to make better decisions in the '90s.

Additional theme support comes from four sessions that cover formulation technology, polymer technology, safety, and testing:

"Interactive Effects of Coatings Components"—Moderator, Richard Hille; "Polymers: The Key Building Block"—Moderator, John Hall; "Basics for the Year 2000"—Moderator, Mary McKnight; and "Safety & Performance into the 21st Century"—Moderator, Steve Bussjaeger.

These sessions, developed from "over-the-transom" submittals, will help keep attendees prepared for the year 2000.

Three FSCT committees have put together sessions that will also tie nicely into our theme. The Professional Development Committee has put together a two-part symposium: "Part I—Testing: The Key to The Quality Revolution"—Moderator, Dan Gilbert and "Part II—Advanced Topics in Coatings Research"—Moderator, Richard Himics.

The Manufacturing Committee will present a seminar on "Challenging Tradition," moderated by John Covington. The Corrosion Committee will present a symposium on "Anti-Corrosive Coatings: The Next Generation," moderated by Don Collier.

Southern Society Representative Dan Dixon and Toronto Society Representative Arthur Hagopian

In addition to these sessions, there will be five Society papers presented in one session moderated by Patricia Shaw and nine Roon Awards competition papers presented in two sessions, one moderated by Dick Eley and the other by Gordon Bierwagen.

When scheduling the sessions, we planned four simultaneous sessions for Monday afternoon and all day Tuesday, with two sessions on Wednesday. We were careful to start sessions at the same time, 9:00 in the morning and 2:00 in the afternoon, and allowed plenty of time between morning and afternoon sessions for lunches, show visit, private meetings, etc. For the most part, talks will start and stop on the half-hour and moderators will keep talks on schedule. We will have speaker breakfasts each morning to go over last minute details, acquaint moderator and speakers, and make everyone comfortable.

Each member of the Program Committee performed admirably, and combining that with the guidance and support of Tom Kocis, the Chairman's job was easy. We believe we have a topnotch program that will indeed live up to the theme.

GARY GARDNER,
Chairman

CORROSION

The Corrosion Committee held its third meeting of the year on August 9, 1990 at the Federation Headquarters in Philadelphia, PA. The meeting covered the following topics:

(1) Publication Award,
(2) Annual Meeting Program for 1990,
(3) Annual Meeting Program for 1991,
(4) Program for Spring Week 1992, and
(5) SSPC Survey Project.

Publication Award— This year's competition was the biggest and best yet! The Committee reviewed eight papers and decided to award two prizes. The first place prize ($750) was awarded to "Mechanisms of Cathodic Protection of Zinc-Rich Paints by Electrochemical Impedance Spectroscopy" Parts I and II—S. Feliu, R. Barajas, J. M. Bastidas, and M. Morcillo, of Centro Nacional de Investigacions Metalurgicas, Madrid, Spain, published in the *JCT*, August 1989. The second prize ($250) was awarded to "Detection and Quantitative Characterization of Blistering and Corrosion of Coatings on Steel Using Infrared Thermography"—Mary E. McKnight and Jonathan W. Martin, National Institute of Standards and Technology, Gaithersberg, MD, published in *JCT*, August 1989.

The Publication Award will be presented during the Corrosion Committee-sponsored symposium at the 1990 Annual Meeting in Washington, D.C.

1990 Annual Meeting Program— This year's committee-sponsored symposium at the Annual Meeting in Washington, D.C., is

Lloyd Reindl (CDIC) and Gerry Gough (Birmingham)

entitled "Anti-Corrosive Coatings: The Next Generation," and will feature the following five presentations and speakers:

(1) "How to Develop an Improved Laboratory Corrosion Test" by Herb Townsend, Bethlehem Steel Corp.

(2) "A Combined Corrosion/Weathering Accelerated Test for Coatings for Corrosion Control: Correlating Field and Laboratory Exposures," by Brian Skerry, The Sherwin-Williams Co.

(3) "Surface Chemistry Aspects of Polymer/Metal Adhesion," by James P. Wightman, Center for Adhesive and Sealant Science," Virginia Polytechnic Institute.

(4) "Compliance When Using Heavy Metals," by William Stewart, The Valspar Corp.

(5) "Development of Chromate-Free Primers for Aluminum and Steel to Meet CGSB Specifications," by Terry Foster, Canadian Department of National Defense.

1991 Annual Meeting Program— The Committee has agreed upon a symposium title of "Coatings for Corrosion Control of Non-Ferrous Substrates" for the 1991 Annual Meeting in Toronto. This would be a half-day session dealing with: new technology, corrosion mechanisms, end users, perceived needs and problems. Substrates covered would include aluminum, zinc, galvanized steel, magnesium, brass, tin, stainless steel, copper, and plated metallics.

A news release will be prepared announcing the symposium and soliciting papers from prospective speakers. Programming will be discussed at greater length at our next meeting.

1992 Spring Week Symposium— The Committee will undertake the program development for the 1992 Federation Spring Seminar (in Boston) and has selected the theme "Understanding Corrosion Protection" (subtitled, "How Rusty Are We?").

The program is envisioned as filling two full days, with presentations fitted into four modules: Corrosion Basics (3 hours); Testing Techniques/Experimental Design and Statistics (3 to 3.5 hours); Raw Material Technology Forum, with supplier speakers (3 hours); and General Formulation/New Technology (3 hours). The programming will be discussed at greater length at the next meeting.

SSPC Survey Project— The modified report on the "Survey of Accelerated Test Methods for Anti-Corrosive Coating Performance" appeared in the August issue of the *JCT*. The completed survey report, conducted by the Steel Structures Painting Council, has been edited and submitted to the Federation Office for processing.

JAY AUSTIN,
Chairman

EDUCATIONAL

In the interval since the last Board meeting, the Educational Committee met in Minneapolis on Saturday, June 2; 15 Societies were represented. The Saturday schedule was chosen, with the prior agreement of the Committee, in order to obtain the advantage of much lower over-Saturday air fares, for a significant saving to the Federation. Willingness to give up a weekend day is a tribute to the dedication of the members.

In a continued departure from previous practice, oral reports about Society educational activities were presented at the start of the meeting, rather than at the end, to assure adequate time for presentation and discussion of each report. The reports, in total, presented a picture of purposeful and fruitful educational activity on many levels, ranging from involvement with local schools to enrichment of Society meeting programs.

Survey of Society Financial Support for Educational Activities— Mention of financial appropriations by individual Societies for scholarships and related educational activities have been so common in the oral and written reports presented at the Educational Committee meetings, that it seemed evident this funding was making a significant added contribution, at the "grassroots" level, to the Federation's support for education; proper recognition of these contributions seemed overdue. Accordingly, a questionnaire soliciting information on the nature and extent of their contributions was distributed to the President of each Society. A summary of the impressive submitted data will be published in an early issue of the *JCT*.

Federation Scholarship Funds— Early this year, the Educational Steering Committee decided to develop closer ties with the schools receiving Federation scholarship funds. Although the administrators of the programs sponsored by the Federation have been submitting detailed written reports annually, it was felt that personal visits by individual Steering Committee membership would give us more insight into facilities, programs, faculty, and students than can be conveyed in written reports. Thus far, day-long visits have been made to Eastern Michigan University (EMU) and the University of Detroit by John Oates (New York Society) and to the University of Missouri-Rolla by Paul Baukema (Louisville).

The success of EMU in achieving a high "capture ratio" of graduates entering the coatings industry was described with enthusiasm. In the past three years, 30 of 46 graduates of the EMU program have entered the coatings or allied industries; EMU graduates average four to five job offers each.

At the University of Detroit, coatings courses are offered by the Departments of Chemistry and Chemical Engineering. The University sponsors a series of evening courses, taught on campus, in conjunction with the Detroit Society; industry personnel serve as instructors. The range of courses includes polymer technology, principles of color, fundamentals of automotive paint systems, and electrodeposition.

Paul Baukema reported his excellent impression of the "hands-on"-oriented program and facilities at the University of Missouri-Rolla. The percentage of graduates who enter the coatings industry varies by year; a fair number do join coatings manufacturers or supplier companies. Some in each graduating class go on to graduate study.

Similar visits to Kent State University, North Dakota State University and University of Southern Mississippi are scheduled.

The Hendry Award—An excellent paper, co-authored by two undergraduates, was received this year from the University of Southern Mississippi, and has been accepted by the three judges of the Steering Committee. Under the new rules for this Award, the paper was accepted with named co-authorship of a graduate advisor who is a doctoral candidate, and the head of the Department of Polymer Science. One other manuscript was received well past the submission deadline, and could therefore not be accepted. The author, who will still be an undergraduate next year, was invited to re-submit the paper in timely fashion.

The scanty response to this Award, for which so few papers have been submitted, has been a disappointment. The Steering Committee intends to review the recent history and nature of the Hendry Award submissions, for a judgment on whether the Award is fulfilling the intent of its founders.

"The Choice" Videotape—Reports by the Society Educational Chairs indicate that the Federation's videotape, "The Choice," is continuing to be shown to various groups. A videotape of this kind has a "shelf life'" so the Societies are urged to continue using this resource before it becomes too dated.

The Cal Poly Program—Since the Steering Committee was used so effectively by the late David R. Kittredge for attracting Federation interest in Cal Poly, this program continues to claim our strong sentimental support. It would be inappropriate to preempt an anticipated detailed report to this Board meeting by the Los Angeles Society Representative, so nothing more will be said here beyond an expression of gratification that the Cal Poly polymer and coatings program is now "in business," with a starting enrollment of 20 undergraduate students, with the proud record of having attracted at least as much financial support from industry as was extended by the Federation.

Need for a Modern Syllabus for a Basic Coatings Course—Among a number of topics that were discussed at the last meeting of the Educational Committee in June was the need for a comprehensive outline for a course on coatings technology, for use by volunteer lecturers who have the background and experience to give such a course, but who lack the time to get it organized. No immediate action was taken, or is planned, on this matter, but the proposal is important enough to be recorded in this report.

Proposal to Tape Selected Talks to Societies—Another proposal was inspired by the thought that many excellent talks to individual Societies amount to "one-night stands"; they involve diligent preparation and excellent presentation — are given once, and then they disappear. The idea was proposed that Societies could be asked to report especially excellent technical presentations, so that timely contact could be made with the speaker to arrange for a repeat presentation before a video camera. An excellent talk could thus be recorded for any interested Societies who might not otherwise be able to arrange for a speaker's personal appearance. This matter, also, was deferred for further consideration.

SID LAUREN,
Chairman

(Mr. Lauren noted comments made earlier by Mr. Estrada regarding the status of the Educational Steering Committee. While he agreed that the Steering Committee lacked formal status within the Federation's By-Laws, he made it clear that the Steering Committee appropriated no funds and that its actions were within the province of the Educational Committee as a whole.

Following discussion, Mr. Geiger moved that until such time as the By-Laws Committee determined appropriate revisions to the By-Laws to incorporate the Steering Committee, the Committee be made an Ad Hoc Committee of the Federation. Seconded by Mr. Van Zelm and unanimously approved.)

ENVIRONMENTAL AFFAIRS

The Environmental Affairs Committee consists of nine members plus the Chairman. On or about the 15th of each month, the *Regulatory Update* which is received from the National Paint and Coatings Association is sent to the Chairman and three members of the Committee. This is edited to print only items of interest to the Federation members. While we try to make cuts to result in four printed pages in the JOURNAL OF COATINGS TECHNOLOGY, sometimes the volume of proposed and new laws and regulations is so vast that it results in eight pages.

The State and Federal Primers we purchase from the NPCA have resulted in more up-to-date and complete information and is keeping our members better informed on these important issues.

SIDNEY J. RUBIN,
Chairman

William Passeno (Detroit) and Van Falcone (Dallas)

HOST

All Committee Chairmen are in place and have full knowledge of the scope of their assignments. The Chairmen have assembled their personnel, oriented and briefed them on their respective duties, and they are prepared to react.

The Spouses Committee, in conjunction with the Federation staff, has arranged a tour of Washington, a wine and cheese social, continental breakfasts and hospitality activities.

Officers of the Baltimore Society have been advised as to their participation and assistance to the Host Committee.

RICHARD C. CHODNICKI,
Chairman

MANUFACTURING

Since our Spring Meeting, the Manufacturing Committee has been working on our seminar for the Annual Meeting in Washington, D.C.

In July, we held a speakers meeting to coordinate our efforts. This took place in Los Angeles and several of our members also attended the Los Angeles Society Manufacturing Symposium which took place the day before.

This year's seminar title is "Challenging Tradition." It will be a stimulating investigation into flexible manufacturing and various alternatives to our industry "batch" approach for making coatings. The following is a list of the participants and their topics:

John W. Covington, Principal, Covington Consultants— "Why It's Dangerous Not to Challenge Our Traditional Ways of Doing Business."

FSCT Past-Presidents John Oates (New York) and Carlos Dorris (Dallas)

Guests attending the Board Meeting included (from left to right): Annik Chauvel, Hiram Ball, Thomas Kocis, Mrs. Nicole Bourgery, Sidney Lauren, Michael Malaga, Jacques Roire, Deryk Pawsey, A. Clarke Boyce, Christian Bourgery, and A. Graham North

Phillip C. Howlett, Senior Vice President, Fluid Management—"Flexible Manufacturing for the Paint Industry."

Kenneth Boyle, Product Manager, Applied Color Systems—"The Other Side of the Story—"How Other Industries Produce Color."

Larry K. Kytasaari, Vice President Operations, Tnemec Co.—"Increasing Service and Reducing Costs While Addressing Small Orders."

Kenneth N. Edwards, Corporate Secretary, Dunn-Edwards Corp.—"Quick-Tint—An Automated Factory Approach to Custom Color Problems."

The Morehouse "Golden Impeller" award will also be presented during this seminar. The nominee for this year's award has been wholeheartedly endorsed by Mr. Dale Morehouse, who will make the actual presentation.

Work is continuing on the revised format for a "Manufacturing Digest" which will be done at little or no cost to the Federation. This is a long-term project and we will keep the Board informed on our progress.

The Manufacturing Committee will have a new Chairman next year and this will be my final report to the Board. I would like to take this opportunity to thank my fellow Committee members for all of their assistance during the past few years. They have given freely of their time and talents and I am very appreciative. I would also like to thank the entire staff of the FSCT, and in particular Tom Kocis, for everything they have done to help us help our industry.

JOSEPH P. WALTON,
Chairman

MEMBERSHIP

A meeting was held on June 19, 1990 at Federation Headquarters to plan a FSCT membership program. Those present were the Chairman Brenda Carr, Robert Ziegler, and Victoria Graves.

Three Societies were selected to receive membership awards at the Annual Meeting in Washington, D.C. for their increased membership in 1989-90. They are Mexico Society (11.5%), Philadelphia Society (13.3%), and Pittsburgh Society (13.7%).

Letters were sent in July to each of the respective membership chairman congratulating them on the award and requesting the attendance at the award presentation October 28, 1990.

It was decided at the meeting that the FSCT would send membership information to all non-member attendees of the 1989-90 Annual Meeting in New Orleans. In the future, the FSCT will have membership packets available at all FSCT meetings/seminars. These would also be available to local membership chairmen for local symposiums.

In July the names of non-members in attendance at the Annual Meeting were sent to the appropriate membership chairmen informing them that the Federation would be sending these people information on membership. They were also sent names of non-members attending FSCT and college seminars and asked to follow up on them as prospective members.

The idea of a Membership Guide was discussed and one was compiled in July, finalized and distributed in August. It is titled "Helpful Hints for Society Membership Chairmen."

Future projects discussed were: the revision of the current application form, a brochure for current non-renewing members (Why Renew?"), a brochure for non-members, postage paid response cards so individuals can request information from the FSCT, and the 1991 Membership Drive (possible promotional item/gift for new members).

Committee Members: Nick F. Dispensa (Kansas City); Joanne Monique (New England); and James Calkin (Los Angeles).

BRENDA L. CARR,
Chairman

PAINT SHOW EXHIBITS

The Committee will consist of approximately 24 volunteers from all aspects of the coatings industry including raw material suppliers, services, manufacturers and technical personnel.

We will meet at 8:00 am, Monday, October 29, 1990 to assign judging duties and to explain the criterion by which booths are to be judged.

We will reconvene at 2:00 pm, Tuesday, October 30, 1990 to determine winners in each category.

KENNETH R. HYDE,
Chairman

PROFESSIONAL DEVELOPMENT

Since the last written report to the Board of Directors, the Professional Development Committee has met twice; on May 17-18 in Louisville and on August 7-8 in Cleveland.

Highlights of our current and projected activities are as follows:

FSCT/PDC MEMBERSHIP SURVEY: The second FSCT membership survey has been completed in 1990, with a response rate of approximately 50% for which the PDC heartily thanks the membership. Inspection of the tabulated responses has led to the suggestion of several correlations which should yield additional relevant information. Following a review of all data, work will begin on a draft of the survey report to be submitted to the JOURNAL OF COATINGS TECHNOLOGY for publication. An oral summary report will be presented at the Fall Meeting of the FSCT Board of Directors.

STATISTICAL PROCESS CONTROL (SPC) LECTURE/WORKSHOPS:

Levels I and II—To date, nearly 1000 participants have attended 20 PDC-sponsored SPC lecture/workshops. In 1990, attendance has been good at the sessions in Chicago with 51 persons attending Level I, 45 attending Level II, and 30 persons attending both levels. A Level I session was also held in Toronto, with 41 attending. No FSCT subsidy is required for the 1990 schedule. Committee proposes to offer both Levels again in March, 1991, in Chicago, as well as a revision of the SPC programming described below.

Total Quality Management (TQM)—A one-day seminar addressing some of the practical aspects of TQM including the planning, costing, organization, implementation, and evaluation of such a program is being developed as a stand alone "module" which is intended to supplement the Level I session for current or former attendees. Several topics covered in the TQM day have been also requested in the questionnaires filled out by Level I/II attendees.

PDC DUAL SYMPOSIUM AT THE 1990 WASHINGTON ANNUAL MEETING—Committee will sponsor two 1-1/2 hour sessions on Monday afternoon, October 29, as described in the following:

Part I: "Testing: The Key to the Quality Revolution"—This session will present speakers from leading industrial and government organizations who will focus on the importance of testing proficiency to a quality management system.

Part II: "Advanced Topics in Coatings Research"—Speakers from university and industrial organizations will present newer work in transportation coatings, formulation of latex coatings, and organic corrosion inhibitor for coatings.

MODERN ANALYTICAL RESOURCES: "THE COATING CHEMIST'S ALLY": First drafts of the extended abstracts from the 1989 Federation Spring Seminar have been completed and are under review for clearance by the speakers. Plans are to submit a summary article to the *JCT*.

Rescheduling of this useful symposium is anticipated for 1992, with the proposed title of "Problem Solving by Scientific Detective Work," which would put more emphasis on examples utilizing analytical techniques.

FUTURE PROJECTS—Committee felt that the topic "Coatings Applications: Methods and Techniques" offered excellent potential for developing into a two-day seminar of interest to the industry and the membership. Application equipment companies will be contacted to collect information. A preliminary listing of topics and a tentative seminar outline have been generated.

The mission of the PDC continues to be the professional development of the technical staff of the coatings industry through continuing education activities. In this mission, the PDC welcomes and actively seeks suggestions and proposals from all concerned parties. The PDC also thanks the Federation for its continued support and for many useful discussions.

RICHARD J. HIMICS,
Chairman

(Mr. Himics presented the findings of the Professional Development Committee's Survey to the Board. He indicated that a comparison of the results will be made and that an article summarizing the results will be published in an upcoming issue of the JOURNAL OF COATINGS TECHNOLOGY.)

PUBLICATIONS

Since out last report, the following items are noted:

(1) The flow of manuscripts is good. Review procedures have been effective in minimizing the time from receipt to return to the author. We are also soliciting papers from ACS and other meetings.

(2) We are working on the publication of seminal papers to provide archival papers for our readers. We have one key topic identified and will be planning to publish this year. A number of key papers have been identified and we hope to proceed on this as an added service to our readers.

(3) Federation Series manuscripts have been published; the latest being "Aerospace Coatings." "Introduction to Coatings Technology" is now is due shortly. We expect "Rheology" and "Cationic Radiation Curing" by year's end.

(4) Book Review, Humbug from Hillman and the Crossword Puzzle are on-going features and are well received.

(5) The Infrared Book is expected this year.

(6) The Chairman expressed his appreciation to the members of the Committee and the Federation Staff for their contributions.

THOMAS J. MIRANDA,
Chairman

TECHNICAL ADVISORY

The Technical Advisory Committee met on May 10, 1990 at the O'Hare Hilton in Chicago. Atlanta was chosen as the site for the next meeting with the Society Technical Committee Chairmen. The meeting was attended by Charles Leete, President of Collaborative Testing Services, Inc. He reviewed the status of the Collaborative Testing Program (CTP) which is sponsored by the FSCT and his questions concerned membership participation. Currently only 50 laboratories are enrolled. Richard Max (Chicago) agreed to act as an immediate contact person concerning day-to-day type questions for Mr. Leete.

The Technical Advisory Committee held its annual meeting with the Society Technical Committee Chairmen on September 12-13, 1990 at the Hyatt-Atlanta Airport in Atlanta, Georgia. The meeting was attended by 19 of the 26 (73%) Technical Committee Chairmen. This is about the average attendance for the last five years. The meeting included:

(1) A report on the activities of the Joint Coatings/Forest Products Committee by Steve Bussjaeger (Kansas City).

(2) A report on the activities of the Corrosion Committee was given by Gail Pollano (New England).

(3) A talk was given by Bob Athey (Golden Gate) entitled "Error, Precision, Accuracy and Bias."

(4) A discussion of the new liaison program between the TAC and Collaborative Testing Services was given by Charles Leete.

(5) A tour of the Gainesville, Georgia, Trade Sales paint manufacturing paint operated by Glidden.

(6) Reports of Technical Committee activity in various Societies.

A total of five papers will be presented at the 68th Annual Meeting of the FSCT by Society Technical Committees. They are:

(1) "Changes in Hiding During Latex Film Formation. Part II. Pigment Packing Effects." (Cleveland)

(2) "Changes in Hiding During Latex Film Formation. Part III. Effect of Dispersant Level and Emulsion Properties." (Cleveland)

(3) "The Effect of Dispersion on the Physical and Performance Properties of Trade Sales (Architectural) Coatings." (Baltimore)

(4) "Correlation of Hardness in Coating Films Using Koenig and Sward Pendulum Hardness Testers." (Toronto)

(5) "A Statistical Model Study of How Coatings Dry." (Golden Gate).

A full report of this meeting will be published in the JOURNAL OF COATINGS TECHNOLOGY in the near future.

Also, in Atlanta, a short meeting of the Technical Advisory Committee was held with Mr. Leete to discuss progress in selecting appropriate test paints and test methods to be used by CTS in future years.

GERRY K. NOREN,
Chairman

Philadelphia Society Representative Wayne Kraus and Piedmont Representative James Husted

TECHNICAL INFORMATION SYSTEMS

The Technical Information Services Committee is busy preparing the Subject Index for the 1990 issues of the JOURNAL OF COATINGS TECHNOLOGY.

HELEN SKOWRONSKA,
Chairman

Society Reports

Baltimore

Monthly technical programs presented by Educational, Technical, and Manufacturing Committees . . . Technical Committee report on "Effects of Over and Under Dispersing of Thixotropes in Alkyd Systems" well received . . . Two scholarships awarded to children of Society members . . . Educational Committee presented coatings course at Catonsville Community College . . . Herman Shugar Memorial Award presented to Robert Hopkins, of SCM. Merit Citations received by Helen Keegan, Mary Somerville, Mary Lou Spurrier and Al Holder.

Birmingham

Membership stands at 216—a 9% increase over the previous year . . . Attendance at monthly meeting averaged 105 during year . . . Technical projects include "History of Paint Manufacture in Midlands" book which is selling well; The Solids/Density Subcommittee project near completion; Museum Project approaching critical stage: decision to develop or abandon project to be made this year; Symposium planned for February 1992 on environmental topics. . . Sale of Federation publications continues at well-established levels of previous years.

Chicago

Seven business meetings held per year, with following changes: practice of pre-dinner speaker to be eliminated. All meetings to be held at one restaurant location . . . SYMCO Series continues successful run. Held in August, its theme was "VOC—How to Hit the Moving Target." . . . With Chicago PCA, co-sponsored "Course in Coatings Technology" at De Paul University. Will continue as advisors to the Masters Degree Program and Coatings in Polymers at De Paul, as well as the B.S. Coatings Program at Elmhurst College . . . With Chicago PCA, awarded $1500 and $1000 scholarship each to two children of Society and Association members. An additional $1000 scholarship was presented to a third student . . .Outstanding Service Award presented to Robert W. Zimmerman, retired from the Valspar Corp. . . Membership decreased about 5% to approximately 730 members. . . Will reissue Society Yearbook. . . . By year's end, Society will be incorporated.

CDIC

In addition to regular meetings, held three meetings in Indianapolis . . . Established "Lew Larson" Education Grant . . . Technical programs presented varied topics and Educational Committee provided nontechnical speakers on general interest subjects . . . Program Committee planning the theme of technical presentations on "Safety and Health."

Cleveland

Environmental Committee provided program on Superfund Amendments and Reauthorization Act at a monthly meeting . . . Joint meeting held with Cleveland PCA. . . Society presented award-winning paper at 1989 Annual Meeting on "Changes in Hiding during Latex Film Formation." Two papers will be given at 1990 meeting. . . . 33rd Annual Conference focused on "The Business of Paint" and "The Technology of Coatings" . . . Cash awards presented to seven junior and senior high school students in Science Fair competition. Society members served as advisors and judges. . . Members continue to serve as lecturers in courses at local universities.

Detroit

Attendance at monthly meetings held steady at 80-90 members . . . Technical Committee won third place with paper on "Poly(epoxy-urethane-acrylic Interpenetrating Polymer Networks for Primer Applications," at 1989 Annual Meeting. Committee plans to present paper at 1991 Annual Meeting in Toronto . . . Educational Committee continues to offer six courses at University of Detroit, FOCUS seminar and in-house training program offered in cooperation with University of Detroit.

Golden Gate

Plans underway for 20th Biennial Western Coatings Symposium to be held February 18-20 in San Francisco. . . Technical Committee presented a paper "Substrate Effects in Drying Coatings" at 1989 Annual Meeting. Paper on "Statistical Modeling of Coatings" to be presented at 1990 Annual Meeting . . . "Introduction to Coatings Technology" course enrollment down. New ideas being explored for future sessions . . . Two $1000 awards made under Alfred Apfel Memorial Scholarship competition. One award of $1000 was given as the Robert E. Minnucciani Scholarship . . . New Committee has researched history of Golden Gate Society from 1922-1989. Copies presented to Golden Gate Board of Directors and one copy sent to FSCT for inclusion in Constituent Societies' history compendium being prepared.

Houston

Awarded two $750 scholarships . . . Sam Leon Bishkin received 50-Year pin . . . Successful Southwestern Paint Convention focused on theme "High Solids Coatings, How to Get There from Here." Table-top exhibits reintroduced.

Kansas City

Nine monthly meetings held, including five technical meetings and joint meeting with St. Louis Society . . . G.O. Stephenson recognized for contributions to paint industry . . . Howard Jerome and Terryl Johnson named Federation Honorary Members.

Louisville

Hosted Federation's Spring Seminar, "Coatings Technology in the 1990s." . . . In conjunction with University of Louisville, offered course in "Surface Coatings Technology". . . Technical Committee conducting study on "Evaluation of Brookfield Viscosity, Data Collection and Standardization of Test Methods."

Mexico

Eleven monthly meetings held, with average attendance of 85 participants . . . Membership increased 11.5%, to total of 231 members. Course on "Philosophy of Paint Formulation" given by Dr. John A. Gordon . . . Training course on "Paint Shading Principles and Procedures" to be presented in Mexico City . . . Annual Conference on "New Horizons in Paint Technology" held in Puebla with 80 participants. . . Effort being made to solve problems encountered in distributing Federation publications.

Montreal

Nine monthly meetings held, with seven technical presentations . . . Attendance averages 60 persons, approximately 25% of total membership. . . Mini-symposium on "The Mastering of Colour" given. Four members presented with 25-Year pins . . . Society was awarded certificate acknowledging highest increase in membership during year . . . Introductory course in coatings technology given in

French has 20 registrants . . . Technical Committee involved in two projects for 1990-91: "Effect of Acid Rain on Coatings" offered in conjunction with Northwestern Society, and "Coatings for Plastics"—an all-Canadian project of Montreal, Toronto, and Vancouver Section of Pacific Northwest Societies. Presentation scheduled for 1991 Annual Meeting in Toronto.

New England

Eight technical/business meetings held in various locations. Approximately 20% of membership attending . . . Seminar on "Health, Safety, and the Environment" well-received . . . Society presented $2000 in scholarships to children of members or members who are students in Coatings Science, Science or Engineering, or Liberal Arts.

New York

Eight monthly meetings held on varied topics . . . Average attendance was 156 persons, up from 138 previous year... Afternoon seminars held . . . Two scholarships, each in amount of $1000 awarded, the NYSCT Scholarship Award to MBA candidate at Seton Hall University and Mattiello Memorial Award to Master's Degree candidate at Polytechnic University . . . Educational Committee, in cooperation with MNYPCA presented advanced courses in "Rheology of Coatings" (14 students) and "Coatings Chemistry and Technology" (25 students) at Fairleigh Dickinson University. . . Technical Committee presented "Additives for High Solids Coatings" at 1989 Annual Meeting. It will be published in *JCT*. . . . 1990 PaVaC Award was presented to George Dippold and Herman Singer. The President's Service Award was given to Arthur Nortman . . . Members continue to be active on Federation Committees.

Northwestern

Presented $3000 in scholarship funds to North Dakota State University.

Pacific Northwest

Membership essentially unchanged with 265 members. Monthly meeting attendance averages 35 members in each of the three sections. . . . $1000 scholarships were awarded by each of three sections . . . The Vancouver B.C. Section continues to support Paint Technology course at Kwantlen College . . . Manufacturing and Safety Committee has continued to publish newsletters for manufacturing personnel... Portland Section looking into feasibility of a latex paint recycling facility . . . Successful Spring Symposium held. 1991 Annual Symposium will be held May 2-4, at Meridien Hotel in Vancouver, B.C.

Piedmont

Total membership declined from 238 to 224. This 7% drop attributed to volume of company acquisitions, restructures, and employee transfers . . . Held first Past Presidents' Night which was well received. Five members received 25-Year pins . . . Historical Committee continues to retrace origin of Society . . . Educational Committee implemented Piedmont Society Paint and Coatings Scholarship Fund . . . Three students from local universities participated in internship program with paint manufacturers. Two scholarships of $1000 each will be awarded in 1990.

Pittsburgh

Membership has increased by 13.7% . . . Innovative ways to increase membership included Purchasing Agents' Night, Technical Night, Managers' Night . . . Society member Ruth Johnson-Feller was awarded Federation's George Baugh Heckel Award at 1989 Annual Meeting.

Members-at-Large George Pilcher and Patricia Shaw

St. Louis

Attendance at monthly meetings was 43-45% . . . Five scholarships awarded for the Short Course in coatings at the University of Missouri-Rolla . . . Manufacturing Night successful. . . Held joint meeting with Kansas City Society at Lake of Ozarks.

Southern

Society membership at 543. Atlanta Section reported increase in attendance at monthly meetings . . . Again co-sponsored Water-Borne Symposium with University of Southern Mississippi . . . USM will begin awarding an SSCT distinguished professorship in September, 1990. Over 100 undergraduates enrolled in Polymer Science Department. . . Society-sponsored A. L. Hendry Award provisions now revised to include credit being given a professor on a paper. . . 1991 Society Annual Meeting scheduled to be held at Peabody Hotel, Memphis, TN, on April 3-5.

Toronto

Membership increased from 443 to 472 for a 6.5% increase. Newly reorganized Long Range Planning Committee focusing on attendance profile at monthly meetings . . . Strong liaison with George Brown College continues. Both Basic and Advanced Coatings Courses being presented . . . Society successfully sponsored Federation SPC Seminar, Level I with 41 participants . . . . Will present paper on "Sward Rocker and Pencil Hardness vs Pendulum Hardness Test in Air Drying and Baking Systems Applied to Various Substrates," at 1990 Annual Meeting. . . . Society By-Laws revised . . . Society anticipating serving as host for 1991 Annual Meeting.

Western New York

Seven technical meetings held . . . Educational Committee active. . . . With help of matching contribution from Buffalo PCA, increased amount and number of scholarships given. Three $600 awards were made. . . Continued involvement with New York Science Congress.

The next meeting of the Federation Board of Directors will be held on Wednesday, May 15, during Spring Week, at the Sheraton Society Hill, Philadelphia, PA.

In Memoriam

We report with deep regret the passing of the following members during the past year.

Affiliated

HANS KRISTIAN RAASCHOU NIELSEN—Retired (Danish Paint and Lacquer Research Institute
Past-President, Scandinavian Federation of Societies for Coatings Technology

Baltimore

ARTHUR E. KROMER—Retired (Ashland Chemical Co.)
Member of New York and Northwestern Societies
G. THOMAS WEISS—Retired (G. Thomas Weiss Co.)

Birmingham

DONALD J. MORRIS—Retired
JOHN TURNER—Retired

CDIC

ROBERT A. BURTZLAFF, SR.—Potter Paint Co.
Society Past-President

Cleveland

ROGER H. DOERING—The Glidden Co.

Dallas

ROBERT L. PATTERSON—R.B. Patterson Co., Inc.

Detroit

HENRY H. REICHHOLD—Retired (Reichhold Chemicals, Inc.)

Houston

ELDER C. LARSON—Retired (Shell Development Co.)
Federation Past-President
Society Past-President
Federation and Society Honorary Member
Golden Gate Society Past-President

Kansas City

JOHN W. BARR—Retired (Cook Paint and Varnish Co.)

Los Angeles

ALBERT ARONOW—Retired (Sinclair Paint Co.)
Society Past-President
DERMONT G. CROMWELL—Retired (Sinclair Paint Co.)
Society Past-President
Society Honorary Member
CHARLES MIYADA—Reichhold Chemicals, Inc.

Louisville

JOHN THOMAS—Jones Dabney/Celanese

Montreal

COLIN MASON—Hoechst Canada, Inc.
YOLANDE MICHAUD—International Paints (Canada) Ltd.

New York

FREDERICK K. DANIEL—Founder, Daniel Products Co.
Society Honorary Member
1983 FSCT Mattiello Lecturer
JEROME L. FRANKEL—Akzo Coatings, Inc.
ALBERT J. KIRSCH—Retired (American Cyanamid Co.)
JOHN D. LUNDQUIST—Georgia Kaolin Co., Inc.
WENDELL G. RANDOLPH—Randolph Products Co.
PETER TORTORICI—Founder, Dux Paint and Chemicals

Northwestern

JACOB SKALA—Retired (G.H. Tennant Co.)
Society Past-President
Society Honorary Member

Pacific Northwest

ROBERT HALSTEAD—Retired (Koppers Co., Inc.)
N. HELZER—Helzer Company, Inc.
WILLIAM L. TILBURY—A & A Anderson Chemical Waste Disposal

Philadelphia

ROBERT MATLACK—Retired
Federation Past-President
Society Past-President
Executive Vice President of Federation

Pittsburgh

EDWARD NEUWIRTH—Retired (Watson Standard Co.)
Soceity Past-President

St. Louis

HERMAN C. "HANK" MILLER—Retired (Thompson-Hayward Chemical Co.)
Former NPCA Regional Vice President

Southern

ROY CUCULLU—New Orleans Paint and Varnish Co.
NORMAN GELLER—Unocal Chemicals Div.
MICHAEL STOGNER—Ashland Chemical Co.
ROY TASSE—Valspar Corp.

Toronto

ALLEN COOKE—Cooke Chemicals Co.

Western New York

GEORGE A. KEIM—Retired (Ashland Chemical Co.)
Society Past-President

A. CLARKE BOYCE
Chairman, Memorial Committee

Chemical Industry Sales to Rise 3% in 1990; Survey Indicates Slight Gains Expected for 1991

Chemical industry sales will rise 3% in 1990 to $263 billion, the fourth consecutive year of record shipments, according to the Chemical Manufacturers Association (CMA), Washington, D.C.

The sales record will be posted despite what CMA calls a softening demand at home and disruptions caused by Iraq's invasion of Kuwait.

CMA states that slower U.S. economic growth and sharp raw material cost increases brought on by the Persian Gulf Crisis are likely to cause industry profits to recede from last year's $24.8 billion record. CMA projects that net income will fall to between $19 billion and $22.5 billion range, still leaving 1990 as the third most profitable year for the industry.

Chemical exporters posted another solid year, while industry maintained stable sales at home. Exports are expected to reach $38 billion in 1990, up from $37 billion in 1989. CMA predicts that imports are likely to climb to about $22.2 billion in 1990, leaving the industry with about a $15.8 billion trade surplus, down from last year's $17.2 billion record.

The industry is also expected to match 1989's $5.1 billion in income derived from foreign direct investments, royalties, licensing fees, rentals, and other service charges.

Consequently, the chemical industry is expected to contribute a surplus of about $21 billion to the 1990 U.S. current accounts balance, making it, according to the CMA study, one of the nation's leading net-exporting industries.

A CMA membership survey predicted that industry expects to sustain a 4-6% sales growth in 1991.

The survey found that industry operating rates in 1990 will average 81.7% of stated capacity, down from 83.4% in 1989. A further slip in operating rates to 80.7% is projected for 1991.

Capital expenditures for new plant and equipment in 1990 will reach $20.8 billion, up from 1989. The CMA survey indicates that capital spending will increase another 13% in 1991. About 16% of the 1991 capital outlays will be spent on pollution controls.

Research and development spending, according to the survey, is projected to reach a record $12.7 billion in 1990, up by $1 billion from 1989, and three times the total spent in 1979. Research and development spending in 1991 is expected to increase by an additional 5-6%.

In conclusion, the survey stated that chemical industry employment posted a small gain in 1990, and will average 1,086,000 jobs for the year.

October 1990 New Construction Contracting Sinks to Lowest Level in Four Years

The decline of new construction contracting continued in October 1990 when it slipped another 3% to 145, its lowest value in more than four years. The decline in new construction starts was reported by The Dodge Index, F.W. Dodge Division of McGraw-Hill, New York, NY.

Newly started construction contracting was at its peak of 185 in October 1989. Since then it has fallen by more than 20%.

October's decline was confined largely to housing, which was off another 9% from September. Single family homes and apartments/condos shared the latest setback proportionately. Small gains in contracting in nonresidential buildings (2%) and "nonbuilding construction" (5%) partially offset October's further collapse of residential building.

According to officers at Dodge, institutional building—educational and health facilities—was the one dependably strong building market.

At the end of 10 months in 1990, the value of 1990 contracting for new construction totaled $207 billion, 10% less than in the comparable 1989 period. Nonresidential building and housing were both off 1989's pace by 12%, while nonbuilding construction (public works and utilities) trailed 1989 contracting by 3%.

By region, most of 1990's weakness in construction has been concentrated in the East, where the Northeast showed a 23% decline through 10 months, and the South Atlantic a 16% shortfall. The losses continued in other parts of the country for 1990. Declines have been reported in the North Central (-2%), South Central (-6%), and West (-5%).

Environmental Literature Available from U.S. EPA

The U.S. Environmental Protection Agency (EPA), Washington, D.C., has announced that the following booklets are available:

"Does Your Business Produce Hazardous Waste? Many Small Businesses Do"—EPA/530-SW-90-027; and

"The New Toxicity Characteristic Rule Information and Tips for Generators"—EPA/530-SW-90-028.

For a copy of the booklets, contact: U.S. EPA, Office of Solid Waste (OS-305), 401 M St., S.W., Washington, D.C. 20460, Attn: Kathy Bruneske. Telephone: (202) 475-9327.

The booklet "Guides to Pollution Prevention: the Paint Manufacturing Industry" can be obtained from: Risk Reduction Engineering Laboratory, Center for Environmental Research Information, Cincinnati, OH 45268, Attn: Lisa Brown. Telephone: (513) 569-7634/7562.

The final available piece of literature is "Common Synonyms for Chemicals Listed Under Section 313 of the Emergency Planning and Community Right-to-Know Act, Pesticides and Toxic Substances (TS-779)"—EPA 560/4-90-005. Write to: U.S. EPA, TS-779, 401 M St., S.W., Washington, D.C. 20460 for a free copy.

Two Paint and Coatings Association Groups Volunteer Time and Efforts to Local Projects

Two local groups participated in several projects as part of the National Paint and Coatings Association's, Washington, D.C., "Picture It Painted" (PIP) campaign.

The Philadelphia Paint and Coatings Association (PPCA) took on several projects, including the construction of homes under the Habitat for Humanity project and the restoration of the historic Woodlands Mansion.

With the help of PPCA, Habitat for Humanity provided two new homes in Bethlehem, PA, and rehabilitated a third home for needy families in Mt. Holly, NJ. The Philadelphia group donated all interior and exterior paint for the housing projects.

The second PPCA volunteer effort was the two-year restoration of Woodland Mansion. The group, which began the project in 1989, provided technical advice and paint products to the University City Historical Society for the completion of the endeavor.

Also included in 1990 PIP program was the proclamation of May as National Paint Month by the Governor of Pennsylvania and the Mayors of Philadelphia and Harrisburg.

The Atlanta Paint and Coatings Association (APCA) helped beautify what was once considered an eyesore. Volunteers painted the fence surrounding Chastain Park Amphitheater, home to the Atlanta Symphony Orchestra.

The Atlanta PIP team donated all of the paint for the project and, with the help of six volunteers, provided the labor. Mayor Maynard Jackson, of Atlanta, proclaimed June 9, 1990, "Picture It Painted Day."

ARCO Heads Joint Venture To Manufacture Foam Resins

ARCO Chemical Company, JSP Corporation, and Mitsubishi Gas Chemical Company, Inc., have announced that they will build a manufacturing facility for engineering foam resins at the ARCO site at Rieme, near Ghent, Belgium. Completion and startup of the new plant is planned for the fourth quarter of 1991.

The new facility will manufacture ARPRO® expanded polypropylene, using a CFC-free process.

In addition, APCA continued its ongoing project with Habitat for Humanity. Involved with Habitat since 1986, this year's efforts were concentrated in Gwinette County.

Dow Corning Opens New R&D Centers

Dow Corning Corporation's new $30 million DC-4 Research and Development Laboratory was formally dedicated in a ceremony on October 7, in conjunction with the opening of another such facility by Dow in Yamakita, Japan.

The three-story research and development lab, located in Midland, MI, totals 164,000 sq ft and includes 60 laboratories. Each lab is equipped with a support room which allows for processes that create noise, dust, or heat to be isolated from the environmentally-controlled laboratory space.

The $8 million Yamakita plant is the first industrial center in Japan dedicated to basic research in silicon-based materials. The three-story building will house 40 scientists and support staff.

Battelle Study Focuses on Thermoplastic Elastomers

Battelle, Columbus, OH, is a conducting an extensive evaluation of thermoplastic elastomers (TPE) "Thermoplastic Elastomers: Present and Future."

The multiclient program is designed to provide extensive data on TPEs, which are rapidly gaining acceptance as an alternative to traditional rubber-based materials used in the manufacture of products, such as automotive and sporting goods.

According to officials at Battelle, TPEs, which have emerged in the past decade, do not require chemical crosslinking to develop their rubbery characteristics. As a result, they have several advantages over vulcanized rubber. The study reports that they are easily processed in high-speed injection molding and extrusion equipment, use less energy in the manufacturing process, provide reusable scrap, have superior aging properties, and can easily be colored.

Officials at Battelle stated that the use of TPEs is growing at a rate of 8-10% a year. In addition, TPEs are replacing conventional rubbers, plastics, and metals in many finished products.

To address this need for information, the Battelle multiclient program team will collect data from Europe, Japan, and the U.S., and offer the results in a comprehensive report that will include market and patent-trend analyses and a report on future trends in the field. The report will include an interactive PC data base that will help subscribers: compare TPEs according to a complex set of weighted performance criteria; select the most appropriate TPEs for specific applications; and design and develop new TPEs for specific market niches.

The program is expected to be completed in the spring of 1991.

For more information on the study, contact Gary W. Good, Battelle, 505 King Ave., Columbus, OH 43201-2693.

BASF Files Lawsuit Against PPG Industries

BASF Corporation, Clifton, NJ, filed a lawsuit against PPG Industries, Inc., Pittsburgh, PA, in the New Jersey Federal District Court in Newark, on October 4, 1989.

The suit seeks a ruling from the court that BASF's electrodeposition paint system is not covered by any PPG patents and is no part of the technology previously licensed in 1979 by PPG to Inmont Corporation, which BASF acquired in 1985.

The paint system, first marketed by BASF in 1989, is employed by automobile and truck manufacturers to apply the first or primer coat to a new car or truck body.

According to officials at BASF, the system was developed through research completed by BASF's in-house plant specialists in the U.S. and Germany. It does not employ the technology of PPG patents.

PPG contends, however, that PPG patents do cover the paint system and that royalties should be paid on the system pursuant to the terms of the 1979 license agreement.

The controversy as to whether the paint system is covered by any of PPG's patents compelled BASF to initiate the lawsuit.

Weh Corporation Report Addresses Future Of Non-Residential and Anti-Corrosive Coatings

Non-residential and anti-corrosive coatings will continue to grow in the coming years according to the report, "Non-Residential Anti-Corrosive Coatings in the United States." The report is published by the Weh Corporation, San Francisco, CA.

This sixth report, published every two years since 1977, predicts that domestic sales in 1990 of $970 million to the 14 most severe exposure markets will be over 24% compared to 1988, and 1995 sales are projected to increase still another 40% to $1,360 million.

Officials at Weh state that this growth will flow from three sources: markets for which funding is already in place (such as water, waste treatment, and storage; and bridges and highways); markets that take advantage of a mild recession to execute necessary but postponed maintenance (such as petroleum refining, all chemicals, and rubbers; pulp and paper; and primary metals and mining); and markets for which growth is continuing in spite of an economic slowdown (airlines and aircraft).

The reports also concludes that, as in the past, governmental regulations are forcing changes. Spray equipment is tending to be more sophisticated, blast cleaning is becoming more environmentally benign, and coating forms are struggling to conform to tighter VOC limits.

However, the report emphasizes that most upheaval will occur in the raw materials used. It projects that pigments based on hazardous metals will be sharply restricted. Solvent reduction will be pushed to the ultimate by shifts to higher solids, water as solvent, and multi-part materials. Polymers, such as epoxies and urethanes, may well be restructured to lessen residual toxic monomers, or at least be subject to careful handling during application.

The report forecasts that in the midst of all this change, coating producers must pay attention to the coming profit squeeze. The Gulf crisis is already starting to push up raw material prices at a furious pace. Coating suppliers must alert their customers beforehand to the prospect of significant price rises pending in high performance coatings. They must begin to alter their handling of inventories, accounts payable, and other preparations to counter the adverse effects of such a scenario, the report cautions.

For more information, write Weh Corp., P.O. Box 470038, San Francisco, CA 94147.

McWhorter Purchases Rights To Du Pont's Acrylic Resins

McWhorter Inc., Carpentersville, IL, announced that it has purchased the worldwide rights of Du Pont's Elvacite® solution-polymerized acrylic resins. The sale was effective September 1, 1990.

The sale included all technology and formulas for commercialized products, and special and developmental resins.

The Elvacite name was not included nor were any physical assets.

McWhorter will add these products to their existing line of solution acrylics, under their Acrylamac® trade name.

Hi-Tek Polymers Operates Under Rhône-Poulenc Name

Hi-Tek Polymers, headquartered in Louisville, KY, recently adopted the Rhône-Poulenc name and image.

Hi-Tek Polymers was acquired in 1989 by Rhône-Poulenc. Hi-Tek's largest manufacturing site is in Louisville, with other sites in Wilmington, DE; Vernon, TX; and Los Angeles, CA.

The U.S. headquarters of Rhône-Poulenc are located in Princeton, NJ.

Haake-Fisons Granted Patent for Torque System

Haake-Fisons Instruments, Valencia, CA, recently has been granted U.S. Patent 4,899,576 for a new torque measuring system. The new system has been incorporated into the Rheocord 90 Torque Rheometer.

The new system is designed to enable direct coupling to a mixer or extruder to eliminate the effects of speed reducers and other power transmission components.

Participants Needed for New ASTM Task Groups

ASTM, Philadelphia, PA, Subcommittees are seeking individuals interested in participating in new task groups.

Subcommittee D01.47 on Masonry Treatments seeks participants for two new task groups formed during the June 1990 meetings of standards-writing Committee D-1 on Paint and Related Coatings and Materials.

The new task groups are: D01.47.06 on Chemical Resistance, and D01.47.02 on Freeze/Thaw Resistance. These groups will meet this month during the standards development meetings of Committee D-1 in Fort Lauderdale, FL.

For more information, contact Subcommittee D01.47 Chairman Frances Gale, ProSoCo, Inc., 755 Minnesota, Kansas City, KS 66101 or Scott Orthey, ASTM, 1916 Race St., Philadelphia, PA 19103.

Standards-writing Committee E-12 on Appearance of Materials has formed a new subcommittee, E-12.11 on Visual Methods.

The new subcommittee will take jurisdiction of several visual methods formerly under the jurisdiction of various other committees in ASTM.

Those interested in developing visual methods for appearance attributes should contact Subcommittee Chairman Nick Hale, Hale Color Consultants, 3 Starlight Farm Dr., Phoenix, MD 21131 or Bode Buckley at ASTM.

Witco Purchases DeSoto's Surfactants Operations

Witco Corporation, New York, NY, has completed the acquisition of the surfactants and emulsifier businesses of DeSoto, Inc., Des Plaines, IL.

Included in the purchase are two plants, one in Harahan, LA, and the other in Fort Worth, TX. The purchase price, including inventories, amounted to approximately $65 million.

The Harahan and Fort Worth facilities will be managed by Witco's Organic Division, which operates six other surfactants plants, two of which are located in Sante Fe Springs, CA; two more in Chicago, IL, area; and one each in Perth Amboy, NJ, and Houston, TX. Other Witco surfactants operations include Oakville, Ontario, Canada; and Elbeuf, France.

CIBA-GEIGY Opens New Resins Plant

The Plastics Division, CIBA-GEIGY Corporation, Hawthorne, NY, has completed work on a new $85 million resins plant in McIntosh, AL. The Specialty Polymer Unit will produce multifunctional epoxy resins; specialty resins and hardeners; and solid, liquid, and solution epoxies.

The new unit is adjacent to the Plastic Division's liquid epoxy resin production facility, as well as new process development laboratories and pilot plant facilities. Liquid epoxy resin is piped to the new unit for processing.

All reactions are managed from a central control room. Adjustment of temperatures, pressures, flow rates, etc., are all computer controlled. Ratios of raw materials are precisely controlled, and on-line analyzers enable the reactions to proceed according to plan. Also, aqueous effluent is pretreated in the unit to become more biodegradeable.

Report Predicts Growth in Powder Coatings Market

The international growth of powder coatings is the focus of statistical material gathered by The Powder Coating Institute, Alexandria, VA.

World production of powder coatings reached 236,000 metric tons in 1989, and is projected to top an annual figure of 332,000 metric tons by 1992, according to the information compiled by The Institute.

Officials at The Institute stated, at a 1990 meeting, that powder now constitutes 15% of the portion of the industrial coating market where powder competes with traditional wet finishes.

Statistics set 1989 North American powder sales at 107 million pounds with a projected sales of 118 million pounds in 1990, and reaching 200 million pounds in 1995. Western Europe still leads in powder production with about 54% of the world total. North America produces 22% of the world's powder, while the Far East produces 17%.

As far as growth rates are concerned, the gathered data suggests that far eastern countries are turning to powder coatings at a rapid rate after a slow start, with a current growth rate of 15% annually. Europe is still growing at 11%, while the North American market is expanding at a 10% rate.

Institute officials reported that 350 new automatic powder coating systems were installed in North America last year, and they estimated that about 360 would go into operation in 1990. Approximately 2,000 systems are currently in operation. Equipment sold in 1989 had a reported value of $49 million.

Further information shows that more 50% of the powder sold in North America in 1989 went into general metal finishing uses, with 22% in the appliance industry, 20% in automotive applications, and 5% on architectural products. These percentages did not change from 1988, and projections suggest penetration of the architectural market is expanding and this market share is growing at a faster rate (16%) than the other market segments (10-11%).

Polyurethane powders account for 33% of the U.S. market with epoxies at 27%, followed by TGIC polyesters at 23%, and hybrid powders at 17%.

In Canada, epoxies leads the list with 36% of the market, followed by hybrids and TGIC polyesters, with polyurethanes trailing with 14% of the market.

The data indicate that the fastest growing resin type in North America is the TGIC polyesters, followed by epoxy-polyester hybrids. TGIC polyester powder production grew from approximately 1.1 million pounds in 1981 to 24 million pounds in 1988. Hybrid powders lead the market in Europe, while polyurethanes are the dominant resins in the U.S. and Japan.

Predicted continued growth of powder coatings market in North America was set at 10% per year through 1995, although this figure could be higher if a breakthrough into a broader segment of the automotive market is accomplished.

Mobay Corp. Introduces New Business Group

Mobay Corporation, Pittsburgh, PA, has organized a new business group for marketing gas detection and monitoring systems to the chemical and other industries in the United States market.

The newly established Compur Monitors Group plans to market gas detection and monitoring products for personal, in-plant, and plant perimeter use.

Compur Monitors' products, manufactured in Germany, have been available in the U.S. since 1979, and were previously sold through independent distributors.

Unicarb™ Licensing Agreement Announced with Binks & BASF

Union Carbide Chemicals and Plastics Company Inc., Danbury, CT, has announced the licensing of Unicarb™ System technology to BASF Corporation, Parsippany, NJ, and Binks, Chicago, IL.

Under the license, BASF will develop, manufacture, and market Unicarb System coating formulations, while Binks will develop and market specially designed Unicarb System spray coating equipment to satisfy a broad range of production requirements.

According to officials at Binks, the company will market delivery equipment to be retrofitted into existing coating lines or installed in new grass-root installations.

Both companies will supply equipment and coatings to the automotive, wood and metal furniture, heavy equipment, appliances, aerospace, truck, and bus markets.

Valspar Purchases Portion Of DeSoto Inc.'s Operations

The Valspar Corporation, Minneapolis, MN, has announced the completion of its acquisition of parts of DeSoto, Inc.'s U.S. and Canadian industrial coatings operations. According to Valspar, the cost of the acquisition was approximately $46 million.

The assets purchased service the industrial markets for coil, packaging, appliance, and specialty coatings, and include a major coatings and resin manufacturing facility in Garland, TX. Revenues for these businesses were approximately $48 million in 1989.

Unimin Corporation Acquires Indusmin of Falconbridge

Unimin Corporation, New Canaan, CT, has announced the acquisition of the Canadian operations of the Indusmin Division of Falconbridge, Toronto, Ontario.

The purchase includes silica operations at Badgeley Island and Midland, in Ontario; silica operations at St. Donat and St. Canut, in Quebec; and nepheline syenite plants in Nephton and Blue Mountain, Ontario.

The Indusmin Division of Falconbridge in Canada will be doing business under the new names of Unimin Canada Ltd./Unimin Canada Ltee.

Regional Groups in Future For Women in Coatings?

More frequent regional meetings was the topic discussed at the most recent meeting of the group Women in Coatings (WIC), at the Sheraton Washington Hotel, in Washington, D.C., on October 28. The meeting preceded the Federation's Annual Meeting, held on October 29-31.

Chairperson of the meeting, Violet Stevens, of Dow Chemical, stated that coordinators would be needed for the establishment of such regional groups and meetings. The purpose of the meetings would be to have discussions on a more regular basis, since members are located throughout the U.S.

The next official gathering of WIC will be at the 20th Western Coatings Societies' Biennial Symposium and Show, in San Francisco, CA, on February 18-20.

For more information on forming WIC regional groups, or general comments, contact Linda Hicks, Subtropical Testing Services, 8290 S.W. 120th St., Miami, FL 33156, or Marilu Novy, Aqualon, 273 N. Willow Rd., Elmhurst, IL 60126.

Information on the meeting at the WCS Show is available from Pat Shaw, Davlin Coatings, P.O. Box 2308, Berkeley, CA 94702.

JOURNAL OF COATINGS TECHNOLOGY

GUIDE FOR AUTHORS

GENERAL

The JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology for its membership of approximately 7,300 in 26 Constituent Societies in the United States, Canada, Great Britain, and Mexico. The JOURNAL is devoted to the advancement of knowledge in the science and technology of surface coatings, the materials comprising such coatings, and their use and performance.

The Editors invite submission of original research papers, review papers, and papers under the special headings *Open Forum* and *Back to Basics*, as well as *Letters to the Editor*. All manuscripts will be assumed to be previously unpublished writing of the authors, not under consideration for publication elsewhere. When review papers contain tables or graphs from copyrighted articles, the authors will be required to obtain permission for use from the copyright holders. When the organization with which the authors are affiliated requires clearance of publications, authors are expected to obtain such clearance before submission of the manuscript. Papers presented to associations other than the Federation must be released by written communication before they can be considered for publication in the JOURNAL OF COATINGS TECHNOLOGY. Authors are obligated to reveal any exceptions to these conditions at the time a manuscript is submitted.

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

Papers in which proprietary products or processes are promoted for commercial purposes are specifically nonacceptable for publication.

SUBMISSION OF MANUSCRIPTS...

...for the Journal

Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 492 Norristown Rd., Blue Bell, PA 19422-2350. The cover letter should address copyright, clearance, and release issues discussed above and should specify paper category: *Original Research, Reviews, Open Forum*, or *Back to Basics*.

Letters to the Editor: The JOURNAL will consider for publication all correspondence relevant to the coatings industry and to the contents of the JOURNAL. When a letter concerns an article appearing in the JOURNAL, the original author is usually given an opportunity to reply.

. . . by Constituent Societies For Annual Meeting Presentation

Ten complete copies of the manuscript are required for committee review. The set of copies should be addressed to the Editor at the address listed previously.

. . . for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to the Chairman of the 1991 Roon Awards Committee, George R. Pilcher, Akzo Coatings, Inc., P.O. Box 147, Columbus, OH 43216. (For complete details, see "Roon Awards" section of the JOURNAL in January 1991 issue.)

MANUSCRIPT PREPARATION

In general, authors are advised to use the "Handbook for Authors" published by the American Chemical Society as a guide to the preparation of manuscripts (ACS, 1155 Sixteenth St., Washington, D.C. 20036). Another excellent reference work is "How to Write and Publish a Scientific Paper," by Robert A. Day (ISI Press, 3501 Market St., University City Science Center, Philadelphia, PA 19104).

Authors are encouraged to consider submissions in several categories and to prepare their manuscripts accordingly. The categories are:

Original Research Papers: The main technical content of the JOURNAL OF COATINGS TECHNOLOGY will continue to be original research papers. Editors support the trend in scientific writing to a direct, less formal style that permits limited use of personal pronouns to avoid repetitious or awkward use of passive voice.

Review Papers: Papers that organize and compare data from numerous sources to provide new insights and unified concepts are solicited. Reviews that show how advances from other fields can beneficially be applied to coatings are also desired. Reviews that consist mainly of computer searches with little attempt to integrate or critically evaluate are not solicited.

Open Forum: Topics for this category may be nontechnical in nature, dealing with any aspect of the coatings industry. The subject may be approached informally. Editors encourage submission of manuscripts that constructively address industry problems and their solutions.

Back to Basics: Papers that provide useful guides to Federation members in carrying out their work are solicited. Topics in this category are technical but focus on the "how to" of coatings technology. Useful calculations for coatings formulation and procedures that make a paint test more reproducible are examples of suitable topics. Process and production topics, i.e., paint manufacture, will also be reviewed in the *Back to Basics* category.

If a submitted paper consists of the text of a presentation made previously to a monthly or special meeting of a Society for Coatings Technology, or to another technical group, the name of the organization and the date of the presentation should be given. If someone other than the author of the paper made the presentation, this information, too, should be noted. Papers originally composed for oral presentation will have to be revised or rewritten by the author to conform to the style described in this guide.

Manuscripts should be typed with double spacing on one side of $8\frac{1}{2}$ x 11 inch (22 x 28 cm) paper, with at least one-inch (2.5 cm) margins on all four sides. All paragraphs should be indented five spaces, and all pages should be numbered at the top center, or upper right corner.

Title

The title should be as brief and informative as possible. Selection of titles that are key word-indexable is a helpful and recommended practice.

Authors' Biographies and Photographs

Give complete names, company or institutional affiliations, and brief biographical sketches of all authors. If available, submit a 5 x 7 inch (13 x 18 cm) black-and-white photograph with glossy or smooth high sheen surface, for each author. See later section on photographs for further details.

Abstracts

A 75 -100 word abstract must be part of the manuscript, and should be a concise description of the key findings or teachings of the work described in the paper. The abstract should not repeat the title or include reference numbers, nor should it duplicate the Conclusion or Summary.

Text

Main headings and sub-headings should be used to improve readability, and to break up typographical monotony. The text should *not* be presented as an alphanumeric outline.

The main headings usually should be INTRODUCTION, EXPERIMENTAL, RESULTS AND DISCUSSION, and SUMMARY or CONCLUSIONS. Sub-headings will be specific to the subject.

Only as much review as is necessary should be given to provide an introduction to the subject; the main burden for extensive background should be placed on the list of references.

Standard scientific and technical terminology should be used to convey clear and unambiguous meaning, but the use of technical jargon or slang should be avoided. Authors should bear in mind that the JOURNAL has an international audience, for many of whom English is a second, not native, language. Use of regional idioms or colloquialisms should be avoided. The use of obscure abbreviations is also discouraged. When appropriate, abbreviations should be made in parenthesis immediately following first mention of the term in the text, and then used alone whenever necessary.

Recent issues of the JOURNAL should be consulted for desired style and technical level.

Metric System

Metric system units should be used wherever applicable with the equivalent English units shown afterwords in parentheses. The ASTM Metric Practice Guide, E 380-72 (American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103) is a convenient reference.

Tables, Graphs, and Drawings

Tables, rather than descriptive text, should be used only when they are genuinely helpful. They should be proportioned in accordance with the height and width limitations of the JOURNAL's pages. Each table should be typed on a separate sheet, rather than included in the text, and appended to the manuscript. Each table should be numbered and have a descriptive caption. Tables should be referenced in the text (e.g., "See *Table* 1").

In numerical data in tables, numbers less than one should have a zero before the decimal point.

Graphs should be on good quality white or nonphotographic blue-lined $8\frac{1}{2}$ x 11 inch paper. Each graph should be drawn on a separate sheet, numbered, and the captions listed on a *copy* of the original graph. Graph captions and legends should also be typed on a separate sheet from original for typesetting.

Drawings should conform to the guidelines given for Graphs and should be proportioned to fit the height-to-width ratio of the JOURNAL'S pages and columns.

Photographs

All photographs should be sharp, clear, black-and-white prints no larger than 8 x 10 inches in size. Photos should be clearly labeled on the reverse side, taking care not to mar the image.

Color prints and slides are unacceptable.

When illustrations are secured from an outside source, the source must be identified and the Editor assured that permission to reprint has been granted.

Nomenclature

Whenever possible, generic names should be used in preference to trade names. When trade names must be used to avoid ambiguity, and the name is a registered trademark, the symbol R, in a circle or parentheses, should be given immediately following, and the manufacturer listed as a footnote. In general, trade names should be used only in footnotes or in an appendix, rather than in the text.

If special nomenclature is used, include a nomenclature table giving definitions and dimensions for all terms.

Nomenclature of chemical compounds should conform to the style of *Chemical Abstracts* and the IUPAC rules. For oligomeric or polymeric materials, characteristics such as molecular weight, polydispersity, functional group content, etc. should be provided.

Equations

Equations must be typed, or written clearly, with equations numbered sequentially in parentheses to the right. If Greek letters are used, write out their names in the manuscript margin at the first point of use. Place superscripts^{a} and subscripts$_{b}$ accurately. Avoid the use of superscripts in a manner that can lead to their interpretation as exponents.

Summary

The paper should be concluded with a summary which is intelligible without reference to the main text. The summary may be more complete than the abstract, listing conclusions drawn from the text. A well written summary can serve to inspire the busy reader to turn back to the paper, to read it thoroughly.

Acknowledgment

If used, it should follow the summary.

References

These should be listed in the numerical order in which they are cited in the text, and should be placed at the end of the manuscript. Names of authors may or may not be shown in the text with reference numbers. If possible, include titles of articles referenced in the literature. The following are examples of acceptable reference citations for periodicals, [1,2,3] books, [4] and patents.[5]

(1) Pascal, R.H. and Reig, F.L., "Pigment Colors and Surfactant Selection," *Official* DIGEST, *36*, No. 475 (Part 1), 839 (1964).

(2) Davidson, H.R., "Use and Misuse of Computers in Color Control," JOURNAL OF COATINGS TECHNOLOGY, *54*, No. 691, 55 (1982).

(3) Stephen, H.G., "Hydrogen Bonding—Key to Dispersion?," *J. Oil & Colour Chemists' Assoc.*, *65*, No. 5, 191 (1982).

(4) Patton, T. (Ed.), "Pigment Handbook," Vol. 1, John Wiley & Sons, Inc., New York, 1973.

(5) Henderson, W.A. Jr. and Singh, B. (to American Cyanamid Co.), U.S. Patent 4,361,518 (Nov. 30, 1982).

OTHER INFORMATION

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

Offprints may be purchased in quantities of 100 or more. Authors will receive price quotations. Each author will receive a complimentary copy of the JOURNAL issue in which his or her paper was published.

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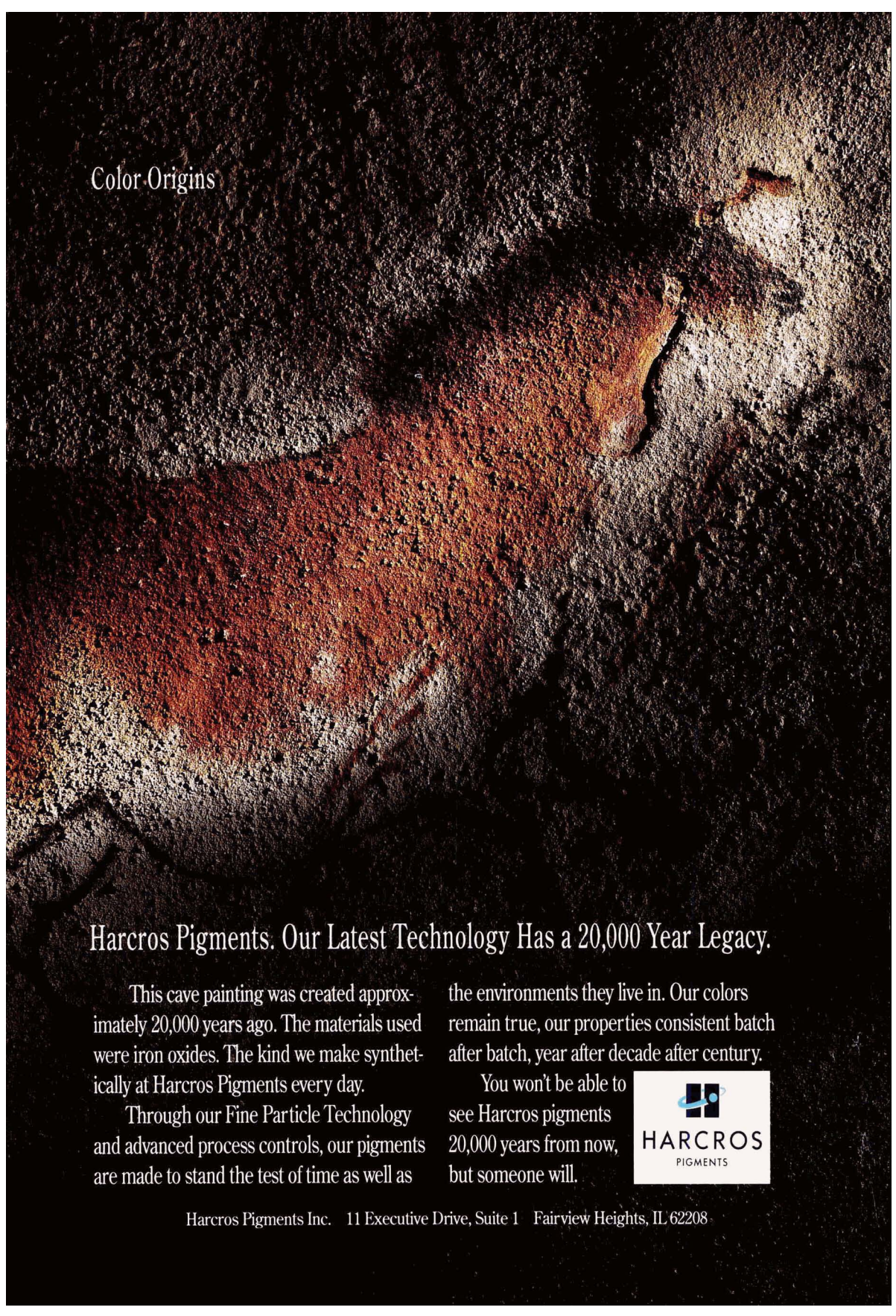

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1990 A.L. HENDRY AWARD PAPER

The following paper, from the University of Southern Mississippi, was the winner of the Federation's 1990 Hendry Award.

The Southern Society Alfred L. Hendry Memorial Award ("The Hendry Award") was established in 1986 by the Southern Society for Coatings Technology as a named memorial to one of the Society's distinguished Past-Presidents. It provides a cash prize of $1,000 and a suitably inscribed plaque.

Competition for the Award is open to currently enrolled undergraduate students. It is awarded for a winning paper of publishable quality describing the results of original research on a subject related to coatings science or technology, or for an insightful review paper of significant scope and depth on a subject in those fields. Submitted papers may be co-authored by a faculty advisor, but the cash award is given only to the undergraduate student, who must be the principal author.

Submissions for the Award are judged by at least three members of the Federation's Educational Steering Committee.

Novel Alternative in High Performance Clear Coats: Molecular Composites Utilizing Arylsilane Aramids

G.J. Tregre, J.S. Reed, K.G. Malone, and S.F. Thames
University of Southern Mississippi*

Novel arylsilane diacids were synthesized and polymerized to yield rigid yet soluble aramids. The aramids were incorporated into an elastomeric epoxy/Jeffamine® coating to yield soluble polymers which are easily cast into clear films with exceptional physical properties. For instance, when films are cast from the elastomeric epoxy control and compared to silicon containing composites, the composites exhibited tensile strength increases of more than six fold, hardness increases from 2H to 8H, and although elongation decreases of 50 fold were noted, film adhesion was excellent as no failures occurred even under a direct impact of 18.1+ J.

INTRODUCTION

Composites are generally defined as a composition of a rigid filler within a polymeric matrix. The former provides strength, while the latter contributes other desirable properties such as adhesion. A common example is silica added to a polymer matrix to enhance mechanical strength and hardness of coatings. In high performance composites, carbon fibers are often the material of choice. Alternatively, organic fibers such as Kevlar® can be used to enhance mechanical strength and abrasion resistance.

It is known that the mechanical strength of a composite relies on the ability of the matrix to transmit stress to the rigid fiber. In order to maximize this transmission, adhesion of the matrix to the fiber must also be maximized. Adhesion can be improved by increasing the fiber's aspect ratio (length-to-width or surface area), and thereby increasing the number of fiber-matrix interactions. The highest aspect ratio is one molecule in width[1]; thus, the ultimate adhesion and properties should come from a rigid molecular fiber, that is, molecular composite.

The best molecular fiber should be a rigid polymer such as poly(p-phenylene terephthalamide). However, common polymers with rigid rod backbones are seldom soluble in normal organic solvents; thus, their processability into molecular composites is severely hampered. It has been our experience that arylsilanes may be used to enhance solubility. We have shown that arylsilanes* can be incorporated into the backbone of aromatic polymers to enhance solubility of otherwise insoluble polymers[2]; however, such silane incorporation increases backbone flexibility. Greater polymer rigidity was accomplished through the synthesis of polymers with pendent silane groups. The pendent substitution increases solubility without decreasing backbone rigidity. Arylsilane solubility combined with enhanced weatherability[3] and thermal stability[2] make the polymers very desirable as high performance coatings.

These silane aramid polymers were readily processed into an epoxy/Jeffamine coating and provided for dramatic increases in tensile strength and hardness without loss of adhesion or impact resistance. Thus, we present the

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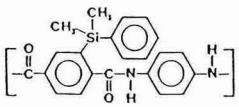
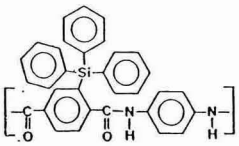
*An arylsilane is a tetraorganosilane wherein at least one of the bonds is an aryl to silicon bond.

Table 1—Some Properties of Arylsilane Aramids

	Acronym	[η]ª	T_g	T_m	Solubility
	Me_2Ph	1.17	127	None	Dimethylformamide Dimethylsulfoxide
	Ph_3	1.43	102	None	Dimethylformamide Dimethylsulfoxide

(a) Intrinsic viscosity at 30° C in DMF.

Table 2—Clear Coat Formulation

Composition	Weight
Epon 828	47.2%
Jeffamine D-230	32.4%
Jeffamine D-2000	16.2%
Byk 306	2.9%
DMF	29.3%

Cured for 30 min at 150°C.

Table 3—Properties of Epoxy Clear Coat Cast onto Cold-Rolled Steel

Tensile Strength (MPa)	Elongation (%)	Cross Hatch Adhesionª	Pencil Hardnessᵇ	Impact Resist.ᶜ (J)	Reverse Impactᶜ (J)
6.5	103	5	2H	18.1+	18.1+

(a) ASTM D 3359 (0 = less than 35%, 5 = 100% adhesion).
(b) ASTM D 3363.
(c) ASTM D 2794.

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SHELBY F. THAMES, Ph.D., is Distinguished University Research Professor of Polymer Science in the Department of Polymer Science at USM. He has a wide interest in coatings research which includes organosilicon polymers, high solids, waterborne, solvent, and powder coatings. Dr. Thames has been actively engaged in coatings research since 1964. He presented the Joseph J. Mattiello Memorial Lecture at the 60th Annual Meeting of the Federation of Societies for Coatings Technology, in Washington, D.C., on November 5, 1982.

Table 4—Physical Properties of Molecular Composites Cast onto Cold-Rolled Steel

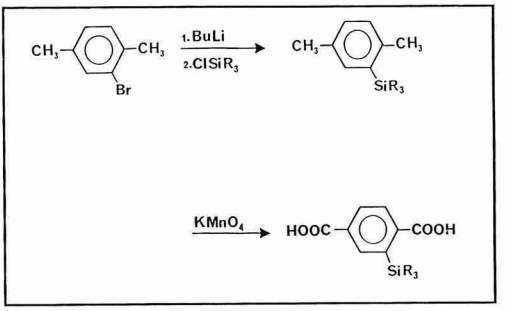
Me_2Ph Aramid (%)	Tensile Strength (MPa)	Elongation (%)	Cross Hatch Adhesionª	Pencil Hardnessᵇ	Impact Resist.ᶜ (J)	Reverse Impactᶜ (J)
0	6.5	103	5	2H	18.1+	18.1+
5	18.8	5	5	4H	18.1+	18.1+
10	—	—	5	6H	18.1+	18.1+
20	23.4	<2	5	6H	18.1+	18.1+
30	35.4	<2	5	8H	18.1+	18.1+
50	18.2	<2	4	6H	11.3	13.6

(a) ASTM D 3359 (0 = less than 35%, 5 = 100% adhesion).
(b) ASTM D 3363.
(c) ASTM D 2794.

Table 5—Weight Loss of Molecular Composites after Extraction with 120°C DMF for 48 Hours

% Me_2Ph Aramid	% Wt Loss
0	3
5	3
20	14
30	25

synthesis and properties of novel arylsilane monomers and their aramids. This work constitutes the first report of the synthesis and characterization of silane aramid/epoxy molecular composites. We have found that coatings prepared from these compositions possess ease of processability and high performance features.



Scheme 1—Synthesis of 2-silyl-terephthalic acid

EXPERIMENTAL

Epon® 828 was provided by Shell Chemical Company, Jeffamines were supplied by Texaco, and Byk® 306 was provided by Byk Corporation. All other chemicals were obtained from Aldrich Chemical Company. Dimethylformamide (DMF) was obtained as <0.005% water in Aldrich "sure seal" bottles. Diethyl ether was distilled from CaH_2 prior to use. All other chemicals were used as received.

Synthesis of 2-Dimethylphenylsilyl-4-Xylene

To 100 g (0.540 mol) of 2-bromo-4-xylene in 1000 mL of diethyl ether was added drop wise 60 mL of 10 M n-butyl lithium in hexanes (10% excess) at 0°C under nitrogen. After one hour, 105 g (0.62 mol) chlorodimethylphenylsilane was added drop wise. After one hour, the solution was filtered and the solvents were removed by distillation. The product was fractionally distilled at 93-100°C/0.01mm to yield 97 g (75%) of the desired compound.

Synthesis of 2-Dimethylphenylsilyl-Terephthalic Acid

To 75 g (0.31 mol) 2-dimethylphenylsilyl-4-xylene in 900 mL pyridine and 600 mL water at reflux was slowly added 250 g of $KMnO_4$. After four hours, MeOH was added to destroy the excess $KMnO_4$ and the solution was filtered and acidified to yield a white solid. After vacuum drying, the product was recrystallized from THF and cyclohexane twice to yield 60 g (65%) of the desired product [C-13 NMR—−0.88 ($Si-CH_3$), 127.5, 128.4, 129.7, 130.3, 132.7, 133.5, 136.8, 139.8 (phenyl), 166.7, and 168.3 (C=O) . (mp=293–294)].

Synthesis of 2-Triphenylsilyl-4-Xylene

A procedure similar to that used for the preparation of 2-dimethylphenylsilyl-4-xylene was employed except that solvent removal yielded a solid which was twice recrystallized from acetone at 0°C [(mp=135°C). C-13 NMR—20.2, 22.7 (CH_3), 127.7, 129.2, 130, 130.7, 132.2, 133.6, 134.7, 135.9, 138.1, and 141.4 (phenyl)].

Synthesis of 2-Triphenylsilyl-Terephthalic Acid

A procedure similar to that used for the synthesis of 2-dimethylphenylsilyl-terephthalic acid was employed and gave a product melting at 301-303°C.

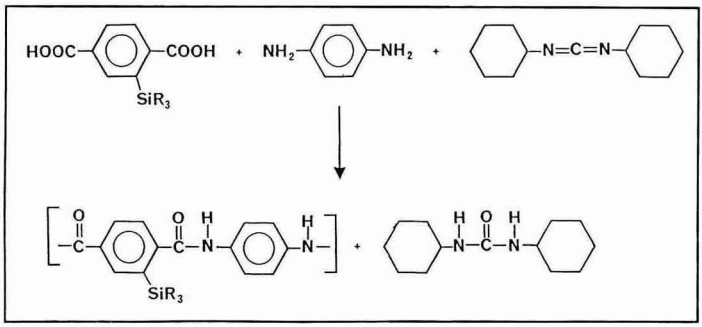
Typical Silane Aramid Synthesis

To 1.8973 g (0.00920 mol) of 1,3-dicyclohexylcarbodiimide was added 1.3811 g (0.00460 mol) of 2-dimethylphenylsilyl-terephthalic acid in 15 mL of DMF at 0°C. To this was added 0.4972 g (0.00460 mol) of 4-phenylene diamine in 15 mL of DMF. After 1.5 hr, the solution was heated to 100°C for 30 min. After cooling, the solution was filtered and the polymer precipitated in water, dissolved in minimal DMF, filtered, and precipitated in methanol to yield 1.59 g (93%).

Table 6—Physical Properties of Molecular Composites Cast onto Cold-Rolled Steel

Ph_3 Aramid (%)	Tensile Strength (MPa)	Elongation (%)	Cross Hatch Adhesion[a]	Pencil Hardness[b]	Impact Resist.[c] (J)	Reverse Impact[c] (J)
0	6.5	103	5	2H	18.1+	18.1+
10	34.6	<2	5	6H	18.1+	18.1+
20	35.6	<2	5	8H	14.7	17.0
30	40.5	<2	5	8H	9.0	10.2

(a) ASTM D 3359 (0 = less than 35%, 5 = 100% adhesion).
(b) ASTM D 3363.
(c) ASTM D 2794.



Scheme 2—Aramid synthesis

Molecular Composite Synthesis

To 1.109 g Epon 828 was added 0.486 g of a 66% Jeffamine D-230 and 33% Jeffamine D-2000 mixture along with 0.069 g of Byk 306 mar and slip additive. To this was added a solution of 0.1817 g of poly(4-phenylene-2-triphenylsilyl-terephthalamide) in 0.688 g of DMF to create a 30% aramid composite. This solution was cast into eight mil films on cold-rolled steel or Fluoroglide® (Norton) coated glass and cured for 30 min at 150°C.

RESULTS AND DISCUSSION

Synthesis

Monomer synthesis followed an analogous route to our earlier synthesis of arylsilane diacids[4] (*Scheme* 1). 2-Bromo-4-xylene was reacted via halo-metal interchange with butyl lithium followed by addition of the appropriate chlorosilane. The resultant 2-triorganosilyl-4-xylene was then oxidized with $KMnO_4$ to yield the desired diacid.

The diacid was polymerized with p-phenylene diamine using dicyclohexylcarbodiimide as a dehydrating reagent (*Scheme* 2). The polymers were readily soluble, displayed low glass transition temperatures (T_g), and no melting point (*Table* 1). This may be attributed to the bulkiness and asymmetry of the silyl pendent group.

The coatings were prepared by the formulation in *Table* 2. The aramid was dissolved in a DMF solution and then added to the formulation just prior to casting the film. The coatings were cast at 70% solids as eight mil wet films on cold-rolled steel. Free films were made by casting onto Fluoroglide coated glass.

Film Properties

The pure epoxy control coating (*Table* 3) was elastomeric with a low tensile strength, high elongation, and moderate hardness, displaying excellent adhesion even under high stress.

The pure aramids, however, formed poor and extremely brittle films that did not adhere to steel.

The coatings synthesized were evaluated for a number of physical characteristics. The data for film performance is included in *Table* 4. It is clear that coating composites ranging in composition from 5-30% Me_2Ph aramid (*Table* 4) display large increases in tensile strength and hardness with concomitant decreases in elongation. Adhesion was also maintained under high impact despite elongations of less than 2%. Thus, the molecular fiber acts to increase mechanical properties, yet the matrix epoxy continues to contribute excellent adhesion.

The films composed of 5-30% silane aramids were clear and homogenous as confirmed by scanning electron microscopy (SEM). The films were extracted in 120°C DMF for two days. After drying in a vacuum oven a weight loss was noted, which corresponds closely to their molecular fiber (silane aramid) content (*Table* 5).

At a loading of 50% Me_2Ph silane aramid, there is a notable decrease in tensile strength, hardness, and adhesion. Unlike the other films of this series, they were opaque and SEM/X-ray analysis confirmed the presence of many regions of less than one micron diameter with inordinately high concentrations of silicon, thus confirming phase separation. This suggests the bunching of molecular fibers to an extent that lowered the aspect ratios and thus decreased film strength. A similar effect has been noted for Kevlar/Nylon 6 molecular composites.[5]

The Ph_3 silane aramid (*Table* 6) showed tensile strengths higher than the Me_2Ph composition at all substitution levels. Moreover, high strength films were produced at low levels of silane aramid composition. The use of higher levels of silane aramids above the 10% level gave only small tensile strength gains. The films also developed excellent pencil hardness of 8H at the 20% molecular fiber level.

Unlike the Me_2Ph silane aramid composite, a loss of impact resistance resulted when the Ph_3 silane aramids loading was increased above 10%, but the impact resistance remained high for a coating of less than 2% elonga-

Table 7—Weight Loss of Molecular Composites after Extraction with 120°C DMF for 48 Hours

% Ph_3 Aramid	% Wt Loss
0	3
10	14
20	20
30	37

Table 8—Glass Transitions of Molecular Composites

% Ph_3 Aramid	T_g (°C)	% Me_2Ph Aramid	T_g (°C)
0	49	5	50
10	53	20	72
20	70	30	81
30	84	50	96

Table 9—Swelling of Molecular Composites

	Percent Weight Increase		
% Ph_3	Water	Toluene	Xylene
0	18	82	62
10	3	45	52
20	9	45	53
30	9	49	48

tion. The loss of impact resistance of the Ph_3 silane aramid composites was not surprising as we have reported that arylsilane's adhesion to cold-rolled steel is inversely related to the number of phenyl substituents on the silicon atom.[4]

The Ph_3 silane aramid, like its Me_2Ph counterpart, produced homogeneous and clear films up to the 30% by weight level as confirmed by SEM. They also showed molecular fiber extraction when heated in DMF (*Table* 7).

Thermal analysis confirms a strong association between the molecular fiber and resin matrix as only one T_g was detected. As the concentration of silane aramid was increased, a concomitant increase in T_g was noted; a consequence of enhanced rigidity (*Table* 8).

Water, xylene, and toluene uptake by the films was decreased by the addition of silane aramid (*Table* 9). This coincides with the aramids total insolubility in these solvents.

CONCLUSION

In an effort to develop and study high performance coatings, we have synthesized a number of heretofore unreported arylsilane molecular composites. We have shown that the attachment of pendent silyl substituents, bonded via the Si-C linkage to an otherwise rigid polymer backbone, greatly enhances solubility in organic solvents. The increased solubility allows the silyl aramids to be easily incorporated into epoxy coatings forming high performance clear coats. The coatings produced are high in tensile strength, very hard, and show limited elongation, yet they retain excellent adhesion even under high impact.

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Sorption of Moisture On Epoxy and Alkyd Free Films And Coated Steel Panels

Howard N. Rosen and Jonathan W. Martin
National Institute of Standards and Technology*

Sorption isotherm curves at 23°C were determined for alkyd and epoxy free films and coated steel panels as well as for alkyd "pocket" panels, consisting of an unadhered free film surrounding and enclosing the steel panel. The isotherms consist of an increasing linear portion to about 75% relative humidity (RH), followed by a rapidly rising nonlinear portion to 100% RH. A model assuming weak bonding forces between the paint film and water with microvoid condensation at high RH gave an excellent fit to the data. Transient sorption data on the approach to equilibrium conditions showed differences between alkyd and epoxy coatings. For alkyd films, surface boundary layer resistance was significant and sorption followed a Fickian model. For the epoxy coating, surface resistance was not significant and moisture movement was non-Fickian.

INTRODUCTION

For normal corrosion of steel to take place, corrosive agents such as water, oxygen, and ions must be present. Organic coatings serve as a protective barrier for retarding the transport of these agents to the metal/coating interface, as well as acting as a reservoir for inhibitors to help the metal surface resist attack.[1] Several types of degradation such as blistering, pitting, and cathodic delamination can occur beneath organic coatings.[1,2] Even though much basic research has been done to explain these degradation processes, the complex chemical nature of coatings and the random variation in exposure environment have made prediction of the rate of degradation, and thus service life, a difficult task.

One approach to quantifying the corrosivity of outdoor conditions is to determine individual variables that characterize that environment. For example, Vernon[3] found that a critical relative humidity (RH) exists above which steel exposed outdoors corrodes. Time-of-wetness (TOW) is defined as the time an exposed surface has a moisture level which is above this critical relative humidity.[4]

Several investigators have used sensors on uncoated metal to measure voltage or current as a function of time and correlate this to corrosion rate.[4,5] By measuring a specified level of electrochemical activity on the surface of the metal, TOW was correlated to the total time that the metal surface was exposed to an RH above a critical value. Depending on the experimenter and the experimental conditions, this critical RH had a value in the range of 40-87%. Although electrochemical techniques are more difficult to apply to organic-coated metals because of the low electrical conductance of the coating, the concept of TOW may be useful in characterizing the corrosivity of a natural atmospheric environment and as input for predicting service life of coated materials.

Moisture transport is critical to corrosion and the degradation of organic coatings on steel or aluminum. Although the coating is intended as a barrier to moisture, moisture will in time move through and be held by the coating. The effects of changes in temperature and humidity on moisture movement in many different coatings have been studied,[6-8] but more work is required to better understand the interactive effects of the variables on the permeation process. A fundamental method for studying moisture uptake in materials is to determine the sorption isotherms. Isotherms have been obtained for a wide variety of materials,[9] but the literature is sparse for organic coatings.

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Table 1—Composition of Epoxy and Alkyd Paints

Epoxy Paint Green Primer, Formula 150, Type I	
Component A	**% by Mass**
Polyamide	1.7
Polyamide adduct	23.6
Magnesium silicate	42.2
Titanium dioxide	8.4
Butyl alcohol	22.3
Copper phthalocyanine blue	0.1
Yellow iron oxide	1.7
Component B	
Epoxy resin	49.6
Magnesium silicate	9.9
Naphtha	25.6
Diatomaceous silicate	14.9
White Alkyd Paint—Type I	
Pigment (47.5% by mass)	
Titanium dioxide	67
Reinforcing and tinting pigments	33
Vehicle (52.5% by mass)	
Alkyd resin solids	47
Mineral spirits	53

The purpose of this paper is to gain a better understanding of the mechanism of moisture sorption in coatings on metal substrates. Comparison of sorption among the separate components of a coated metal panel, that is, the free film, the free film covering (but not attached to) the metal surface, and the coated metal itself should provide insights into the mechanism of moisture transfer to the coating/metal interface.

EXPERIMENTAL

Combinations of coatings and steel substrate were subjected to several steps of constant RH to determine moisture change and, in some cases, rates of moisture change.

Four groups of specimens were prepared: (1) bare steel panels; (2) free paint films; (3) coated steel panels; and (4) unadhered free paint films surrounding and enclosing steel panels (pocket). All steel panels were 0.8 mm thick, had a dull matte finish, and were cut into pieces 7.6 cm × 4.8 cm unless otherwise noted. For most groups, epoxy and alkyd paints (described in *Table* 1) were used for the free film and coated panel specimens. Only alkyd was used for the pocket. Each of the six combinations of specimens described had six replicates, except for the bare steel which had only three. As specimens were prepared, they were stored in a desiccator with Drierite* until the beginning of the sorption experiment.

Specimen preparation included:

UNCOATED METAL—7.6 cm × 5.8 cm size, washed with acetone, and dried for 24 hr at 75°C.

FREE FILM—A large film was spread out with a 75-micron drawdown blade on a Teflon sheet. The films were cured at room temperature for 24 hr, then at 75°C in an oven for 24-36 hr. For the alkyd, the film was cured in the oven on the Teflon sheet, and then separated from the sheet. The epoxy film was separated from the sheet before curing in the oven as a large film. Finally, the films were cut into smaller pieces 12.7 × 7.6 cm. The average thickness of the dry films was 0.23 mm with a range of 0.10-0.30 mm.

COATED STEEL—The steel coupons were coated on one side with a 75-micron drawdown blade, cured for 24 hr at room temperature, after which they were cured in an oven for 24-36 hr at 75°C. The other side of the panel was then coated and cured in the same way. The average thickness of the dry film was 0.16 mm with a range of 0.13-0.21 mm.

ALKYD POCKET (unadhered free film surrounding the metal)—A metal coupon was inserted into a pocket made from cured alkyd free films and the front flap of the pocket sealed with alkyd paint. The coating was not bonded to the metal. The coated pocket was then heated in an oven for 24 hr at 75°C. The average thickness of the pocket material was 0.28 mm with a range of 0.19-0.41 mm.

Apparatus

The sorption studies were carried out in a stainless steel glove box about 1.2 m long × 0.6 m high × 0.6 m deep. The glove box contained a Vaisala HMP 113Y temperature and humidity probe, a desiccator containing all of the dry specimens, an electronic balance accurate to 1 mg, three trays 15 cm × 20 cm × 2.5 cm deep to contain water saturated with salts for humidity control, a small fan for air circulation, and four racks to hold the 33 specimens. Changes in salt solution could be made with minimal change in the controlled atmosphere in the glove box through a sealed antechamber. The equipment and experimental procedures were similar to those of Cooper.[10] Dry nitrogen continually purged the glove box to minimize the concentration of oxygen and thus the corrosion of steel.

The glove box was exposed to phosphoric anhydride (*Table* 2) for several days prior to the experiments to remove water from the system. To initiate the experiments, all 33 specimens were removed from desiccators and placed on racks in the glove box. The masses of the specimens were weighed twice a day until values were

Table 2—Equilibrium RH at 23°C for Saturated Aqueous Salt Solutions Used in This Study[a]

Salt	RH	Reference
Phosphoric anhydride (P_4O_{10})	0	11
Lithium chloride (LiCl)	11	12, 13
Potassium carbonate (K_2CO_3)	43	13, 14
Sodium nitrite ($NaNO_2$)	65	12-14
Sodium chloride (NaCl)	75	12, 13
Potassium bisulfate ($KHSO_4$)	86	14
Ammonium phosphate ($NH_4H_2PO_4$)	93	13, 14
Potassium sulfate (K_2SO_4)	97	12

(a) Humidity probe readings were within ±1% of the listed humidities. The literature values were used in the mathematical analysis.

*Certain commercial materials and equipment are identified in this paper in order to adequately specify experimental procedures. In no case does such identification imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it necessarily imply that the item mentioned is the best available for the purpose.

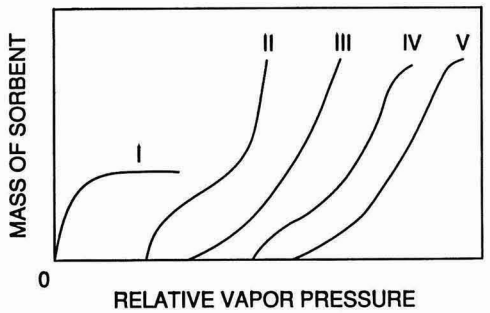

Figure 1—Five types of sorption isotherms for various gas-solid systems after Simpson[25]

stable over several days. These steady-state values were defined as the dry masses of the specimens at 0% RH. After the masses of the specimens had reached a constant value, a new saturated salt solution, having the next higher RH in *Table* 2, was placed in the glove box. The specimens took two to three days to reach equilibrium and were exposed to the salt solution two days beyond that to insure that their masses remained constant. All mass measurements were made in the glove box. When the saturated solution of potassium bisulfate (86% RH) replaced that of sodium chloride (75% RH), mass measurements were made more frequently to obtain a mass uptake curve and thus get the transient approach to the equilibrium moisture content. After the exposure to the saturated solution of potassium sulfate at 97% RH, the specimens, except for the alkyd pocket and the uncoated coupons, were soaked in distilled and de-ionized water for 72 hr, blotted dry, and weighed.[15]

Immediately after the water soak, a saturated solution of lithium chloride was placed in the glove box, and all specimens were dried to and equilibrated at 11% RH. While the specimens were drying, they were weighed several times to observe the desorption transient approach to equilibrium and thus to allow estimation of the diffusion coefficients. Moisture contents (MC), defined as the mass change of the sample divided by the dry mass of the coating, were determined for all specimens at each condition. MCs were all on a "dry coating" basis.

Two other tests were made on some of the materials. Three samples of uncoated metal were placed at the top of a vacuum desiccator with distilled water on the bottom. A vacuum equal to the partial pressure of water at the temperature of the desiccator was maintained in the desiccator. The masses of the bare metal samples were taken after three days and several weeks.

A goniometer was used to measure the contact angle of two liquids on the front and back surfaces of the epoxy and alkyd films before and after exposure to the sorption experiments. The surface tensions of these surfaces were determined by the harmonic mean-method.[16]

MATHEMATICAL ANALYSIS

Sorption of water vapor by coatings can be described by two main analytical steps; (1) the approach to equilibrium (a transient process); and (2) equilibrium itself. Each can be defined mathematically.

Equilibrium

Equilibrium can be expressed in terms of percent moisture content (the ratio of the mass of water to that of the dry material multiplied by 100) and relative vapor pressure (the vapor pressure of water in air to the vapor pressure in air which is water-saturated).

Five general types of sorption isotherms have been identified for gas-solid systems (*Figure* 1).[17] These can be adsorption isotherms, as in this study, where moisture is gained by the solid; or desorption isotherms, where moisture is lost by the solid. These two isotherms can differ markedly for the same system because of hysteresis of the processes involving water within the solid material. Type I and II isotherms, which occur when the forces of attraction between the vapor molecules and the solid surface are large, are the most common in the literature. Type III isotherms occur when the forces between the vapor molecules and the solid are relatively small. Type IV and V isotherms describe the cases where the amount of adsorption is limited by capillary condensation in rigid capillaries. Many coatings fall under a Type III isotherm.[8,18] Based on the Langmuir isotherm model, the BET multilayer sorption isotherm equation can be represented by:[19]

$$m_e = \frac{M_m Ch[1 - (n+1)h^n + nh^{n+1}]}{(1-h)[1 + (C-1)h - Ch^{n+1}]} \quad (1)$$

where

m_e is the equilibrium MC, %;
h is the relative vapor pressure of water, RH/100;
C is a constant related to the energy of sorption;
M_m is the MC of a complete monolayer, %; and
n is the number of monolayers on an adsorption site.

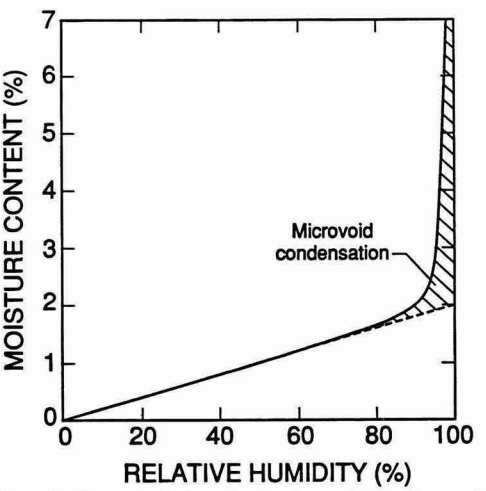

Figure 2—Theoretical adsorption isotherm with multilayer adsorption and microvoid condensation

Equation (1) reduces to the Langmuir isotherm when n = 1 and provides a good general equation for mathematically describing all five types of isotherms. Several other models, such as the Hailwood-Horrobin[20] and King[21] models give curves of similar shape to that of the BET Equation.

We assumed that weak bonding forces exist between the polymer chains in a coating and water molecules. Compaction of the water, normally associated with strong bonding of water with a sorbent, would give a specific gravity of the adsorbed water greater than 1.0. For example, the water first adsorbed by dry wood has a specific gravity of 1.3.[22] Kittleberger[15] showed that the specific gravity of sorbed water in an alkyd paint film is very close to 1.0 and thus the water bonding forces are weak. A Type III isotherm best described the system. At lower RHs the masses of water vapor adsorbed was assumed proportional to RH. At higher RHs, microvoids or small open areas in coatings, particularly those at the pigment/binder interface, at the coating/substrate interface, and within gas inclusions can fill up with condensed water.[23,24] This moisure, which we refer to as "moisture inclusion," must also be considered in the model. Thus:

$$m_c = b_1 h + m_c \qquad (2)$$

where

b_1 is a sorption bonding constant and
m_c is moisture inclusion, %.

An expression using the Kelvin equation has been derived by Simpson[25] to account for moisture inclusion during water vapor sorption:

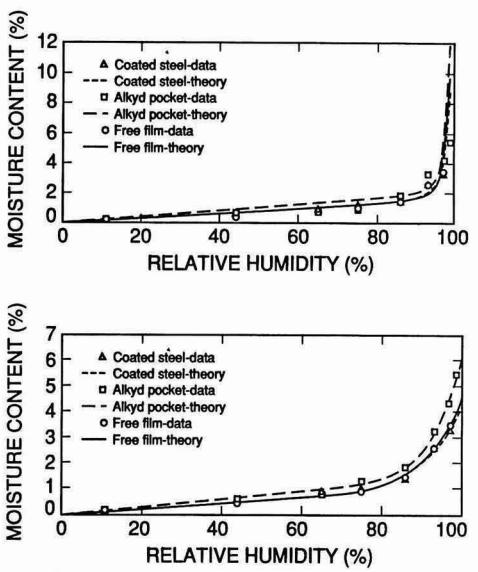

Figure 3—Adsorption isotherm at 23°C for alkyd free film, pocket, and coated steel panel [a—the solid line is the least squares fit of equation (5) and b—the solid line is the least squares fit of equation (7)]

Table 3—Coefficients and Fit of Equations (5) and (7) for Adsorption Isotherms for Epoxy and Alkyd Coatings

Specimen Group Name	b_1	b_2		R^2
Equation (5)				
Alkyd coated steel	1.610	0.00166		0.948
Alkyd free film	1.615	0.00187		0.957
Alkyd pocket	2.055	0.00225		0.959
Epoxy coated steel	1.336	0.000801		0.971
Epoxy free film	0.867	0.000236		0.994
	b_1	b_4	p	R^2
Equation (7)				
Alkyd coated steel	1.060	2.992	10	0.991
Alkyd free film	1.094	3.216	11	0.998
Alkyd pocket	1.484	3.179	13	0.993
Epoxy coated steel	0.949	1.580	8	0.997
Epoxy free film	0.821	0.800	20	0.993

$$m_c = \frac{\pi\lambda}{W_d\rho}\left(\frac{360\tau}{RT\ \ln(1/h)}\right)^2 \qquad (3)$$

where

λ is the microvoid length, cm;
W_d is the dry mass of the coating, g;
τ is the surface tension of the liquid, erg/cm^2;
R is the gas constant, erg/(g-mole °K);
T is the absolute temperature, °K; and
ρ is the density of water, g/cm^3.

For isothermal conditions, equation (3) reduces to:

$$m_c = b_3[\ln(h)]^{-2} \qquad (4)$$

where $b_3 = \frac{\pi\lambda}{W_d\rho}\left(\frac{360\tau}{RT}\right)^2$

Substituting equation (4) into equation (2),

$$\begin{aligned} m_c &= 0 && h = 0 \\ m_c &= b_1 h + b_3[\ln(h)]^{-2}; && 0<h<1 \end{aligned} \qquad (5)$$

Although equation (5) gives the correct trend for a Type III isotherm, the expression has discontinuities at h = 0 and h = 1 and approaches infinity as h→1 (*Figure* 2). The moisture inclusion expression, equation (4), describes idealized moisture uptake in cylindrical-shaped microvoids. Some deviations could be expected from this expression because of the complex microvoid structure within the coatings. Therefore, an alternative power law approximation, having a similar trend to equation (5), but finite values at h = 0 and h = 1, will be used to account for moisture inclusion.

Let:

$$m_c = b_1 b_4 h^{p+1} \qquad (6)$$

Combining equations (2) and (6),

$$m_c = b_1 h(1 + b_4 h^p) \qquad (7)$$

The parameter b_1 is related to the multilayer polar bonding of water molecules in the coating and parameters b_4 and p are related to moisture inclusion in the microvoids.

Table 4—Sorption Parameters for Alkyds at 23°C[a]

	Thickness (cm × 10^2) Range	Mean	D ($cm^2/s \times 10^9$)	L	$t_{0.5}$ (hr)	SEE[b]
Free film[c]						
des.	1.0 - 2.7	2.7	5.40	1.8	3.21	0.04
ads.	1.0 - 2.7	2.7	1.62	6.1	5.60	0.07
Coated steel panel						
ads.	1.3 - 1.7	1.6	1.05	7.4	5.00	0.04
Pocket						
des.	1.9 - 4.1	2.8	9.00	1.6	3.89	0.05
ads.	1.9 - 4.1	2.8	4.05	3.5	5.75	0.10

(a) Surface mass transfer coefficient, α, = 9.72×10^{-7} cm/s.
(b) Standard error of the estimate for equation (9).
(c) Density of dry alkyd film was 1.97 gm/cc, desorption was from wet for the free film and 98.5% RH for the pocket to 11% RH, adsorption was from 75% to 86% RH.

Transient Analysis

Transient analysis involves the mathematical description of water vapor movement through the boundary layer on the surface of the coating and then through the coating itself. The literature[6,26] shows that, during moisture sorption, the diffusion coefficient, D, in many coating systems is dependent on moisture content. For ease of analysis, we assumed a constant D, and therefore define D as a mean value over a range of humidities. The basic diffusion equation from Fick's Second Law is:

$$\frac{\partial m}{\partial t} = \frac{D\,\partial^2 m}{\alpha x^2} \tag{8}$$

and the boundary conditions are:

$$x = 0 \qquad \frac{\partial m}{\partial x} = 0$$

$$x = \pm a \qquad \frac{-D\,\partial m}{\partial x} = \alpha(m_e - m_s)$$

where
- m is MC as a funciton of distance and time, %;
- α is the surface mass transfer coefficient, cm/s;
- t is time, s;
- x is distance through the thickness of the film, cm;
- a is the half thickness of the coating, cm;
- D is the mean diffusion coefficient over a range of conditions, cm^2/s; and
- m_s is m at the surface of the coating, %.

The solution can be represented as an infinite series in terms of the relative moisture content, E, which is defined as the moisture uptake of a film at time, t, as a fraction of the total uptake at infinite time:[27]

$$E = \frac{\overline{m}}{m_T} = \sum_{n=1}^{\infty} \left[\frac{2L^2 \exp(-\beta_n^2 Dt/a^2)}{\beta_n^2(\beta_n^2 + L^2 + L)} \right] \tag{9}$$

where the β_ns are the roots of:

$$\beta_n \tan(\beta_n) = L \tag{9a}$$

$$L = \frac{a\alpha}{D} \tag{9b}$$

where
- $\overline{m}$ is the average moisture content across the film, % and
- m_T is the total moisture uptake at infinite time, %.

Choong and Skaar[28] have shown that the parameters α and D can be evaluated from the following relationship:

$$\frac{t_{0.5}D}{a^2} = 0.196 + \frac{0.7D}{a\alpha} \tag{10}$$

where $t_{0.5}$ is the time when half the evaporable water either absorbs to or desorbs from the coating (E = 0.5) for a given set of conditions.

If sorption experiments are done on the same material at two different thicknesses, a_1 and a_2, having one-half times of t_1 and t_2, respectively, then:

$$D = \frac{0.196(a_2 - a_1)}{\left(\frac{t_2}{a_2}\right) - \left(\frac{t_1}{a_1}\right)} \tag{11}$$

$$\alpha = \frac{0.7D}{\left(\frac{Dt_1}{a_1} - 0.196a_1\right)} = \frac{0.7D}{\left(\frac{Dt_2}{a_2} - 0.196a_2\right)} \tag{12}$$

For negligible surface boundary layer resistance and E ≥ 0.67, D can be approximated by:[22]

$$D = \frac{\pi(Ea)^2}{4t} \tag{13}$$

RESULTS AND DISCUSSION

To observe the mechanisms of moisture uptake by coated panels, we first considered uncoated steel, epoxy-coated steel, and alkyd-coated steel separately, and then made generalizations on the combination.

Bare Steel

The uncoated steel specimens were put in the glove box as a control. We knew that it was not possible to purge all of the oxygen from the glove box with nitrogen and we wanted to ensure that corrosion would not be a major factor in the gain of mass of the specimens. Although some corrosion was observed by discoloration of the

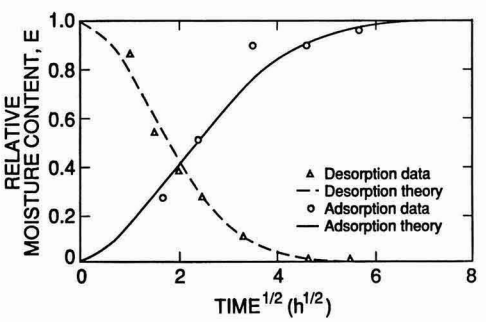

Figure 4—Adsorption and desorption curves at 23°C (E vs $\sqrt{t}$) for alkyd free film [the solid line is equation (9) with parameters evaluated from equations (11) and (12)]

metal surface at 11% RH, the mass gain was less than 0.1% below 40% RH (*Figure* 5a). After 1000 hr, the specimens had increased in mass by 0.18% as a result of corrosion and 0.08% as a result of adsorbed water. The adsorbed water was determined from the mass difference before and after an acetone wash. The tendency of iron oxide to adsorb many layers of water has been documented in the literature.[29,30]

In a separate experiment, three clean, dry steel coupons were placed in a vacuum desiccator on a steel wire screen above distilled and de-ionized water. A vacuum was drawn equal to the partial pressure of water at 24°C for one hour in an effort to remove as much air as possible from the desiccator. The desiccator was left undisturbed for three days. After this time, rust was visible on the metal surface, but the mass of rust was less than 0.1 mg (within the precision of the balance). Since the air had been pumped out of the desiccator, the corrosion must have resulted from dissolved oxygen in the water, thus, substantiating our belief that the removal of all oxygen from the glove box is difficult.

Alkyd Coating

The alkyd free film, the coated steel panel, and the pocket each give a Type III adsorption isotherm (*Figure* 1). Equation (5), depicted by the theoretical curves in *Figure* 3a, gives a reasonable fit to the experimental data, but equation (7), which has one more parameter, gives a better fit (*Figure* 3b), as indicated by the higher square of the correlation coefficient, R^2 (*Table* 3). The coated steel and free film had nearly identical isotherms—the differences in data for each RH using a t-test were not statistically significant at the 0.05 level.

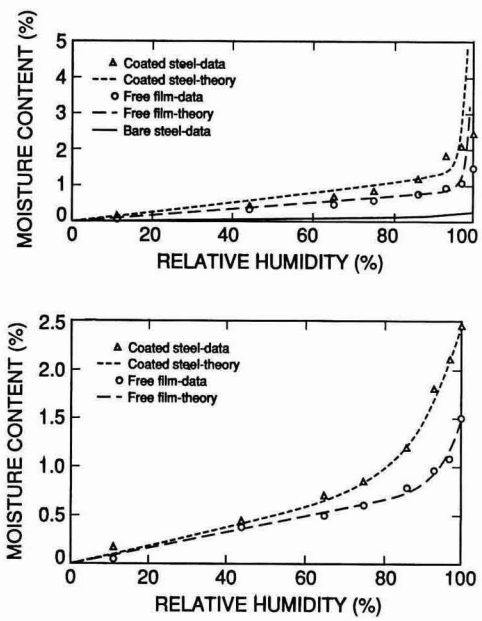

Figure 5—Adsorption isotherm at 23°C for: a—epoxy free film, epoxy coated steel panel, and bare steel panel [the solid line is the least squares fit of equation (5)] and b—epoxy free film and epoxy coated steel panel [the solid line is the least squares of equation (7)]

Table 5—Sorption Parameters for Epoxies at 23°C

	Thickness (cm × 10^2) Range	Mean	D ($cm^2/s \times 10^9$)	$t_{0.5}$ (hr)	SEE[a]
Free film[b]					
des.	2.0 - 3.4	2.7	3.17	4.50	0.10
ads.	2.0 - 3.4	2.7	1.00	6.33	0.06
Coated steel panel[c]					
des.	0.7 - 1.4	1.6	9.20	0.53	0.14

(a) Standard error of estimate for equation (9).
(b) Density of dry epoxy film is 1.58 gm/cc. desorption was from wet to 11% RH. adsorption was from 75% to 86% RH.
(c) Scatter in data for coated panel adsorption too great over a small change in weight for evaluation of D.

The increases in the film and coated panel masses with RH were linear up to about 75% RH, whereas the increase of the alkyd pocket was only linear up to about 65% RH. At 86% RH, ripples appeared on the coated steel panels and on the alkyd pockets. These ripples intensified as the humidity increased indicating possible accumulation of water at the coating/substrate interface. The ends of the free films also curled at humidities above 75%. The previous discussion indicates that stresses developed in all the specimens as they adsorbed moisture.

Upon immersion of the coated panels in distilled water, the alkyd coating separated from the metal substrate and corrosion was observed on the edges of the panels, while the rest of the substrate remained free of corrosion. This type of degradation is associated with water disbondment and cathodic delamination.[2,29] Since the coating delaminated from the substrate, the data is not reported for the water soak and the samples not used to determine the desorption isotherm.

The alkyd pockets were not soaked in water. As a result of the presence of water in the glove box during the water soak, the RH of the glove box increased to an equilibrium value of 98.5%. This value was included in the isotherm data for the pocket.

The alkyd films averaged 10.6% moisture content after three days of soaking, about three times higher than the value at 97% RH. The texture of the film changed on soaking to give the surface a slippery feeling. The microvoids in the alkyd coating may fill to a greater extent with a water soak than at 100% RH. The water soak for the alkyds was not represented as a datum point in the adsorption isotherm curve of *Figures* 3a and 3b. Large changes in uptake near 100% RH have been reported in the literature. Yaseen and Funke[31] found greater than 30% increase in weight of a microvoid coating subjected to 24 hr of water soak at 23°C, whereas the equilibrium MC was only 1.6% when exposed to 98.5% RH.

The previously discussed observations indicate that moisture uptake of free coatings and coated steel panels during water soak is not necessarily the same as the uptake at 100% RH. A further indication of a difference is

the mass change of the exposed coatings. When redried at 0% RH, the alkyd film and coated steel panel specimens which had been water soaked were found to have lost approximately 1% of the coating mass, whereas the unsoaked pocket had only lost 0.1%.

The amount of moisture uptake by the alkyds was less than 1% by mass at RHs below 70%. The pocket specimens had a slightly higher moisture uptake, probably due to moisture accumulation at the metal/coating interface. Further indication of moisture uptake was the development of rust on the surface of the metal panel enclosed within the pocket. Three of the metal coupons were removed from their pockets, dried, and weighed to determine the mass gain resulting from corrosion. The gain in mass of these coupons after 1000 hr exposure over the range of humidities was less than 0.1 mg. The degree of rusting of these coupons was considerably less than that of the bare metal specimens.

The adsorption time versus mass data between 76 to 85% RH and the desorption time versus mass data from immersed to 11% RH provided the transient data for the sorption rate experiments. Values of D and α were determined from desorption data of the six alkyd film specimens by averaging the high, a_2, and low, a_1, values of thickness; determining half times, $t_{0.5}$, from the curves, and using these values in equations (11) and (12) (*Table* 4). Equation (9) yielded an excellent fit to the alkyd film desorption data at each RH level (*Figure* 4). Curves of E versus the square root of t, rather than t, are presented to compress the ordinate of the graph and give a clearer comparison of the theory with the data. The value of α should be independent of humidity or coating thickness, since it is an external parameter. The value of $\alpha = 9.72 \times 10^{-7}$ was assumed for other conditions and types of panels, and equation (11) was used to calculate D (*Table* 4). D was not calculated for desorption from the coated steel panels because of separation of the coating during water immersion. Equation (9) was used to generate other alkyd curves. The fits were adequate, but not as good as for film desorption, as indicated by the standard error of estimate values in *Table* 4.

The diffusion constants are several times larger for desorption than for adsorption indicating a possible dependence of D on MC. The D for the pocket is much greater than for the other two. The value of L [equation (9b)] provides an indication of the importance of surface boundary layer resistance on a film's overall diffusivity.[32] Surface resistance is significant for L less than 10.[27] As seen in *Table* 4, surface resistance contributes significantly to the movement of moisture in the films, especially during desorption.

Table 6—Total Surface Force and Polarity of Epoxy and Alkyd Free Film Surfaces Before and After Humidity Exposure as Determined by the Harmonic Mean-Method[16]

Free Film	Epoxy				Alkyd			
Exposure Conditions	Unexposed		Exposed		Unexposed		Exposed	
Surface condition[a] ...	A	T	A	T	A	T	A	T
Total surface force, dynes/cm	44	27	44.5	27.5	35.0	31.0	37.5	32.5
Polarity	0.51	0.28	0.48	0.36	0.26	0.26	0.32	0.28

(a) A is surface exposed to atmospheric conditions, whereas T is the surface exposed to the Teflon sheet surface.

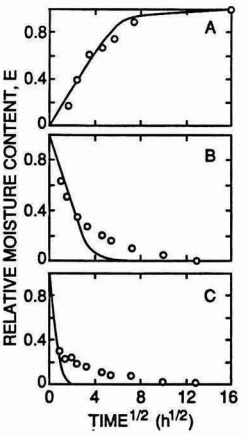

Figure 6—Adsorption curve of epoxy free film (A), desorption curves for epoxy free film (B), and coated panel (C) at 23°C (E vs $\sqrt{t}$) [the solid line is equation (9) with parameters evaluated from equation (13)]

Epoxy Coating

The epoxy coated steel panel and free film formed Type III isotherms and were linear up to 75% RH (*Figure* 5a). Equation (5) fitted the data reasonably well, but equation (7) fitted much better (*Figure* 5b), as shown by the higher R^2 in *Table* 3. Unlike the case of alkyds, the exponent, p, was very different for the epoxy free film and coated panel cases; also, moisture uptake was less than for the alkyds. At 97% RH, the epoxy film has a MC of slightly over 1%. The values of MC were higher for the coated panel than for the film, implying that moisture must have been accumulating at the coating/substrate interface.

The physical changes in the coated panels as a result of the water soak were quite different between the epoxy and the alkyd coated panels. At higher humidities, the epoxy free film specimens became brittle and slightly curled on the ends. Soaking in water for three days resulted in little additional moisture pickup at an RH above 97%. No significant separation of the epoxy films from the metal panels was observed. When dried, the specimens all returned to within 0.05% of their original dry weight. Upon closer examination, it was seen that the epoxy film could be removed more easily by scraping with the end of a razor blade from these panels than from panels that had not been subjected to high humidity and soaking. The coating film was removed from several panels to determine if rust was present, but no rust was observed.

The analysis for the evaluation of α and D by equations (11) and (12) was not applicable for the epoxy specimens

because the data fit poorly. As an alternative approach, we assumed no surface resistance and determined D from equation (13) at E = 0.4 for adsorption and desorption of coated panels and films (*Table* 5). With L being given a large value to assume negligible surface boundary layer resistance, curves were generated from the D values in *Table* 5 using equation (9). As seen in *Figure* 6, the fits were not good. Desorption curves had a rapid drop to about E≈0.3 followed by a slow approach to equilibrium. This slow desorption at low MC may result from stress relaxation and realignment of the polar water bonds in the coating matrix as the final water is removed. Values of D showed a similar trend to alkyds, that is, greater values for desorption than adsorption.

The properties of a free film can be affected by the substrate used during preparation. Yaseen and Raju[33] showed adsorption isotherms differed for alkyd free standing films made on eight different materials. Teflon has been used as the substrate for preparing films by many researchers because of its low surface energy and weak adhesion to many coatings.[33] We also used Teflon and found this substrate to be acceptable for making our free films, except for difficulties in controlling the thickness of the films and in removing the epoxy coating.

Substrates and type of exposure can affect the properties of free film surfaces. We tested the epoxy and alkyd free standing films for two comparisons. First, surfaces "exposed" to the humid conditions and water soak in the glove box were compared to those stored in plastic bags under room conditions (unexposed). No significant differences existed in surface free energy or polarity between exposed and unexposed films (*Table* 6). Second, the surface energy of the outside surface of the free film (A) was compared to the inside Teflon exposed surface (T). The alkyd free film showed no difference, but the epoxy film showed a big difference. These contrasts may explain some of the differences in adsorption MC values between the epoxy free film and coated steel panels.

SUMMARY AND CONCLUSIONS

The adsorption of moisture at 23°C by an alkyd paint film was greater than that of an epoxy film and was less than 3% by mass in both types of film at RH below 95%. The adsorption isotherms followed similar forms in all cases examined: a linear portion from 0% RH to about 75% RH, followed by a rapidly rising uptake to 100% RH. A model assuming weak bonding forces between the coating and water layers coupled with microvoid condensation at higher RH has been presented. The model provides an excellent fit to the data.

Transient data on the approach to equilibrium MC values show differences between epoxy and alkyd coatings. For the alkyd coating, diffusion appears to follow Fick's Laws. Surface resistance influences moisture sorption in the alkyds. For the epoxy coatings, desorption occurs rapidly at first, but then slows considerably as equilibrium is approached. The diffusional process does not follow Fick's Laws.

Corrosion was observed in the coated specimens as well as in the pockets. The coated alkyds completely separated from the metal substrate upon water soak. Corrosion on the edges of the panels confirmed cathodic delamination occurred on the faces of the panels. Although the panels in the alkyd pockets were corroded, the degree was considerably less than that of the uncoated steel panels. Epoxy panels remained intact and no evidence of corrosion was observed even though several panels were scraped to look for corrosion. The coatings did show evidence of water disbondment because adherence to the substrate was not as strong as prior to exposure to high humidities.

Mass transport, which includes water sorption, is just one mechanism of several that must be understood before corrosion can be fully understood. It is critical to relate mass transport to mechanical degradation and chemical reaction to get a more complete understanding of the problem.

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Flow Agents for High Solids Coatings

Marvin Schnall
Troy Chemical Corporation*

Government restrictions on solvent emissions have forced coatings chemists to re-formulate solvent based coatings to higher solids types. As these new formulations have been developed, it became apparent that problems of poor flow were more prevalent than with the conventional solvent coatings. As a result, interest has increased in flow control additives for high solids coatings.

This paper reviews the theory involved in the flow of coatings, emphasizing the importance of surface tension effects. We then describe experimental work conducted with a number of commercial flow control additives in four basic types of high solids coatings: air-drying alkyd, baking alkyd, baking acrylic, and baking polyester.

The results indicated a correlation between the efficiency of the agent and its ability to reduce the surface tension of the coating. It was also noted that compatibility of the agent in the system was an important requirement.

THEORETICAL CONSIDERATIONS

Figure 1 illustrates the reason for the existence of surface tension or surface energy, as it is sometimes called. When a molecule is in the bulk of a liquid, as is indicated toward the bottom of the figure, the forces acting upon it are balanced in all directions. However, when this molecule rises to the surface of the liquid, the forces become unbalanced and tend to be stronger at the surface. This basically is why we have the phenomenom of surface tension.

Another concept important to the understanding of the spreading of liquids on surfaces is that of the contact angle. As illustrated in *Figure* 2, this is the angle formed by a line drawn tangent to a small drop of a liquid on a solid surface. If the contact angle indicated by the Greek letter ϕ in the diagram is less than 90°, the liquid will spread readily over the substrate. If angle ϕ is greater than 90°, the liquid, rather than spreading readily, will tend to de-wet or crawl or bead up on the substrate.

Young's equation, illustrated in *Figure* 3, relates the spreading of a liquid with surface tension values and contact angles, as shown below the sketch. γ, or the surface tension of the solid, equals γ of the liquid divided by the solid plus γ of the liquid times the cosine of ϕ, the contact angle. This equation, although derived many years ago, is still considered valid today. Its meaning in effect is that for the cosine of ϕ to be less than one, or for the liquid to spread, the surface tension of the solid must be greater than the surface tension of the liquid. This is a basic concept that is important for us to understand in studying the spreading of coatings on substrates. Therefore, by measuring the surface tension of the solid substrate and the liquid coating, it is possible to determine in advance whether or not the coating will wet the substrate.

SURFACE TENSION MEASUREMENTS

There are a number of instruments used to measure the surface tension of a liquid, but no instrument exists to

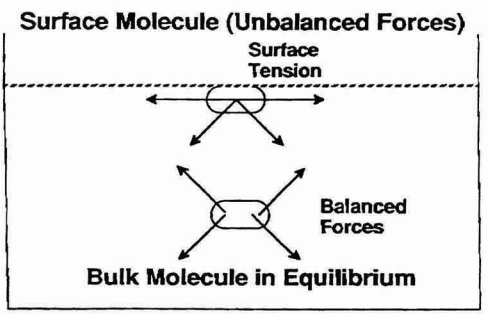

Figure 1—Origin of liquid surface tension

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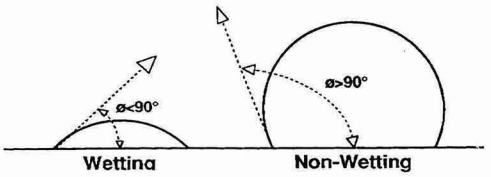

Figure 2—Wetting related to contact angles

directly measure the surface tension of a solid substrate. However, Dr. Zissman devised a method for determining what he referred to as the critical surface tension of a solid, and the procedure is illustrated in *Figure* 4. A series of small drops of liquid varying in surface tension was placed on the substrate in question, and the contact angles formed by these drops were measured. A plot was then made of the surface tension of the liquids versus the cosine of the contact angle. A straight line was drawn through these points and was extended to the horizontal line represented by cosine ϕ equals one. The surface tension value at this point is designated as the critical surface tension of the substrate. In the example shown, drops of blends of ethanol and water were placed on a cured silicone alkyd substrate. The contact angles were measured and a plot was made of the surface tensions of the drops versus the cosine of the contact angles. In this instance, the line drawn through these points intersected cosine ϕ equals one at a surface tension value of 27.5 dynes/cm. This is then designated as the critical surface tension of the substrate. In a similar manner, the critical surface tension values of numerous other substrates have been determined by a number of researchers.

Table 1 illustrates some typical values of critical surface tension of some common substrates, as found in the literature. The highest value shown here is a film of polyvinyl butyral. Polyvinyl chloride is the second one indicated, and a third is polyethylene, which has a fairly low surface tension value. Applicators of water-based printing inks have found that it is difficult to apply these inks to polyethylene film because of this relatively low critical surface tension value. One solution is to treat the polyethylene in order to raise its critical surface tension. As shown in the table, this treatment can raise the critical surface tension of the polyethylene by 10 units, thereby permitting easier wetting of this substrate by water-based inks. Metallic surfaces such as aluminum, iron, and tin plate generally have a range of critical surface tension values, depending on factors such as the degree of oxidation and the treatment of the metal. The last substrate illustrated is Teflon which has a very low critical surface tension value of 20. We are all aware of the difficulty in wetting Teflon with any organic coating. This results from its extremely low critical surface tension value.

The surface tension values of some typical solvent-free coating resins determined by extrapolation are illustrated in *Table* 2. Melamine, epoxy, and urea resins all have fairly high surface tension values, while a typical alkyd and polyvinyl acetate are substantially lower. As a result, coatings employing alkyd and polyvinyl acetate vehicles will tend to wet substrates more readily than coatings based on melamine or epoxy resins, an experience with which coatings chemists are fairly familiar.

Another important component of the surface tension of a finished coating is the surface tension of the solvents used in the coating. *Table* 3 illustrates surface tension values of a number of commonly employed solvents. Water, the first listed, has by far the highest surface tension, 72.7 dynes/cm. It is well known that water-based coatings in general do not wet substrates as readily as solvent-based coatings. The reason for this is the high surface tension of the water, which makes it more difficult to reduce water-based coatings to a low surface tension value as compared to solvent systems. Ethylene glycol also has a fairly high value, while the other oxygenated and aromatic solvents illustrated vary within a range of 35 to 23 dynes/cm. At the bottom of this table the low surface tension values of two common surface contaminants are illustrated; mineral oil and silicone oil. As a result, if either is present on a substrate, it will be difficult for many surface coatings to flow over this type of contamination.

FLOW PROBLEMS

Substrate Contamination

Figure 5 illustrates two possibilities occurring when a coating is applied over a substrate that has been contami-

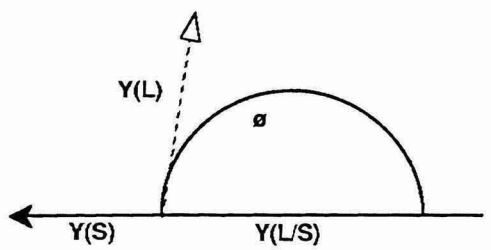

Figure 3—Liquid spreading and Young's equation. A balance of forces gives: Y(Solid) = Y(Liquid/Solid) + Y(Liquid) Cos ϕ

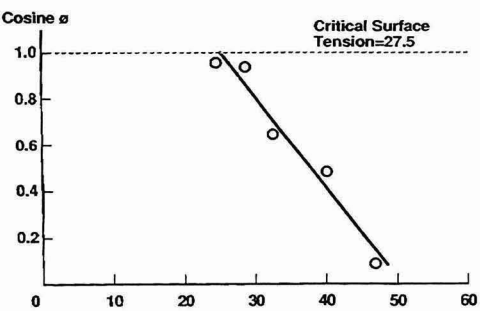

Figure 4—Critical surface tension of a silicone-alkyd substrate

Table 1—Surface Tensions of Substrates

Substrate	Surface Tension Dynes/cm
Polyvinyl butyral	53
Polyvinyl chloride	42
Polyethylene	32
Treated polyethylene	42
Aluminum	37-45
Iron	36-45
Commercial tinplate	30-40
Teflon	20

Table 2—Surface Tensions of Resins (Solvent-Free)

Resin	Surface Tension Dynes/cm
Melamine (HMMM type)	58
Liquid 100% epoxy	46
Urea resin	45
Polystyrene	43
Polyvinyl chloride	42
65% soya alkyd	38
Polyvinyl acetate	37

nated by a drop of oil or other low surface tension contaminants. In *Figure* 5A, the surface tension of the coating is relatively low compared to the contaminant, and therefore the coating is able to flow over this contamination to form a smooth continuous film. Of course the area of contamination could also represent an area of poor adhesion, but at least the coating will be continuous. In *Figure* 5B, the surface tension of the coating is relatively high, substantially higher than that of the drop of contaminant. Therefore, instead of flowing over the contaminant, the coating will tend to pull away from it and the contaminant itself may flow out over the coating, creating what is commonly referred to as "fish eyes" or "craters" in the applied film. If the contamination exists over a large area of substrate, the result is the gross condition called "crawling" of the applied film.

Coating Contamination

Figure 6 illustrates another type of flow problem caused by contamination, but in this case the contaminant exists in the liquid coating itself rather than on the substrate. This contaminant could be droplets of a defoamer that have not been well assimilated into the coating, or some other additive which is relatively insoluble and low in surface tension. If the surface tension of the liquid coating is relatively high compared to the droplets of contamination in the coating, and the coating is applied to a substrate, there will be a movement of liquid away from the drop of contaminant and toward the remainder of the film, since liquids tend to move away from areas of low surface tension and toward areas of high surface tension. The result will be a crater or fish eye in the coating. This type of problem has been observed fairly often in latex paints when an excess of defoamer or an incompatible defoamer, such as a silicone, is used.

Flow Defects Caused by Surface Tension Gradients

It is also quite possible to have flow defects occurring when applying a film onto a substrate without the presence of contamination in either the coating or the substrate. This is quite often referred to as "orange peel." There can be a number of causes of this type of phenomenon, but one mechanism, surface tension gradient, is illustrated in *Figure* 7. When a film is applied to a substrate and the solvent begins to evaporate, differences in surface tension are set up at the liquid surface for a variety of reasons, including differences in temperature, evaporation rate, etc. As a result, surface tension gradients are set up and, the higher the surface tension of the coating itself, the greater the gradients formed. *Figure* 7 illustrates the formation of orange peel or surface irregularities caused by these surface tension gradients. A difference in surface tension has been set up between points A and B on the surface of a liquid applied to a substrate. Therefore, there is a flow of material indicated by J1 and J2 in the sketch on the left, away from point A and toward point B. Liquid accumulates at point B and is deficient at point A as shown on the right, producing an uneven or bumpy surface. It should be noted that orange peel is not always caused by surface tension differences, but is often influenced by the rheology of the coating, as well as the method of application. However, this is a subject to be dealt with in another paper.

EXPERIMENTAL

Surface Tensions of Conventional Versus High Solids Coatings

The first procedure in the experimental portion of this paper was to document that high solids coatings have inherently higher surface tension than conventional coatings. *Table* 4 illustrates the procedure and results obtained with four typical coating vehicles: a long oil alkyd system; a baking alkyd system; a baking acrylic coating; and a baking polyester coating. With each of these types, a typical conventional resin was compared versus a typical high solids resin. Both were reduced with the same solvents to similar application viscosities. The second column indicates the solvents used for each system, mineral spirits for the air-drying alkyd and either methyl amyl ketone or methyl isoamyl ketone for the three baking

Table 3—Surface Tensions of Solvents

Solvent	Surface Tension Dynes/cm
Water	72.7
Ethylene glycol	48.4
Cyclohexanone	35.2
Xylol	30.0
Ethylene glycol monoethyl ether	28.7
Toluol	28.4
Methyl ethyl ketone	24.6
Mineral spirits	24.0
Methanol	22.6
Mineral oil	30.0
Silicone oil	24.0

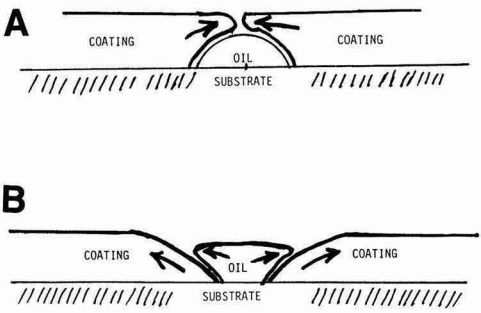

Figure 5—Flow of coating on contaminated substrate

systems. The next two columns indicate the nonvolatile content and the resulting surface tension readings with each of the conventional resins. The last two columns illustrate the nonvolatile content to which the high solids resins were reduced, resulting in approximately equal viscosity versus the conventional systems. With each type, the surface tension of the high solids resin solution was approximately 3 dynes/cm higher than the solution of the conventional resin. This data tends to confirm that high solids systems have inherently higher surface tension than conventional coatings systems, which is a major reason for the increased flow difficulties with the high solids systems.

High Solids Formulations Prepared

The next step in the experimental procedure was the preparation of four typical high solids clear coatings. The formulations for these coatings are given in *Tables* 5-8. The high solids long oil alkyd coating prepared consisted of a commercial 90% nonvolatile long oil alkyd, mineral spirits, and high flash naphtha as thinners, a typical drier system, and methyl ethyl ketoxime anti-skinning agent. The high solids baking alkyd coating consisted of a 90% non-volatile short oil alkyd resin, hexamethoxymethyl melamine as a crosslinking agent, a blocked acid catalyst to accelerate curing, and methyl isoamyl ketone as a solvent. The high solids baking acrylic coating was prepared with a 75% nonvolatile thermosetting acrylic resin, hexamethoxymethyl melamine as a crosslinking resin, and solvents of n-butanol, methyl amyl ketone, and propylene glycol monomethyl ether acetate. The fourth coating was a high solids baking polyester. In this formulation, an 85% nonvolatile saturated polyester resin was employed along with hexamethoxymethyl melamine, a blocked acid catalyst, and methyl amyl ketone as a solvent. The nonvolatile contents of three of these formulations were at or close to 70%, while the nonvolatile content of the baking acrylic coating was substantially lower at about 59%.

FLOW AGENTS EVALUATED

Table 9 describes the five flow agents which were evaluated in this study. These are all commercial products commonly employed in high solids coatings formulations. The compositions are proprietary, but illustrated in the table is the description offered by the additive manufacturers. For convenience, the letters shown on the left in the table will be used in describing our results on adding these products to the four coatings systems described previously. A actually represents the control sample without any addition. B is an acrylic polymer, while C, D, E, and F are all silicone based additives. The surface tension values of the additives themselves, as measured with the DuNuoy tensiometer, are given in the right column. We note a fairly broad range of surface tension values ranging from a minimum of 23.5 for Agent D to a maximum of 33.5 for Agent B, the acrylic polymer. The results following will confirm a rather rough correlation between these surface tension readings and the efficiency of the agents in reducing the surface tension of the coatings. These agents were added to the coating formulations at a uniform level of 0.5% based on total weight, which is reasonably close to the typical recommendations of the manufacturers. However, it should be noted that this level may not be optimum for all of these agents in all of the systems evaluated.

RESULTS

Air-Drying Alkyd Coating

The results upon addition of the flow agents to the air-drying high solids alkyd coating are shown in *Table* 10. Surface tension values were measured with the DuNuoy tensiometer as before. Flow and crawling were observed with two mil drawdowns of the coating samples on either bare steel or contaminated steel. We realize that this is, in a sense, an artificial method since the coatings are usually applied either by spraying or brushing. However, we felt that it was important to make comparisons at uniform film thicknesses and under uniform application conditions. Upon observing the column of surface tension values, it is noted that Agent B, the acrylic polymer, and Agent F, the 10% solution of a modified silicone polymer, had relatively little effect on surface tension. Agent C, the paint compatible silicone resin, produced the greatest reduction

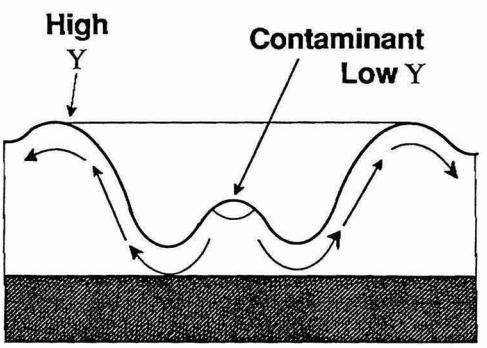

Figure 6—Poor flow due to coating contamination

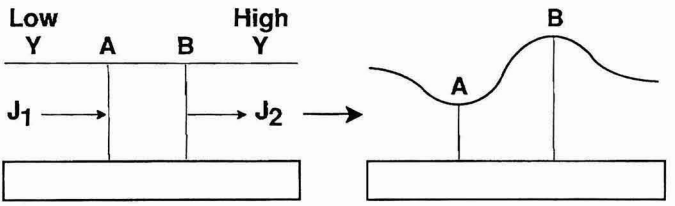

Figure 7—Orange peel caused by surface tension gradients. γ—surface tension; J—flow of material

in surface tension, 2.6 dynes/cm. Agents D and E, the surfactant modified silicone copolymers, also reduced surface tension but to a lesser extent. Flow and crawling were rated numerically on an arbitrary basis with zero indicating perfect flow or complete absence of crawling, and five indicating poor results. The flow column represents the degree of surface irregularity or orange peel in applying the coatings over a clean steel substrate. Crawling was measured by applying the samples over a steel substrate which had been contaminated with either a stripe of mineral oil or a stripe of silicone oil. The crawling rating shown represents an average over different types of contamination.

The flow of the control sample in this system was relatively good, with only slight irregularities shown. Agent B, the acrylic polymer, and Agent F, the 10% silicone resin solution, did not produce any improvement in flow. The silicone additives C, D, and E did eliminate all indications of orange peel or film uneveness.

Agent B and Agent F produced little or no improvement in crawling over contaminated substrates. In contrast, Agents C, D, and E, were all fairly effective, particularly Agent C. It can be noted that Agent C also was the one which produced the greatest reduction in surface tension. In fact, the efficiencies of C, D, and E in eliminating crawling is more or less in proportion to their surface tension reducing ability.

In many applications of high solids coatings, the ability to apply a second coat over the first coat is of importance. It has been observed that some flow agents, particularly silicone types, have a tendency to reduce recoatability. This property was measured by applying a second coat of the samples over the first coat after four days of drying. The second coat was dried four days and a ⅛-in. crosshatch pattern was cut in the coating. Cellophane tape was applied over the crosshatch and pulled off rapidly, followed by an observation of the degree of removal of the second coat. The recoating rating in this and the following tables is based on both the degree of removal and the tendency for edge crawling of the second coat. In the air-drying alkyd system, Agent C was observed to give poor results for recoatability, while Agent E was also deficient in this property. Unfortunately, Agent C also was the most effective agent for reducing crawling. Agent D was somewhat less effective, but it would be preferred in this system if recoating is a requirement.

Baking Alkyd Coating

The results upon adding the flow agents to the high solids baking alkyd system are indicated in *Table* 11. Note that Agent B, the acrylic polymer, had the least effect in reducing surface tension and also was quite ineffective in improvement of either flow or crawling. Agent C produced the greatest reduction in surface tension, more than five units, and it was also quite effective in improving both flow and crawling. However, Agents D and E were equally effective for flow and crawling improvements, and although they did reduce surface tension, it was not reduced to the same extent as Agent C. Agent F produced a moderate reduction in surface tension, but only a slight improvement in crawling, and actually had an adverse effect on film flow.

Recoating was determined by applying a second coat of each sample over the first coat, with both coats baked separately at 350°F for 15 min. As before, the ratings reflect both edge crawl of the second coat and loss of intercoat adhesion. Agents C and E, two of the silicone compounds, failed this test, exhibiting both edge crawl and poor intercoat adhesion. Agent D, however, developed good recoating properties, and is therefore the best choice for this system, particularly where recoating is required.

Baking Acrylic Coating

Table 12 illustrates the results upon adding the flow agents to the high solids acrylic baking coating. In this series, Agents C, D, and E had similar effects on surface tension, reducing these values by approximately 3 to 3½ dynes/cm. These three agents were also very effective for both improvement of flow and elimination of crawling over a contaminated substrate. In contrast, Agent B, the acrylic polymer, had much less effect on both surface tension and flow properties. Agent F, the 10% silicone solution, adversely affected both flow and crawling.

Table 4—Coatings Surface Tension—Conventional vs High Solids

		Conventional		High Solids	
System	Solvent	N.V.	S.T.	N.V.	S.T.
Long oil soya alkyd	Mineral spirits	47	27.5	73	30.5
Short oil baking soya alkyd	MIAK	41	30.6	70	33.7
Baking hydroxyl functional acrylic	MAK	41	31.6	70	34.0
Baking hydroxyl functional polyester	MIAK	50	31.5	70	34.9

Table 5—High Solids A.D. Alkyd Coating

	Grams
Long oil alkyd—90% in MS/xylene	513.0
Mineral spirits	115.0
High flash naphtha	18.0
6% cobalt drier	3.2
12% zirconium drier	35.0
o-Phenanthroline	0.9
Methyl ethyl ketoxime	1.0
	686.1

Nonvolatile = 70%.

Table 6—High Solids Baking Alkyd Coating

	Grams
Short oil alkyd—90% in PMA	457
Hexamethoxymethyl melamine	103
Blocked acid catalyst	10
Methyl isoamyl ketone	169
	739

Nonvolatile = 69.6%.

Table 7—High Solids Baking Acrylic Coating

	Grams
Thermosetting acrylic—75% in MAK	429
Hexamethoxymethyl melamine	107
n-Butanol	129
Methyl amyl ketone	38
PM acetate	26
	729

Nonvolatile = 59%.

Table 8—High Solids Baking Polyester Coating

	Grams
High solids polyester—85% in PMA	467.0
Hexamethoxymethyl melamine	132.0
Blocked acid catalyst	10.6
Methyl isoamyl ketone	155.0
	764.6

Nonvolatile = 69.4%.

Unfortunately, all three of the successful agents had pronounced adverse effects on recoatability, so that if recoating is an important consideration, none of these agents can be recommended. However, it should also be noted that these results were obtained with a specific level of the agents. Based on the excellent results with all three, it is quite possible that lower levels of any or all of them would give satisfactory flow properties and freedom from crawling. Lower levels might also improve recoating properties.

Baking Polyester Coating

The results in the final system, the baking high solids polyester coating, are shown in *Table* 13. The three agents that were most effective in the three previous systems, silicone polymer compounds C, D, and E, were approximately equal in reducing the surface tension of the coating, from 6.7 to 7.3 dynes/cm. However, in this system, the correlation between reduced surface tension and flow improvement is not as direct as it was previously, since Agent E was substantially more effective against crawling than Agents C or D, and Agent C was also less effective for flow improvement. Agents B and F, which produced less surface tension reduction, also were relatively ineffective for flow improvement. In fact, Agent F, as before, had adverse effects on both flow and crawling.

The polyester system apparently has inherent problems with recoating, since the control itself without agents exhibited a degree of edge crawling and is therefore rated as fair for this property. Agents C and E both had adverse effects on recoating, while Agent D gave results equivalent to the control. With this system, it can be said that if recoating is not a major factor, Agent E would be the best choice, but that if recoating must be considered, Agent D could be a satisfactory compromise.

EFFECT OF AGENT COMPATIBILITY

A puzzling aspect of this work was the poor results with Agent F. This agent is a silicone polymer type as are Agents C, D, and E, but in contrast to them, Agent F not only did not help, but actually hurt flow and crawling in a number of systems. One possible explanation can be deduced from the results shown in *Table* 14, which indicates the degree of turbidity imparted to the clear coatings by the addition of the agents. Turbidity is rated from zero, or complete clarity, to five or considerable turbidity. We may assume that turbidity is a rough measure of the degree of compatibility of the agent in the systems. Observing the results for Agent F, we note substantial turbidity in all systems, particularly in the baking coatings where Agent F adversely affected flow. This indication of poor compatibility may explain the poor results with this additive. Agent B, the acrylic polymer, impart-

Table 9—Flow Agents Evaluated

Agent	Composition	Surface Tension
A	Control	—
B	Acrylic polymer	33.5
C	Paint compatible silicone resin	26.5
D	Surfactant modified silicone copolymer	23.5
E	Surfactant modified silicone copolymer	26.2
F	Modified silicone polymer—10%	32.1

Table 10—Agents in Air-Drying Alkyd

	Coating Properties			
Agent	Surface Tension	Flow[a]	Crawling[a]	Recoating
A	29.6	1	2.8	Good
B	29.5	1	2.8	Good
C	27.0	0	0.3	Poor
D	27.5	0	0.8	Good
E	28.2	0	1.3	Fair
F	29.1	1	2.5	Good

(a) 0 = Best; 5 = poorest.

Table 11—Agents in Baking Alkyd

	Coating Properties			
Agent	Surface Tension	Flow[a]	Crawling[a]	Recoating
A	32.8	2	2.5	Good
B	31.5	2	3.0	Fair
C	27.5	0	1.0	Poor
D	29.0	0	1.0	Good
E	28.8	0	1.0	Poor
F	29.8	3.5	2.0	Good

(a) 0 = Best; 5 = poorest.

ed substantial turbidity to three of the systems. This could also be a factor in its relatively poor performance as a flow agent. The other silicone polymers, C, D, and E, demonstrated better overall compatibility in the system with one exception, Agent D in the air-drying alkyd.

Agent D did impart turbidity to this system, but it also performed well as a flow agent. The reason for this apparent anomaly is not known at this time. However, since this agent is a blend of surfactants and a silicone polymer, one possible explanation is that one or more of the surfactants employed in the agent exhibits an incompatibility with the system which does not interfere with overall performance. At any rate, it would seem advisable to test the compatibility of an agent by adding it to the clear vehicle of a coating, and to consider rejecting an additive which imparts substantial turbidity to the system.

Table 12—Agents in Baking Acrylic

	Coating Properties			
Agent	Surface Tension	Flow[a]	Crawling[a]	Recoating
A	31.0	3	2.5	Good
B	30.0	2	1.5	Good
C	27.5	0	0	Poor
D	27.8	0	0	Poor
E	28.0	0	0	Poor
F	30.0	4	3.3	Fair

(a) 0 = Best; 5 = poorest.

Table 13—Agents in Baking Polyester

	Coating Properties			
Agent	Surface Tension	Flow[a]	Crawling[a]	Recoating
A	33.5	3	3.5	Fair
B	32.0	3	4.0	Fair
C	26.2	2	1.5	Poor
D	26.8	1	1.5	Fair
E	26.3	1	0	Poor
F	31.0	5	5.0	Fair

(a) 0 = Best; 5 = poorest.

Table 14—Turbidity of Agents in Coatings

Agent	Air-Dry Alkyd	Baking Alkyd	Baking Acrylic	Baking Polyester
B	0[a]	3	2	3
C	0	0	0	2
D	2	0	0	1
E	0	0	0	1
F	2	3	4	5[b]

(a) 0 = Complete clarity.
(b) 5 = Considerable turbidity.

SUMMARY

This paper has reviewed the theory involved in flow and substrate wetting of coatings, emphasizing the importance of surface tension considerations. Experimental work has documented the higher surface tension values of high solids coatings as compared to conventional formulations, which could account for their poorer flow characteristics. Experimental work has determined that flow control agents tend to function by reducing the surface tension of coatings and that there is an approximate, but by no means exact, correlation between surface tension reduction and the efficiency of a flow agent. The compatibility of the agent in the system also appears to be an important factor in efficiency. Finally, the work has demonstrated that silicone polymers as a class can be effective flow agents for high solids coatings, but their efficiency and adverse effects can vary substantially depending on the specific composition of the agent.

ACKNOWLEDGMENT

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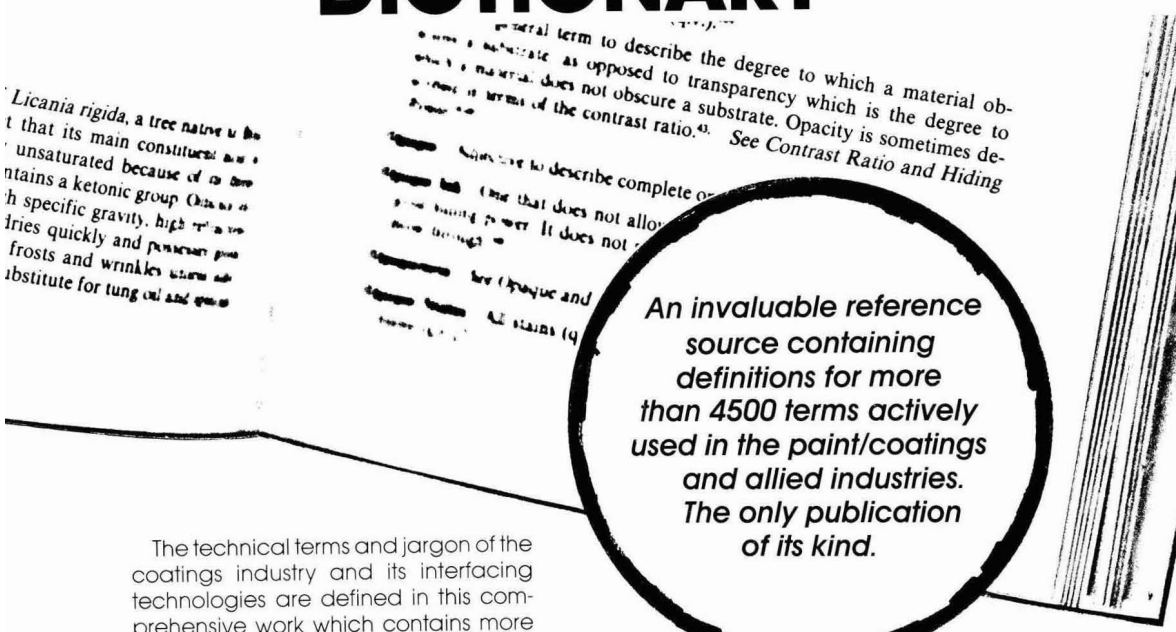

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Novel Approach to Quality Analysis, Optimization, And Control of Film Coating Process

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A novel approach based on statistical clustering is proposed for mathematical description of the film coating process. The approach provides a relationship between various quality outcomes of the product and particular regions in the operational space of coating variables. Combined with a regression quality model, the approach is used for the quality analysis and prediction, optimization, and stabilization of the process. A recursive version of the clustering procedure, suggested for on-line implementation, is presented.

INTRODUCTION

The manufacturing of photographic materials involves the coating of substrate (web) with several layers including photosensitive emulsions. The coating process consists of preparation and delivery of emulsions, emulsion application, transport, and drying of the wet coated substrate. Theoretically, the coating regime is defined by the variables representing particular stages of the process: chemical and physical characterization of the emulsion, application conditions, speed and tension of the web, and temperature profiles of the dryer zones. The quality of the product depends mainly on the stability of the coating applicator system, which in the case of a multilayer slide (cascade) applicator (see *Figure* 1) is achieved by the proper combination of vacuum, gap width, viscosity, surface tension, flow rate, and web speed. Speed variation of the web during its transport and drying conditions is also important with respect to final film or paper quality. Product quality can be characterized numerically on the scale of 0 to 10 (best quality) by quality inspectors. According to the existing practice, these scores are compared against the established customer acceptance standards and interpreted as "acceptable" or "unacceptable." Unacceptable quality is caused by the following typical defects: streaks, darts, mottle, bars, and remelt.

Acceptable quality of the product can be achieved by the selection of the appropriate coating regime and accurate control of coating variables. Solution of these problems, however, presents a difficult task due to the complexity of the process (poorly known physical nature of the coating process, large number of interrelated coating factors, and significant delays in major dynamic channels), incomplete information (low accuracy of measurements, delays in the information channels, and use of quality inspectors rather than automatic monitoring systems), and presence of a large number of random factors affecting the process (fluctuating characteristics of emulsions, speed of the web, and human factor). Under these circumstances, present practice of regime selection and control is based primarily on the experience and intuition of human operators, and often leads to noticeable quality losses.

The development and application of computer-based methods have great potential for significant improvement of the product quality. However, the existing research is focused primarily on the investigation of the physical nature of the coating process, analysis of particular factors affecting the quality of the product, finding an operable speed within a range of coatability, and identifying the limits on coating thickness.[1-5] Existing mathematical models, particularly fluid mechanical models, reflect generic properties of the coating process and are not suitable for analysis, optimization, and control of a particular manufacturing line where combinations of specific operational conditions and existing practices create unique effects on quality.

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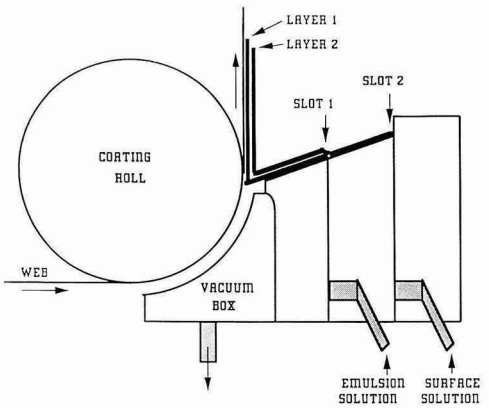

Figure 1—Multilayer slide (cascade) applicator

The development of a mathematical model providing a quantitative basis for process analysis and selection of coating regime are the objectives of the present work.

STATISTICAL CLUSTERING ANALYSIS OF PROCESS VARIABLES

The description of the existing coating technology and practice of the quality rating of the end product leads to the definition of coating as a continuous process with discrete event outputs. Theoretically, the process outcome, defined as "acceptable quality" or "defect #i," can be evaluated by a number, and a mathematical model relating quality measure to the values of input variables could be obtained. On the basis of such a model, the quality of the product can be predicted and controlled. This approach, common in process control, cannot be directly employed in the case of the film coating, primarily due to the large number of coating variables, and unavailability of accurate automatic sensing devices.

It is possible to distribute particular realizations of the coating process, that is, coating regimes and quality outcomes, between different groups on the basis of quality. Then, the following questions arise: how to detect a group of coating variables which serve as the key factors for the particular quality outcome, and what is the minimum number of these factors sufficient for the determination of the quality? Such a problem is common in pattern recognition; a pattern, described by a large number of continuous variables, can be recognized as a pattern of a particular class by analyzing only a small group of dominant variables. These groups of key variables, associated with particular classes, can be selected by processing available statistical data. While many techniques have been developed for the solution of this problem, we will formulate and employ a statistical clustering procedure which generates graphical output, convenient for interpretation.[6]

Assume the following configuration of coating data:

$$\{X,Q,t\} = \{X_1(t), X_2(t), \ldots, X_i(t), \ldots, X_j(t), \ldots, X_n(t), Q(t)\},$$

where

$t = 1,2, \ldots$ is time index,

$X_i(t)$, $i = ,1,2, \ldots n$ are numerical values of the particular coating variables, and

$Q(t)$ is the quality outcome which has only two possible discrete values, $Q(t) = A$ or $Q(t) = B$. (Which corresponds to acceptable or unacceptable quality.)

While $\{X,Q,T\}$ data can be viewed as points in the n-dimensional space of process variables, marked as "A" or "B" depending on the Q(t) value, $\{X_i(t), X_j(t), Q(t)\}$ are projections of these points on the ij-th plane representing a combination of two particular coating variables, X_i, X_j, as shown in *Figure* 2.

While a uniform distribution of A and B realizations can be observed on some planes [*Figure* 2 (top)], a distinctive clustering phenomenon can be observed on another [*Figure* 2 (bottom)]. Occurrence of two distinct clusters on the ij-th plane indicated that:

Variables X_i and X_j are among the factors determining the product quality.

Variables X_i and X_j can provide necessary information for quality prediction. A separating line between A and B clusters can be defined by inspection and used to formulate a quality prediction rule.

Variables X_i, X_j are to be included in the conventional model of quality.

The process control problem can be formulated as "maintaining the numerical values of X_i, X_j variables within the allowed region of the plane."

It is too optimistic to expect that a plane can be found, such that A and B clusters do not overlap. Therefore,

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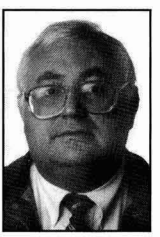

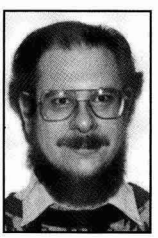

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more than two process variables (more than one plane) have to be involved in the development of a reliable quality prediction rule. However, it is possible to select such planes (or combinations of two process variables) that the overlapping is minimized. If, for example ij-th and km-th planes were selected as the most informative, quality value Q(t) can be predicted as:

$$Q(t) = \begin{cases} A, \text{ if } \{X_i(t), X_j(t)\} \in \{A_{ij}\} \text{ and } \{X_k(t), X_m(t)\} \in \{A_{km}\} \\ B, \end{cases}$$

otherwise, where $\{A_{ij}\}$ and $\{A_{km}\}$ are A clusters in the ij-th and km-th planes.

Selection of the most significant (informative) combinations of process variables requires the numerical characterization of the clustering phenomenon. Such a characteristic can be defined as an "average distance between a point of cluster A and a point of cluster B measured in the ij-th plane" and numerically evaluated for all possible combinations of process variables.

It should be emphasized that the proposed procedure analyzes two-dimensional rather than one-dimensional or multi-dimensional clusters for the following reasons. Analysis of single variables does not allow for the investigation of combined effects of several variables. Analysis of multi-dimensional clusters leads to an excessive amount of calculations, and also does not allow taking advantage of the transparency of two-dimensional clustering patterns.

Block diagram and example of the output of the FORTRAN code implementing the proposed technique are shown in *Figures* 3-5.

CLUSTERING MODEL OF THE COATING PROCESS

The Experimental Coating Machine (ECM) located at Anitec Image Corporation was the source of all statistical data. The machine is equipped with a cascade applicator station and transports web, which is approximately 220 m in length from unwind to rewind. Web speeds in excess of 100 m/min are obtainable. The machine is partitioned into zones which allow pre- and post treatment of the web to specific temperature/humdity environments and separate controlled multizone dryers and chiller zones. Support equipment includes, but is not limited to, web cleaning devices, electrostatic pretreatment (corona) of web, and fluid conditioning equipment (filtration and degassing). The machine is physically similar to most machines producing photosensitive products except that web width is 32.0 cm.

The ECM operates daily, producing photosensitive coatings on polyethylene subbed paper and PET film base. All coatings generated in a six-month period were subjected to a quality evaluation. An expert quality inspector, utilizing a set of visual standards, rated the coated samples. Samples were viewed under standard conditions as back-lit transparencies.

All quality assessments were loaded into a database along with corresponding off-line fluid analysis data and machine variables.

The total number of observations was reduced from above 500 by removal of deviants whose defects had known assignable causes (machine failure, operator error, or fluid instability). The data set was further reduced to films only as the comparison between back-lit coated paper and film caused difficulties.

The final data set included over 200 observations of various product types, colors, and both positive and negative working photographic materials. The majority of these were blocks of factorial designs which boldly covered the fluid and machine variable ranges reported herein.

The clustering model of the coating process relates the quality of the end product to the particular regions in the space of process variables. Statistical clustering analysis of the available experimental data presents a reliable alternative to the direct investigation of mechanisms of particular defects.

Prior to the application of clustering technique, experimental data was reduced by the preliminary analysis to 20 process variables and associated quality grades of the product. The selected coating variables are:

X_1— viscosity of the emulsion layer
X_2— viscosity of the surface layer
X_3— surface tension of the emulsion layer
X_4— surface tension of the surface layer
X_5— temperature of the emulsion
X_6— temperature of the surface layer

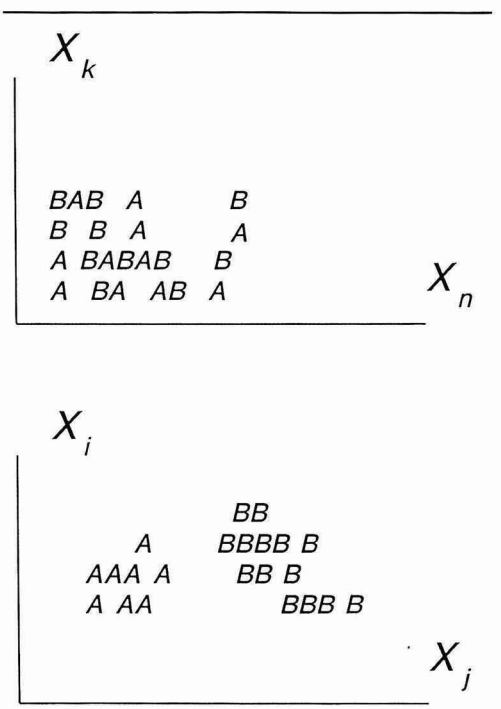

Figure 2—Clustering of realizations (quality). Top: uniform distribution of quality; bottom: distinct clusters

X_7— specific gravity of the emulsion
X_8— specific gravity of the surface layer
X_9— flow rate of the emulsion onto the web
X_{10}— flow rate of the surface layer onto the web
X_{11}-X_{15}— temperature of different zones of the dryer
X_{16}— temperature of the chiller
X_{17}— gap between the web and the hopper
X_{18}— vacuum applied to the meniscus
X_{19}— speed of the web
X_{20}— total capacity of the dryer in pounds water per hour

The first stage of the clustering analysis was aimed at the formulation of the acceptable quality conditions in terms of the coating variables. Particular observations were labeled as A or B depending on acceptable or unacceptable quality grade of the end product. Application of the developed procedure resulted in the formation of distinctive clusters associated with quality A and quality B.

Figure 4, for example, illustrates clustering in the "speed of the web—viscosity of the emulsion layer" domain (in relative units). Inspection of the clustering pattern suggests an arbitrary but functional border line between the clusters:

$$X_{19} - 5.084*X_1 = 255.860$$

Since the cluster A is located below this line, the following requirement constitutes one of the acceptable quality conditions:

$$X_{19} - 5.084*X_1 < 255.860$$

Similar analysis performed on all detected clusters resulted in the following set of acceptable quality conditions (the conditions are listed in descending order of the clustering criterion value; all variables are expressed in relative units):

$X_{19} - 5.084*X_1 < 255.860$
$X_{16} - 114.01*X_7 < 111.545$
$X_{19} < 301.54$
$X_{16} - .255*X_1 < 5.715$
$X_7 + .0044*X_1 < 1.083$
$X_7 + .0344*X_5 < 2.325$
$X_7 < 1.0234$
$X_7 - .0132*X_4 < .6086$
$X_7 + .0059*X_2 < 1.0995$
$X_{16} - 75.572*X_7 < -67.877$

Although the obtained requirements are based on limited statistical data and reflect specific operational conditions of a particular manufacturing process, they summarize experience of process operation in the form suitable for computer-based process operation.

The second stage of this study was aimed at the solution of a typical quality analysis problem: detection of conditions leading to particular defects of the coated film (streaks, lines, bars, etc.). Application of the clustering technique requires that only two distinct classes of quality (A and B) be present in the data base. Therefore, in order to formulate operational conditions responsible, for example, for streaks, the existing observations were relabeled as A, when streaks took place, and B, otherwise. Results of the clustering analysis are illustrated in *Figure* 5, featuring formation of the clusters in the domain of "temperature of zone #5 of the dryer-temperature of the chiller." Inspection of the clustering pattern suggests the following separating line:

$$X_{15} + 2.9689*X_{16} = 55.924$$

and the condition facilitating streaks

$$X_{15} + 2.9689*X_{16} > 55.924$$

The analysis of the entire set of clustering patterns results in the following "streaks conditions":

$X_{15} + 2.9689*X_{16} > 55.924$
$X_2 - 1.4573*X_{16} < 4.9087$
$X_{17} < .00087$
$X_{14} + 2.3495*X_{16} < 51.5815$
$X_{16} + .03741*X_{19} < 16.2812$

While somewhat arbitrary, the obtained conditions present a valid interpretation of existing statistical data. Sets of conditions pertaining to particular defects create a unique opportunity for the detailed analysis of the coating process, improvement of existing practices of process

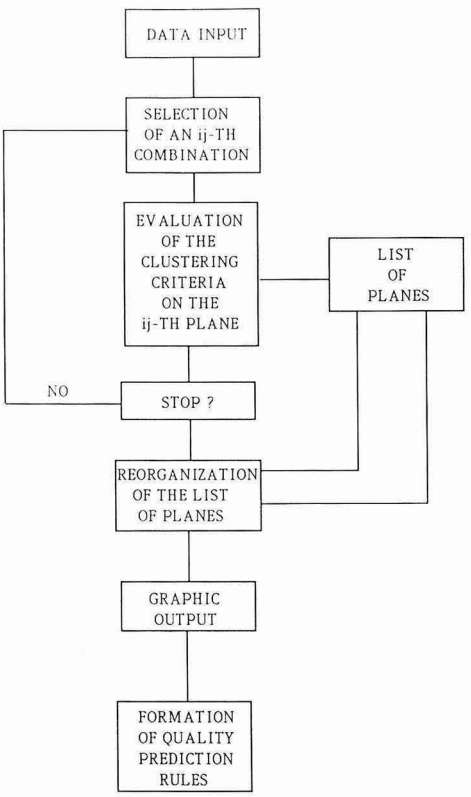

Figure 3—Block diagram of clustering analysis procedure

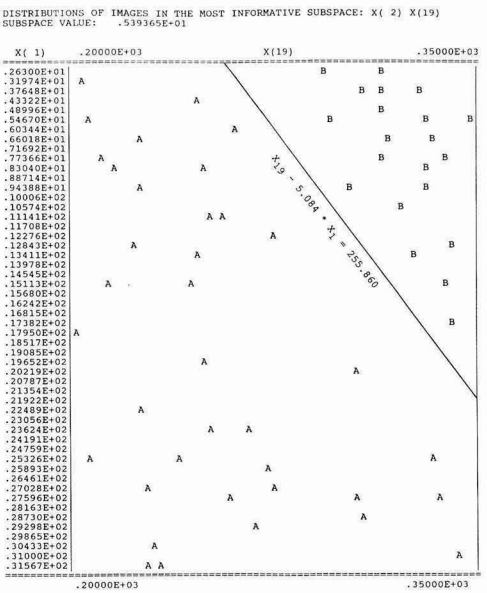

Figure 4—Example of the graphic output of the clustering procedure; acceptable vs unacceptable quality

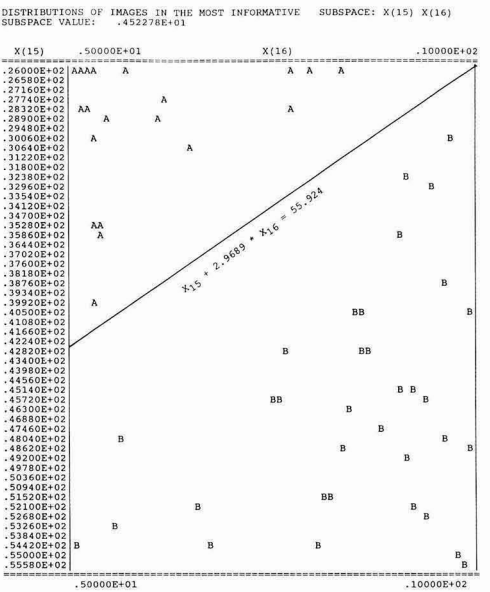

Figure 5—Example of the graphic output of the clustering procedure—streak conditions

operation and control, prediction of the product quality, and generation of warnings to an operator.

REGRESSION MODEL OF QUALITY

The formulated conditions for acceptable quality do not address the issue of optimizing the process. Although the existing practice does not provide accurate numerical measure of quality, it can be expected that estimates are unbiased, and estimation errors are bounded and statistically independent. Therefore, the required quality measure can be defined in the form of a regression model, nonlinear with respect to process variables, but linear with respect to unknown parameters. Such a model was developed by the application of the principle component analysis method[7] which allows one to "weigh" contributions of particular process variables to the model, and results in significant simplification of the final model. According to the results of the principle component analysis, the following variables are responsible for 82% of the production quality: chiller temperature ("weight" 38.5%), zone 5 temperature (14.4%), zone 4 temperature (14.4%), web speed (8.7%), and hopper/web gap (5.8%). These results are consistent with the results of the clustering analysis.

It is important, however, to realize that a particular set of parameters of the obtained quality model reflects only the current status of the process, and accuracy of the model can be maintained only by continuous adjustment of these parameters.

RECURSIVE STATISTICAL ANALYSIS

The suggested clustering and regression analyses imply accumulation of a certain amount of statistical data, and consequent extraction of the required information from this data. Such procedures are appropriate for "off-line" applications such as quality analysis and regime selection. An "on-line" procedure operates on a recursive basis, dealing exclusively with "prior" estimates and the recent measurements. Recursive statistical procedures are typically used for accumulation of available information in a continuously updated model. The recursive estimation procedures are numerically efficient and, therefore, are capable of tracking time-varying characteristics of the coating process, providing a reliable basis for on-line process prediction, operation, and control. However, performance of recursive estimation greatly depends on the accuracy of initial estimates. The common approach implies application of conventional estimation for finalizing the configuration of mathematical models and estimation of model parameters. Then the obtained estimates are used as initial estimates in recursive procedures.

Recursive analysis of the coating process includes development of recursive regression and clustering models. While the first model can be easily serviced by a recursive least squares procedure,[8] the following is the special procedure developed for the clustering model.

The clustering procedure described previously requires that the entire data array be processed simultaneously. Development of an on-line, that is, recursive clustering procedure, implies that already selected combinations of informative variables will be reevaluated each time when

an additional portion of observation data is received, and the procedure deals only with the recent observation data and prior clustering results. However, the "average distance between a point of the set A and a point of the set B" cannot serve as a recursively estimated clustering criterion. The following approach suggests a new definition of the clustering criterion, consistent with the recursive estimation principle.

Consider the coordinates of the geometrical center of the cluster A in a particular plane

$$\{M^a_i(N),\ M^a_j(N)\}$$

where

i, j are indices of the appropriate variables and

N is the total number of data points in the set A.

Coordinates $\{M^a_i(N),\ M^a_j(N)\}$ can be computed recursively as:

$$M^a_i(N) = Ma_i\,(N-1) + \{X^a_i(N) - M^a_i\,(N-1)\}/L$$
$$M^a_j(N) = M^a_j\,(N-1) + \{X^a_j(N) - M^a_j\,(N-1)\}/L$$

where

$L>>1$ is a constant;

$X^a_i(N)$, $X^a_j(N)$ are "posterior" coordinates of the center of the set A corresponding to time N; and

$M^a_i(N-1)$ and $M^a_j(N-1)$ are prior coordinates.

While $M^a_i(N)$ and $M^a_j(N)$ are actually mean values of the appropriate random variables, the variances $V^a_i(N)$, $V^a_j(N)$, and standard deviations of these variables, $S^a_i(N)$, $S^a_j(N)$, can be also evaluated on the recursive basis:

$$M^a_i(N) = M^a_i\,(N-1) + \{X^a_i\,(N) - M^a_i\,(N-1)\}/L$$
$$V^a_i(N) = V^a_i\,(N-1) + \{[X^a_i\,(N) - M^a_i\,(N)]^2 - V^a_i\,(N-1)\}/L$$
$$S^a_i(N) = \{V^a_i(N)\}^{1/2}$$

Knowledge of the mean values and standard deviations of pairs $(X^a_i,\ S^a_j)$ is sufficient for characterization of the distribution of these pairs. Under the assumption that the distribution is normal and X_i is uncorrelated with X_j, it can be expected that approximately 95% of data points of the Set A (actually, projections of these points on the ij-th plane) are located within the ellipse:

$$\{[X_i - M^a_i(N)]/S^a_i(N)\}^2 + \{[X_j - M^a_j(N)]/S^a_j(N)\}^2 = 4$$

A similar analysis can be carried out using recursive estimates of the parameters of the ellipse containing practically all currently available points of the set B. Then, according to *Figure* 6, clustering criterion can be defined as the "distance between ellipse A and ellipse B measured along the line connecting their centers."

Finally, the recursive clustering procedure implies:

(1) Receipt of the recent observation in the form of coordinates $\{X^a_i(N),\ i=1,2,\ldots,n\}$ of a point of class A, or coordinates $\{X^b_i(N),\ i=1,2,\ldots,n\}$ of a point of class B.

(2) Updating of the parameters of the ellipse A or ellipse B (depending on the recent observation data) using recursive formulas for means and standard deviations.

(3) Determination of the coordinates of the intersection points between the straight line connecting centers of ellipses and the ellipse $A - P_1$.

(4) Determination of the coordinates of the intersection points between the straight line connecting centers of ellipses and the ellipse $B - P_2$.

(5) Determination of the clustering criterion as the distance between points P_1 and P_2.

CONTROL OF THE COATING PROCESS

Control of the coating process implies selection and automatic stabilization of a combination of numerical values of coating variables. Natural decomposition of the general control problem results in a logical sequence of "local" problems, such as regime selection, quality stabilization, and stabilization of process variables. These problems are associated with particular decisions on the operation of the coating process and are to be solved with a certain frequency determined by the dynamics of particular groups of process variables. While the stabilization of process variables is a typical digital control problem, the following approach is suggested for quantitative rather than intuitive, and possibly optimal, solution of the first two problems.

Selection of the Coating Regime

Solution of this problem results in the selection of particular numerical values of the most important process variables, detected by regression and clustering analysis, while the rest of the variables are maintained on the experimentally selected levels. This problem is formulated as a process optimization problem, where the optimization criterion is the quality measure, defined via the regression model, and the constraints reflect both feasibility and good quality conditions. While the first group of constraints is self-explanatory, the second one can be formulated on the basis of the clustering model. Mathematically, the problem can be defined as follows:

$$\text{MIN } Q\,(X_i,\ i=1,2,..,n) \,/\, \{C_k(X_i,\ i-1,2,..,n) > C_k,\ k-1,2,..,K\}$$

where

X_i, $i=1,2,..,n$ — are process variables;

$Q(.)$ — is the quality measure represented by a nonlinear regression equation; and

$C_k(.) > c_k$, $k-1,2,..,K$ — are, generally speaking, nonlinear constraints.

Although mathematical programming offers a number of alternative solution methods to such a problem, solution of a nonlinear multivariable constrained minimization problem always constitutes a formidable task. The simplex optimization procedure developed[9] can be viewed as the most reliable optimization tool, equally applicable to linear, nonlinear, continuous, and discontinuous problems. It is suggested that the formulated regime selection problem first be transformed into an unconstrained one by the introduction of penalty functions:

$$\text{MIN } \{Q(.) + P_k[C_k\,(.),\ c_k]\}$$

where penalty functions $P\,[.]$ are defined as follows:

$$P_k\,[.] = \begin{cases} 0 \text{ if } C_k\,(.) > c_k \\ g>>1 \end{cases}$$

otherwise, then the augmented criterion be minimized by application of simplex optimization.

The solution provides the numerical values of the major coating variables, which satisfy the clustering conditions and, therefore, according to the available statistics, assure acceptable quality of the product. However, these values minimize (maximize) the quality measure, and promise the best possible quality within the accuracy limits of the regression quality model.

Please note that the regime selection/optimization problem is to be solved once for every batch of the product. It is expected that a particular set of model parameters, constituting the problem, will correspond to every type of the coated film. Periodically updated, this information will provide a basis for a quantitatively-justified selection of the coating regime for each particular product type.

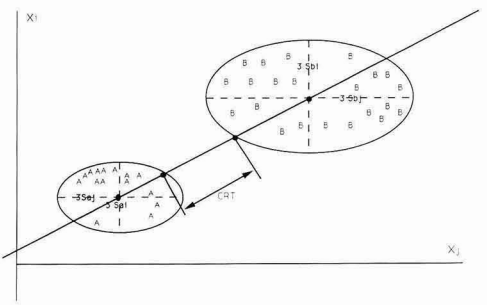

Figure 6—Illustration of the recursive clustering procedure

Quality Stabilization

Although solution of the regime selection problem suggests particular values of the coating variables, it is expected that some of these variables fluctuate during the process operation. This happens due to the fact that such variables as the characteristics of the emulsion chemistry cannot be automatically stabilized. While the regime selection defines only average values of such variables, their current values normally fluctuate about the averages. Under these circumstances, stabilization of the "controllable" process variables in order to maintain the selected coating regime is meaningless. The clustering model establishes ratios between the controllable and "uncontrollable" process variables leading to the acceptable quality of the product, and these ratios (rather than values of single variables) are to be maintained by the solution of the process stabilization problem.

The quality stabilization problem can be formulated as variation of numerical values of controllable variables in order to keep the coating regime within the coating windows established by the clustering analysis, despite the random fluctuation of uncontrollable variables. Therefore, solution of the stabilization problem reflects: current numerical values of all process variables, both controllable and uncontrollable; the set of the feasibility conditions for all variables; and the set of the acceptable quality conditions defined by the clustering model.

By its nature, the previous problem is equivalent to solving a system of linear and nonlinear inequalities. This formulation, however, can easily result in a situation where the solution does not exist at all. Moreover, it is good to realize that constraints reflecting the clustering conditions are probabilistic, and not necessarily to be strictly enforced. Therefore, the stabilization problem is formulated in the form of the following optimization (minimization) problem, resulting in a compromise solution:

$$\text{MIN } \{\Sigma_k P\,[C_k\,(X^c_j + dX^c_i,\ i=1,2,..,3, X^u_j,\ j=r+1,\ r+2,..,n),\ c_k]\}$$

where

X^c_i and X^u_j represent fixed (current) values of controllable and uncontrollable process variables;

Pk[.] are penalty functions defined in the previous section; and

dX^u_i, $i=1,2,..,r$, are increments of the values of the controllable variables, serving as the variables of optimization in this problem.

The solution of the stabilization problem depends on the dynamics of the varying characteristics of the emulsion, such as its density and chemical composition, providing that these characteristics are automatically measured. Solution of the stabilization problem representing the current values of the controllable variables should serve as reference for numerical control systems.

IMPLEMENTATION ASPECTS

Implementation of the proposed approach for computer-based quality analysis and control of the coating process leads to the development of the following program modules and a program-driver initiating the solution of particular problems in accordance with the established hierarchy and schedule:

Data Acquisition: This module is responsible for the continuous updating of the data base and providing recent data to other modules.

Updating of the Clustering Model: Resulting in an upgraded list of significant variables and parameters of constraints representing particular clusters.

Updating of the Regression Model: That is, generation of recent estimates of parameters of the regression model of quality.

Quality Prediction: This problem is to be solved on the basis of clustering model suggesting conditions for each particular outcome of the process in the form of specific regions in the space of process variables. If the predicted outcome is of acceptable quality, the quality rating is to be obtained via the regression model.

Regime Selection: This problem defines recommended values of coating variables, maximizing the expected quality rating of the end product, and satisfying the feasibility and "good quality" conditions.

Quality Stabilization: Solution of this problem generates reference signals to the digital control systems maintaining values of controllable process variables.

Numerical Control: Recommended for stabilization of selected values of process variables.

SUMMARY

Within the many industries that utilize coating technology, quality as a function of fluid and machine parameters is often a subject of folklore. The technique presented in this paper generates formal models presenting a basis for statistical quality analysis, and facilitating computer-based prediction, optimization, stabilization, and control of the coating process. The statistical clustering procedure was initially employed to isolate coating conditions leading to unacceptable product quality. A bounded coating operating window, within which acceptable quality can be assured, was established. The same approach was used for the detection of coating conditions associated with particular types of defects of the end product, specifically streaks. The findings, summarizing experience of process operation, provide some valuable insights in the specifics of the coating process.

The clustering model was used as a basis for a quality stabilization procedure, intended to maintain the coating operation within a desirable window. Since applications of the clustering model are limited to constraint formulation, a conventional regression quality model was developed and, supplemented by the clustering model, was used to formulate the process optimization problem.

Recursive versions of the suggested procedures, operating under varying characteristics of the coating process, were formulated and recommended for implementation in the form of a computer-based process control system.

ACKNOWLEDGMENT

The authors are grateful to Mohamad Riad Khaldy and Adrian Skarvinko for their contribution in this study. The assistance of Kevin Hight is acknowledged as being central to the construction of a quality rating system.

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BALTIMORE .....OCT.

"Dispersants"

The meeting's guest speaker was Eric Johnson, of Rohm and Haas Company, who talked about "The Role of Dispersants in Paint Formulating."

The speaker began his presentation by defining a dispersant. He explained the differences between a good dispersion and a poor dispersion, including the properties that result in the coating. Dr. Johnson stated that a good dispersion will yield good hiding, enhanced gloss, a stronger film, better flow, higher film build, and less spattering. He continued by saying that a poor dispersion will give the opposite properties.

Dr. Johnson went on to describe the dispersion process. He broke the process into three steps: (1) wetting the pigment at the water interface; (2) reducing the pigment agglomerates to primary particles (using a mixer); and (3) stabilizing the resulting dispersion.

The speaker also described the physical chemistry of dispersants, explaining the various electrical charges.

Dr. Johnson presented the criteria for choosing a dispersing agent. He said the decision depends on the following: dispersing efficiency; gloss potential; foaming tendency; divalent ions; corrosion resistance; wet adhesion; early water resistance; and thixotropy.

Upon selection of a dispersing agent, the speaker stated that the amount needed is dependent upon viscosity testing. The optimum amount of dispersant is determined by adding small amounts and watching the viscosity decrease. When the viscosity begins to increase, the optimum amount of dispersant to be used has been reached.

Jim Smith, *Secretary*

CHICAGO .....NOV.

"Human V.O.C."

Roger Sether, Manager of Risk Management, of Wicks Lumber Company, gave the evening's presentation. His talk was on "Human V.O.C. (Victims of Crime)."

The speaker, a former police detective, a founder of the Illinois State Crime Stoppers Association, and a graduate of the National Crime Prevention Institute, attended the Royal Canadian Mounted Police College in Ottawa, Canada.

Mr. Sether's talk focused on safety. He presented suggestions to prevent crimes from taking place, including: good locks on doors; solid cored entry doors; securing sliding patio doors by drilling two vertical holes in the top of each door frame and screwing metal screws upward until they almost touch the upper door channel; leaving the car in the driveway whenever leaving home for any extended period of time; disconnecting radio controlled garage door openers and locking the garage doors; leaving a radio playing, preferably on a timer, leaving lights on (a bathroom is a good choice); if using timed lights, use several and stagger the timing.

The speaker talked about other common sense safety items, for example, never go into a strange or high crime area alone, especially at night; at night, park in well lighted areas and try to back into parking spaces; always look into the back seat of a car before opening the doors; and always have a plan of exit from a possible ambush, running toward people, not away from them.

Clifford O. Schwahn, *Publicity Photographer*

CLEVELAND .....SEPT.

"Latex Film Formation"

The traditional President's Gavel was turned over to incoming President Richard J. Ruch, of Kent State University.

By-Laws Committee Chairman Charles K. Beck, retired, read to the membership two proposed resolutions to the Standing Rules of the Federation; no vote was taken at the meeting. Resolution I, Article XIII, A-1 is in reference to the Society Representative and Alternate Society Representative being an Active member in good standing to hold these offices. Resolution II, Article XV, pertained to the procedures on how to impeach an officer.

The meeting featured two speakers, including Society Technical Committee Chairman Freidun Anwari, of Coating Research Group, Inc. Mr. Anwari presented the Technical Committee papers on "Changes in Hiding During Latex Film Formation, Part II" and "Part III."

The Technical Committee developed a method, which employed a computer-interfaced spectrophotometer, to observe the changes during the actual drying process. Mr. Anwari said three types of behavior were observed. In low pigment volume concentration (PVC) paints, the hiding decreases to a final constant value (Case I); the wet paint hides better than the dry film. In higher PVC paints, hiding decreases to a minimum, then increases to a final constant value (Case II, again the wet paint hides better than the dry film). In very high PVC, the hiding decreases to a minimum and then increases to a final value, however, the dry film now hides better than the wet paint.

According to the speaker, comparison with other tests (contrast ratio, abrasive scrub resistance, film porosity, etc.), showed that the appearance of a minimum during drying indicated that the paint was above the critical PVC (CPVC).

Mr. Anwari went on to describe the Committee's work on pigment packing. It was concluded that the depth of the minimum during drying quantitatively measures the dry hiding of a given formulation and that this technique clearly defines regions above and below CPVC that were not identified by other experimental techniques.

Another area investigated by the Technical Committee using the developed technique was the effect of coalescent level, latex particle size, and polymer glass tran-

1990-91 CLEVELAND SOCIETY OFFICERS (l-r): R. Edward Bish, Secretary—Roy Glover, Constance Williams, Society Representative—Fred G. Schwab, President—Richard J. Ruch, Treasurer—Freidun Anwari, and Vice President—Ben J. Carlozzo

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Snyder's Willow Grove Restaurant, Linthicum, MD). JIM SMITH, Eastech Chemicals, 5700 Tacony St., Philadelphia, PA 19135.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.C. MORRIS, PPG Industries (UK) Ltd., P.O. Box 359, Birmingham, B16 OAD, England.

CDIC (Second Monday—Location alternates between Columbus, Cincinnati and Dayton). ALIPIO R. RUBIN, JR., Hilton-Davis Chemical Co., 2235 Langdon Farm Rd., Cincinnati, OH 45237.

CHICAGO (First Monday—alternates between Sharko's Restaurant, Villa Park, IL, and Como Inn, Chicago, IL). WILLIAM FOTIS, Valspar Corp., 1191 S. Wheeling Rd., Wheeling, IL 60090.

CLEVELAND (Third Tuesday—Brown Derby, Independence, OH in Sept., Oct., Nov., Feb., March, April; Jan. meeting, Landerhaven, Mayfield Heights). ROY GLOVER, Mahoning Paint Corp., 653 Jones St., P.O. Box 1282, Youngstown, OH 44501.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). MIKE EVANS, J.M. Huber Corp., 803 Pleasant Valley, Richardson, TX 75080.

DETROIT (Second Tuesday—meeting sites vary). SCOTT WESTERBEEK, DuPont Co., 945 Stephenson Hwy., Troy, MI 48007.

GOLDEN GATE (Monday before third Wednesday—alternates between Francesco's in Oakland, CA, and Holiday Inn in S. San Franscisco). LARRY G. SAYRE, O'Brien Corp., 450 E. Grand Ave., S. San Francisco, CA 94080.

HOUSTON (Second Wednesday—Sonny Look's Sirlion Inn, Houston, TX). TERRY F. COGAN, Raw Materials Corp., P.O. Box 690285, Houston, TX 77269.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). CRAIG HUGHES, Farmland Industries, Inc., P.O. Box 7305, N. Kansas City, MO 64116.

LOS ANGELES (Second Wednesday—Steven's Steakhouse, Commerce, CA). V.C. BUD JENKINS, Ellis Paint Co., 3150 E. Pico Blvd., Los Angeles, CA 90023.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). TIMOTHY FORTNEY, American Dispersion, Inc., P.O. Box 34033, Louisville, KY 40232.

MEXICO (Fourth Thursday—meeting sites vary). ANTONIO JUAREZ, Amercoat Mexicana, via Gustavo Baz 3999, 54030 Tlalnepantla, edo de Mexico.

MONTREAL (First Wednesday—Bill Wong's Restaurant, Montreal). ROBERTO CUBRAL, L.V. Lomas Chemical Co., 1660 Hynus, Dorval, Que., H9P 2N6, Canada.

NEW ENGLAND (Third Thursday—Sheraton Lexington Hotel, Lexington, MA). JOHN LUKENS, D.N. Lukens, Inc., 15 Old Flanders Rd., Westboro, MA 01581.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). MICHAEL FRANTZ, Daniel Products Co., 400 Claremont Ave., Jersey City, NJ 07304.

NORTHWESTERN (First Tuesday after first Monday—Jax Cafe, Minneapolis, MN). JOSEPH WIRTH, Consolidated Container Corp., 735 N. Third St., Minneapolis, MN 55401.

PACIFIC NORTHWEST (PORTLAND SECTION—Third Tuesday; SEATTLE SECTION—Third Wednesday; BRITISH COLUMBIA SECTION— Third Thursday). JOHN BARTLETT, Pacific Bartlett Co., 11813 S.E. 257th St., Kent, WA 98031.

PHILADELPHIA (Second Thursday—Williamson's Restaurant, GSB Bldg., Bala Cynwyd, PA). WILLIAM J. FABINY, Sermaguard Coatings, 155 S. Limerick Rd., Limerick, PA 19468.

PIEDMONT (Third Wednesday—Ramada Inn Airport, Greensboro, NC). ANNETTE SAUNDERS, Akzo-Reliance, P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). JEFFREY STURM, Kop-Coat, Inc., 3020 William Pitt Way, Pittsburgh, PA 15238.

ROCKY MOUNTAIN (Monday following first Wednesday—Zangs Brewery, Denver, CO). ED MCCARTHY, Cyprus Minerals, 8995 E. Nichols, Engelwood, CO 80112.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant, St. Louis, MO). DENNIS CAHILL, Archway Sales, Inc., 4321 Chouteau Ave., St. Louis, MO 63110.

SOUTHERN (GULF COAST SECTION—third Thursday; CENTRAL FLORIDA SECTION—third Thursday after first Monday; ATLANTA SECTION—third Thursday; MEMPHIS SECTION—bi-monthly on second Tuesday; and MIAMI SECTION—Tuesday prior to Central Florida Section). BILLY M. LEE, Kemira, Inc., P.O. Box 368, Savannah, GA 31402.

TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). MIKE HAZEN, L.V. Lomas Ltd., 99 Summerlea Rd., Brampton, Ont., L6T 4V2, Canada.

WESTERN NEW YORK (Third Tuesday—meeting sites vary). MARKO MARKOFF, 182 Farmingdale Rd., Cheektowaga, NY 14225.

sition temperature (T_g). Mr. Anwari stated that increasing latex particle size, increasing polymer T_g, or decreasing coalescent level decreased the dry hiding in dry paint films. According to the speaker, the developed technique is unique in that these trends can be detected in the initial stages of drying.

The meeting's second speaker was Richard Holsworth, of The Glidden Company, who presented "COATING PROBLEMS WITH RECYCLED INTERFACES AND SURFACES."

Mr. Holsworth said several analytical techniques are used when problems are presented in the laboratory, including: microscopy, IR, and FTIR. The speaker described several examples of how these techniques are used to detect where corrosion occurs and to identify surface materials.

In conclusion, Mr. Holsworth demonstrated how analytical testing used today can "thumb print" problems. This identification process usually encompasses several different analytical techniques such as x-ray, IR, and FTIR.

ROY GLOVER, *Secretary*

GOLDEN GATE .....SEPT.

"Latex Gloss Enamels"

Nine Society Past-Presidents attended the monthly meeting, including: Louis Sanguinetti (1963), Gordon Rook (1965), Barry Adler (1966), Neil Estrada (1968), Bud Harmon (1977 and 1982), Ted Favata (1980), Kendall Trautwein (1985), Patricia Shaw (1987), and Timothy Donlin (1988).

Robert Backlin, of Hüls America, presented the traditional Gavel of Leadership to incoming President Gordon Pioch, Consultant.

Mr. Pioch then presented Immediate Past-President Ernest Soldavini, of Hüls America, with a Past-President's Pin and watch. Mr. Pioch also thanked Mr. Soldavini for his many years of service to the Society.

The remaining members of the new Board of Directors were then introduced: Vice President—Jack Duis, of Pacific Coast Chemicals; Secretary—Larry G. Sayre, of O'Brien Corporation; Treasurer—Margaret Hartmann, of Dexter Corporation; and Society Representative—Timothy Donlin, of Pacific Coast Chemicals.

Chairmen for the 1990-91 year also were announced: Educational—Ted Favata, Consultant; Environmental Affairs—Stephen S. Depetris, of The Flecto Company; Manufacturing—Louis Sanguinetti, of Jasco Chemical Corporation; Membership—Patricia Tostenson, of The Carmona Company; and Technical—Robert Athey, of Athey Technologies.

Western Coatings Societies Symposium and Show Chairman Patricia Shaw, of Davlin Coatings, Inc., announced that the symposium will be held at the Hilton Hotel Square, in San Francisco, CA, on February 18-20, 1991.

Society-sponsored scholarships were presented to Jessica Cardana, Lorrie Sanguinetti, and Mark Hughes.

Gerald Allen, of Eastman Kodak, gave a brief overview of the upcoming California Proposition 128 and its potential impact on the paint industry, as well as on the general economy and the population of California.

The meeting's speaker was Sharon S. Kraus, of Rohm and Haas Company, who presented a talk on "THE QUEST FOR HIGHER PERFORMANCE ACRYLIC LATEX GLOSS ENAMELS."

The speaker said that Rohm and Haas conducted a survey in 1988 to define the market for latex products from an applicators viewpoint. It was determined from the survey that latex products were, in general, used by contractors for wall coatings, but were not being used for trim work.

Ms. Kraus then stated her opinions of the good values that latex offers over alkyd products: excellent water resistance when cured, excellent adhesion, easy application, fast dry characteristics, easy clean-up, good VOC statistics, safety, and good waste disposal properties.

According to the speaker, it was concluded that latex products represented good value for the end user.

In conclusion, Ms. Kraus stated that modern latex products are a valid alternative to alkyd products for architectural applications.

LARRY G. SAYRE, *Secretary*

LOS ANGELES ..... NOV.

"Epoxy Resins"

A moment of silence was observed in memory of Orville "Moose" Moran, of Southern California Drum Company, who died recently. Mr. Moran was an active member in the the Southern California paint coatings industry.

Environmental Affairs Committee Chairman Dave Muggee, of E.T. Horn Company, updated the membership on the latest in regulatory behavior.

Mr. Muggee reported that Proposition 128 did not pass.

Also, he stated that the Los Angeles County Fire Department will be asking every company within its jurisdiction to register their acutely hazardous materials annually. In addition, a business plant needs to be submitted for these acutely hazardous materials. Hazardous materials inventory only needs to be updated every two years unless there has been a 10% change in volume. This change must be reported within 30 days. Further information can be obtained from Fire Chief Freeman at (213) 720-5129.

According to Mr. Muggee, California Supreme Court upheld the incorporation of Proposition 65 into the Cal/OSHA Safety Plan. Cal/OSHA said that this will be difficult to implement because of the differences between Proposition 65 regulations and Cal/OSHA regulations. (Proposition 65 is the Clean Drinking Water Act which keeps any business from allowing even detectable amounts of certain cancer-causing chemicals to reach ground water.) Storm water runoff and municipal landfills are the two likely areas that Cal/OSHA inspectors will be trained to evaluate for Proposition 65 violations.

Also, the EPA is requiring generators of waste paint (manufacturing and applicators) to run the EP Toxicity test to determine if it is hazardous waste or not, including waste paint, sludge, overspray, and dirty spray booth filters. The state of California has its own procedure. The EPA procedure can be found in 40CFR Part 261, while the California procedure can be found in Title 22, Section 66680-66740. The EPA test uses acetic acid, while the California test uses citric acid, a better metal complexing agent. Mr. Muggee said some generators are not using the correct procedures to determine percent heavy metal in their waste paint. If atomic absorption is used, it will give a much higher reading since solubility is not a factor.

Manufacturing Environmental Regulations Subcommittee Chairman Jerry L. Mulnix, of Cal Western Paint Corporation, reported that the South Coast Air Quality Management District (SCAQMD) was beginning to enforce Rule 1141.1 which pertains to paint and ink manufacturing.

Mr. Mulnix also said that SCAQMD is amending Rule 1107 to allow the use of high volume transfer pressure spray guns to satisfy the 65% transfer efficiency requirement. However, SCAQMD is discussing a licensing for certified equipment operators, as well as licensing paint users to purchase certain coatings, which will put further burdens on the paint manufacturer.

The speaker was Gary Green, of Pacific Coast Chemicals Company. Mr. Green spoke on "FACTORS AFFECTING LOW TEMPERATURE CURING OF EPOXY RESINS."

The speaker discussed low temperature curing epoxy systems. He also talked about some of the factors affecting the ability of hardener systems to cure epoxy resins. This was used to explain the relationship between minimum cure temperature and hardener type.

The speaker than compared a hardener system versus minimum cure temperature, and discussed cure stages.

Mr. Green explained the four factors used to determine how different systems cure at low temperatures: catalysis, a substance that will alter the rate of the reaction; mobility, the addition of a modifier to permit more complete reaction by increasing molecular mobility; conformation, the shape of the molecule which will help determine the rate of reaction through the second and third state; and active hydrogen availability, the spacing of active hydrogens.

Mr. Green concluded his talk with an explanation of a formula used to estimate the percent epoxy reacted at gel point for different hardeners.

Q. Can you tell us anything new about non-chalking epoxies?

A. Ciba, among others, have some products out that offer UV stability. They do work, but they cost around three to eight dollars a pound. This makes it hard to compete in the present market. Epoxy esters are sometimes thought to offer better UV stability, but as long as they are based on Bisphenol A, they will still chalk.

Q. What is the best 100% solids system to give complete cure at low temperatures?

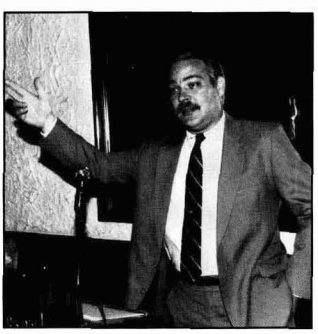
A. The best system is a liquid epoxy resin with a monofunctional diluent such as Epoxide 7 or 8, with Benzyl alcohol or Furfuryl alcohol as mobilizing agents, and to use a hardener with all secondary amines.

V.C. BUD JENKINS, *Secretary*

LOUISVILLE ..... OCT.

"Rheological Modifiers"

Society member Wayne Mattingly, of United Catalysts, Inc., was the meeting's

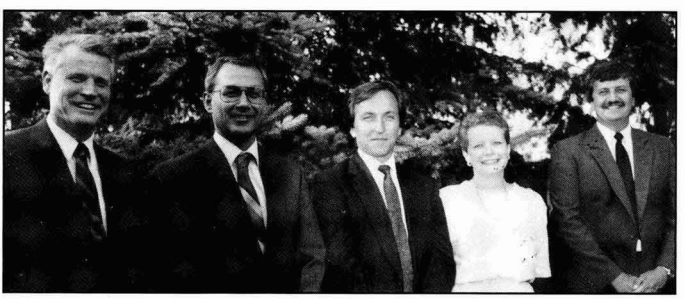


NOVEMBER SPEAKER—Roger Sether, of Wicks Lumber Co., addresses the membership of the Chicago Society on "Human V.O.C. (Victims of Crime)"

1990-91 OFFICERS OF THE KANSAS CITY SOCIETY: Secretary—Craig Hughes, Vice President—Mark Algaier, President—Jeff Laurent, Treasurer—Yvonne D'Arcy, and Society Representative—Norman Hon

OFFICERS OF THE LOUISVILLE SOCIETY FOR 1990-91: Secretary—Timothy Fortney, President—Raymond L. Mudd, Vice President—Kris Grauer, Louis Holzknecht, and Treasurer — Lloyd Browning

MONTREAL SOCIETY EXECUTIVE COMMITTEE FOR THE COMING YEAR: Seated: Society Representative—Horace Philipp, Treasurer—Luc Pepin, President—Robert Benoit, and Vice President—Bruce Bridges. Standing: Corresponding Secretary—Roberto Cabral, G. Belisle, Jean Brunet, Recording Secretary—Richard Bordeleau, V. Pedersen, Y. Abraham, and G. Simpson



OFFICERS OF THE NORTHWESTERN SOCIETY FOR 1990-91: President—Terry Strom, Vice President—Daniel DeChaine, Secretary—Joe Wirth, Treasurer—Sarah Oebser, and Society Representative—Larry Brandenburger

speaker. The topic of his presentation was "RHEOLOGICAL MODIFIERS—A NEW PERSPECTIVE."

The speaker reveiwed rheology, discussing the various ways to measure viscosity and the projected results about the performance of the coatings. He then described the structure, function, and manufacturing of organoclays, placing emphasis on the effects of the quaternary amine location on the swelling properties of the clays.

Mr. Mattingly defined the roles of the organic activator and the temperature requirements for optimizing use of organoclays.

The talk focused on the description and incorporation of castor oil-based thixotropes. The speaker discussed methods for selection of organic thixotropes based on solvent type; processing problems (seeding and false body) and respective corrective actions; and the use of anti-settling agents to keep solids in suspension, prevent hard settling, and improve sag in coatings.

In conclusion, Mr. Mattingly reminded the membership that environmental pressures have led to an increased use of these types of products in the industry and these products offer the formulator a broad spectrum of ways to solve rheological problems.

TIMOTHY FORTNEY, *Secretary*

NEW YORK ..... OCT.

"Stabilization of Coatings"

Environmental Affairs Committee Chairman A. Wayne Tamarelli, of Dock Resins, Inc., reported to the membership the latest in regulatory issues.

Mr. Tamarelli stated that due to the many comments on problems with the New Jersey State Right-to-Know Labeling Requirements, New Jersey is not enforcing the regulations through inspections at the present time. He asked that any company inspected for this regulation to contact the Chemical Industry Council for sharing of information.

Mr. Tamarelli also brought up the Right-to-Act Bill, known in New Jersey as Hazard Elimination through Local Participation (H.E.L.P.), which could allow local groups with 100 signatures to shut down a facility without regard to constitutionally guaranteed due process rights. He stated that the bill, as it now stands, has no trade secret protection and it is a national target for labor unions and environmental activists. He said that the reason the bill was initiated in New Jersey was a result of the assumption that it could be passed in that state. Mr. Tamarelli said that the State Legislature is beginning to understand some of the problems with the bill.

Federation Environmental Affairs Committee Chairman Sidney J. Rubin, of Empire State Varnish Company, Inc., reported the U.S. EPA has published several booklets to help manufacturers understand hazardous waste and pollution legislation. Also, New York City has prepared a summary of its Community Right-to-Know Law.

Ted Friedman, President of the Metropolitan New York Paint & Coatings Association, addressed the membership regarding a new organization, The Environmental Coatings Council (ECC). The ECC was organized by representatives of paint manufacturers, painters, paint dealers, distributors, and suppliers to counter the negative image frequently labeled on the coatings industry. The new group will attempt to present a public awareness campaign "to counter, with a positive effort, the ridiculous claims and statements being made daily by sources who have no understanding of our industry's concern for a cleaner, healthier, more beautiful world."

Mr. Friedman asked the membership for financial support. The membership then voted to donate $500 to the ECC.

Society member Andrew Mar, of CIBA-GEIGY Corporation, spoke on "DEGRADATION AND STABILIZATION OF COATINGS."

The speaker discussed the basic mechanisms for polymer degradation, the visible effects of degradation on coatings, and stabilizing additives and their functions and mechanisms. Dr. Mar gave practical examples of the stabilizing additives in use.

Q. Can you use the ultraviolet stabilizers to coat redwood to keep it from going gray, and would you have to use a varnish with it or could you use it for a primer coat?

A. In our experience, UV stabilizers do work in clear wood finishes and sanding varnishes.

MICHAEL C. FRANTZ, *Secretary*

NORTHWESTERN ..... OCT.

"Corrosion Reduction"

The Society Executive Committee voted to donate $1,000 in scholarship monies to North Dakota State University.

The meeting's first speaker was Lawrence B. Cohan, of Rhone-Poulenc. Mr. Cohan's topic was "CORROSION REDUCTION IN SOLVENT AND WATERBORNE COATINGS USING ZIRCOALUMINATES."

The speaker said the absence of wet adhesion is a fundamental cause of coating failure on metal surfaces. He stated that zircoaluminate adhesion promoters (and pigment dispersants) improve wet adhesion thereby reducing blistering and rusting.

The evening's second speaker was Chicago Society member George W. Goodwin, of Daniel Products Company. Mr. Goodwin's talk was on "OPTIMAL DISPERSION DESIGN."

The speaker said the ultimate quality of any pigment dispersion can be affected by a variety of factors. He stated that careful formulation and milling are required to optimize strength, rheology, and compatibility of a dispersion, as well as its effect on the gloss of the finished coating. In conclusion, Mr. Goodwin said dispersion can be affected by the vehicle, pigment load, or particle size.

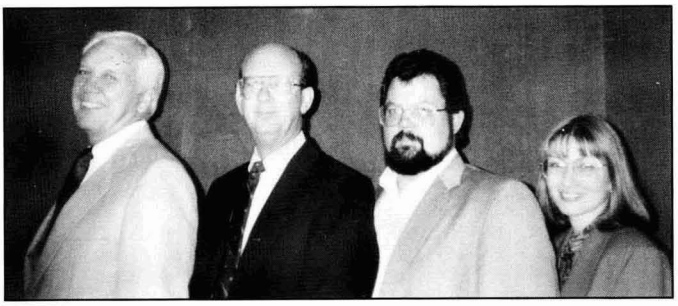
JOE WIRTH, *Secretary*

PHILADELPHIA ..... OCT.

"Acrylic Maintenance Systems"

The 1990-91 Officers who were unable to attend the September meeting were installed, including: President—Christopher H. Huhn, of Arizona Chemical Corporation; Secretary—William J. Fabiny, of Sermagard Coatings; Society Representative—Wayne A. Kraus, of Aqualon Company; Senior Past-President—Lawrence J. Kelly, of Eastech Chemical, Inc.; and

ST. LOUIS SOCIETY OFFICERS FOR 1990-91: Membership Committee Chairman—Howard Jerome, Vice President—Stanley Soboleski Jr., Treasurer—Michael Schnurman, Secretary—Dennis Cahill, President—Terry Gelhot, Society Representative—John Folkerts, and Assistant Treasurer—Chuck Reitter



SOUTHERN SOCIETY OFFICERS FOR THE COMING YEAR: President—James W. Donnelly, Vice President — Vernon Sauls, Secretary — Billy M. Lee, and Treasurer—Mary G. Finnigan

Technical Committee Chairman—Julio J. Aviles, of Kronos, Inc.

Frank Gaffney, of Harry W. Gaffney Company, presented the traditional Hüls-Nuodex presidential gavel to Mr. Huhn.

Society member Robert Washburne, of Rohm and Haas Company, gave the meeting's technical presentation. His talk was "Waterborne Acrylic Maintenance Systems."

The speaker reviewed several performance case histories of thermoplastic acrylics on structures, salt spray resistance testing and its place in actual practice, and new developments for heavy duty performance utilizing an acrylic crosslinker for epoxy systems.

In conclusion, Dr. Washburne said current waterborne technology is making monumental advances and is approaching performance levels comparable to, or in some cases, exceeding solvent-borne counterparts. He stated that the acrylic crosslinked epoxy system is but one approach to improve performance in heavy duty service applications. Dr. Washburne encouraged the membership to consider cyclic QUV condensation testing to better correlate performance to in-field service.

Q. What are the QUV condensation cycle parameters?

A. The testing is conducted per ASTM G53 using four hours condensation and four hours UV cycles.

William J. Fabiny, *Secretary*

PIEDMONT .....OCT.

"Waterborne Resins"

The evening's speaker was Carol J. Williams, of Reichhold Chemicals, Inc., whose topic was "Waterborne Resins—Versatility and Compliance."

The speaker talked about the waterborne resins options that are available to the coatings industry, stressing the fact that performance does not have to be sacrificed to achieve VOC compliance.

In conclusion, Ms. Williams stated that the paint industry is changing for everyone involved. VOC regulations in combination with higher performance requirements are compelling companies to evaluate new resin systems. She said waterborne resins are one way toward meeting the challenge of the future.

Annette Saunders, *Secretary*

PITTSBURGH .....OCT.

"VOC Reduction"

Jeff Goad, of Union Carbide Chemicals & Plastics Company, was the meeting's technical speaker. His topic focused on "VOC Reduction Using Super Critical CO_2."

The speaker explained the process of using super critical CO_2 is UNICARB system. In this process, CO_2 replaces solvents in a spray applied paint.

Mr. Goad said various gases can be used as super critical liquid. However, CO_2 was chosen because: it mixes very well with numerous paint polymers; the critical parameters required are easily attained and are well within airless systems in use today; it has a very low density, 0.47 g/cc; CO_2 rivals hydrocarbons in its solvency; it has very low toxicity; CO_2 is readily available and is inexpensive; and it has no odor and is considered a non-VOC.

The speaker displayed slides of various objects that had been coated using the UNICARB system. He pointed out that many of the items in the slides had been coated with paint bought off the shelf. The paints required thinning to spray, but were merely mixed with supercritical CO_2 and sprayed. VOC levels using this process for furniture and automotive paints were reduced from over 6 lb/gal to less than $4\frac{1}{2}$ lb/gal.

Q. What is the cost of licensing the UNICARB system for a six-gun spray line?

A. We are not really licensing commercial uses yet. Spray equipment companies that we have worked with, particularly Nordson and Graco, could lease or license equipment. The cost of the prototype UNICARB system with six guns would be in the neighborhood of $100,000.

Q. With so much CO_2 being introduced into the spraying area using the UNICARB system, what precautions do you recommend for air replacement?

A. The amount of CO_2 being sprayed is basically negligible in a spray booth because of the large volume of air circulation taking place. If spraying is going to be performed in an area with little or no air circulation, we have attached a CO_2 indicator that is very sensitive. This will alert the applicator if an unsafe air mixture arises.

To reach the TLV limits of CO_2, which is 5000, it will take an extremely high volume spray line with virtually no air circulation.

Jeffrey C. Sturm, *Secretary*

ST. LOUIS .....OCT.

"Flash Rust"

Chicago Society member Patrick Gorman, of Hüls, presented the President's Gavel to incoming President Terry Gelhot, of Spatz Paints, Inc.

Ms. Gelhot gave Immediate Past-President Howard Jerome, of Mozel Equipment Company, a pen and thanked him for his many years of dedicated service to the Society.

Ms. Gelhot announced that the Society has the Macbeth Farnsworth Munsell 100 Hue Color Test. Member companies may borrow the test at no cost.

Society member Michael Van De Mark, of University of Missouri-Rolla, was the speaker for the evening. Dr. Van De Mark's presentation was "Flash Rust Measurement Via Spectral Integration Using a Color Computer."

The speaker explained what flash rust is, why it's important, and how to test for it. Dr. Van De Mark discussed an experiment which was set up to test panels coated with various paints.

Conclusions revealed that most index methods work well, deviation is optimus at five readings, the technique is applicable, and errors were due to humidity changes in the equipment used.

For future testing for flash rust, the speaker recommended: building a better humidity chamber to maintain an accurate humidity and temperature; and test solid anti-corrosive pigments, that is, putting in inert filler pigments.

Dennis Cahill, *Secretary*

Regulatory UPDATE

JANUARY 1991

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 National Paint and Coatings Association, Washington, D.C.

The following are some of the environmental legislative initiatives from the 101st Congress that affect the paint and coatings industry:

Legislation	Description	House	Senate
H.R. 99	Urban air quality	Merged into H.R. 3030; renumbered S. 1630	—
H.R. 1457, S. 585	Voluntary waste reduction	Approved June 25, 1990	Passed as rider to 1990 budget reconciliation
H.R. 2323	Urban air quality	Provisions merged into H.R. 3030	See S. 1630
H.R. 2585	Reduction of toxic air emissions	Provisions merged into H.R. 3030	See S. 1630
H.R. 5827	Surety bond exemption for superfund contractors	Passed October 26, 1990, as S. 3187	See S. 3187
S. 1630	Clean Air Act amendments	Passed	Passed
S. 3187	Surety bond exemption for superfund contractors	See. H.R. 5827	Approved October 27, 1990 awaiting president's signature status of S. 3187

The Environmental Protection Agency (EPA) has announced that the joint committee of the Organization for Economic Cooperation and Development (OECD) is soliciting letters of support from environmental leaders of OECD-member countries, for its project to reduce the risk of five chemicals.

The project centers around methylene chloride, cadmium, mercury, brominated flame retardants, and lead, because they are known to have toxic characteristics related to existing uses. EPA officials said that the objective of the project is "to collect information on existing uses and sources of exposure, chemical fate data and anticipated or known substitutes for the chemicals, and regulatory and non-regulatory actions under way in OECD countries to reduce risks from the substances."

Volunteers from five countries are leading efforts to assemble information on these chemicals. The United States is collecting the data on lead. For further information, contact the office of the Assistant Administrator for Pesticides and Toxic Substances, U.S. EPA, 401 M Street, SW Washington, D.C. 20460, (202) 382-2902.

The Office of Management and Budget (OMB) granted emergency approval to the Environmental Protection Agency (EPA) to require by December 17, 1990, data from producers, importers, transformers, and exporters of certain ozone-depleting chemicals.

The EPA is requiring that companies send EPA 1989 production and consumption data on the chemicals so they can set baseline production and consumption levels and start scheduling specific reductions. Section 114 of the amended Clean Air Act authorizes "any person who operates any emission source or who is subjected to any requirement of the Clean Air Act to provide EPA with the information it needs to carry out the act." The agency maintains that without this information, it will be difficult to inform a company exactly how much they must reduce in the first year of the reduction schedule, until the year is nearly over. The first rule implementing the phase-out schedule must be issued by EPA within 10 months of enactment, which was November 15, 1990.

The ozone-depleting chemicals that the EPA is requiring data on are as follows: CFC-13, CFC-111, CFC-112, CFC-212, CFC-213, CFC-214, CFC-215, CFC-216, CFC-217, carbon tetrachloride, methyl chloroform, and isomers of any of the above chemicals except 1,1,2-trichloroethane, which is exempted under the amended 1990 Air Act. For further information, contact Daniel Blank, U.S. EPA, (202) 475-8894.

The Department of Transportation has announced that although the comprehensive overhaul of the United States rules for the packing and shipping of hazardous materials (HM-181) will technically take effect October 1, 1991, they will actually be phased in over "several years."

The purpose of the rulemaking is to keep in sync the U.S. hazardous materials transport rules with those that go into full effect in all United Nations member countries on January 1, 1991. All shipments to those countries must have U.N.-approved markings and be contained in performance—tested packaging beginning on January 1. Currently, U.S. packagings are determined not on a performance testing basis, but by the substance being shipped.

A representative from the Research and Special Programs Administration said the reason for the January 1, 1991 general compliance date is that all shippers who export overseas will be in compliance with international standards. Otherwise, domestic shipments would require certain markings, and entirely different markings would be required for international shipments. DOT is hoping for publication of the final rule on or before the first of the year. While the DOT is still unsure about the time schedule for phasing in the rules, some industry officials have proposed a five year period for full compliance.

The Department of Transportation (DOT) has announced that it is unlikely they will meet the first deadline for rulemaking on the newly revamped Hazardous Materials Transportation Act (HMTA).

The enactment date for the revised statute was November 16, 1990. DOT was given 30 days from that date to begin issuing rules for an advanced placarding system for vehicles that haul hazardous materials, and for a needs assessment program for a national computerized tracking system for all hazardous materials shipments. DOT was also supposed to initiate a study with the National Academy of Sciences (NAC) as to whether such a tracking system would be feasible and beneficial.

The reason given for the missed deadline is that the Secretary of Transportation has not formally delegated the responsibility of implementing the new requirements of the 1990 HMTA to the Research and Special Programs Administration (RSPA). RSPA is the DOT agency responsible for developing regulations for hazardous materials transportation. Representatives from RSPA are still reviewing the requirements for the HMTA and the food safety legislation (backhauling). They maintain they fully intend to comply with the laws, but there are some setbacks, such as the NAS study that was ordered without appropriations.

States Proposed Legislation and Regulations

California

Testing—A. 45 (Jones) defines the term "regulatory purposes," as used in current law relating to certification of accreditation of laboratories that perform analyses of food, drinking water, wastes and soils.

Air Quality—S. 46 (Torres) revises the definition of toxic air contaminant to delete an exclusion for pesticides, and to include a description of cancer-causing substances. Redefines the threshold level below which no health effects are anticipated. Imposes new duties on the affected agencies, including air pollution control districts and air quality management districts with respect to reducing or eliminating emissions of toxic air contaminants.

S. 84 (Presley) defines the term volatile organic compounds; requires a generator of these compounds to pay a surcharge to the Board of Equalization, at a rate set by the board to generate $20,000,000 per year.

Toxic Substances—S. 48 (Torres) requires a registration form to be filed annually concerning hazardous materials. Authorizes an administering agency to have access to the specified information in the handler's possession prior to the implementation of a Risk Management Prevention Program (RMPP).

Massachusetts

Toxic Substances—H. 3529 z (DiMasi) establishes a fund to assist local Housing Authorities and owners of Private Property Receiving Federal and State Rental Subsidy to remove lead-based paint.

Packaging—H. 4456 z (Roosevelt) promotes environmentally acceptable product packaging.

Michigan

Transportation—S. 1101 z (J. Hart) regulates transportation of certain hazardous materials. Provides for notice of transportation of certain hazardous materials. Provides for registration fees.

New Hampshire

Hazardous Waste—This proposed regulation governs the generation, storage, transportation, and disposal of hazardous waste and the permitting of transporters and facilities. It also contains requirements for recyclable materials, requirements and procedures for household hazardous waste projects applicable for state funds. For more information, contact Ms. Green, Department of Environmental Sciences, Waste Management Division, 6 Hazen Dr., Concord, NH 03301, (603) 271-2920.

New Jersey

Toxic Substances—A. 988 (McGreevey) establishes a regulatory program in the Department of Environmental Protection designed to prevent pollution through the reduction in the use and discharge of hazardous substances; owners and operators of certain facilities at which hazardous substances are used or manufactured would be required to inventory the substances they use or discharge; requires facilities to prepare and submit to the Department pollution prevention plans.

A. 4056 (Charles) establishes presumption that lead toxicity is due to lead paint in residences. From Assembly Committee on Energy and Environment.

S. 2220 (Dalton) establishes a regulatory program in the Department on Environmental Protection designed to prevent pollution through the reduction in the use and discharge of hazardous substances. Establishes as a statewide goal a 50% reduction over five years in the use of hazardous substances, in the discharge of hazardous substances into the air and water and in the generation of hazardous waste. Requires owners and operators of certain facilities to inventory the substances that they use or discharge.

Packaging—S. 2261 (Contillo) requires manufacturers and distributors of packaging or packaging materials to reduce the amounts of toxic substances added to packaging or packaging materials used or sold within the state.

Future Society Meetings

Birmingham

(Feb. 7)—"Can Lines"—R.P. Clarke, Nacanlo Ltd.

(Mar. 7)—"Modern Dispersion Equipment for Surface Coatings"—Colin Bow, Netzsch Ltd.

(Apr. 4)—"1992: A Legislative Update for the Paint Industry"—Tony Newbold, Paintmakers Association of Great Britain.

(May 2)—62nd Annual General Meeting.

Cleveland

(Jan. 15)—Joint Meeting with Cleveland PCA.

(Feb. 19)—"The Use of Ropaque Opaque Polymers in Architectural Coatings"—Dr. Elmer Williams, Jr., Rohm and Haas Co.

(Mar. 19)—"Choosing the Most Effective Dispersants for High Solids Coatings Systems"—Marvin Schnall, Troy Chemical Corp.

(Apr. 16)—"Coatings Characterization by Thermal Methods"—Michael Neag, The Glidden Company.

(May 21)—"Formulation of New Varnishes for Old Master Paintings"—Dr. E. Rene´ de la Rie, National Gallery of Art.

Kansas City

(Feb. 7)—"Environmental Monitoring, Establishing a Baseline for Future Real Estate Transactions and Potential Litigation"—Steve Loosbrock, Terracon.

(Mar. 14)—"New Products from UCC"—Dave Darr, Union Carbide.

(May 10)—"Deforestation and Its Effects on our Global Environment"—Sierra Club Representative.

(June 2-3)—Joint Meeting of St. Louis/ Kansas City Societies.

Louisville

(Jan. 16)—Past-Presidents' Night.

(Feb. 20)—"A Solvent Property and Solubility Parameter Calculator"—Dan King, Exxon Chemical Co.

Montreal

(Feb. 6)—"Type 2 Urethane Associative + Latex Paint = Value Added Performance"—Robert Dey, Rheox, Inc.

(Mar. 6)—"Precipitated Calcium Carbonate to Extend TiO_2."—George Green, Pfizer Minerals.

(Apr. 3)—"Modified S/B to the Rescue for Meeting VOC and Still Produce Quality Coating"—Violet L. Stevens, The Dow Chemical Co.

(May 1)—Progress Report on Technical Committee Projects—A. Brisson, Technical Committee.

New York

(Jan. 15)—"Improve Quality Now—Here's How"—Daniel Baker, McWhorter.

(Feb. 7)—Joint Regulatory and Legislative Update Meeting for the NYSCT/ MNYPCA.

(Mar. 12)—"Polyurethanes in Powder Coatings for Wire and Cable"—Robert Henderson, Mobay Corp.

(Apr. 9)—Diatomaceous Silica Topics—Title to Be Announced— Sid Lauren.

(May 14)—PaVAC Night—"Low VOC Architectural Coatings"—Richard Johnson, Cargill.

Philadelphia

(Feb. 14)—"Meeting the Challenge of the Nineties with VOC Compliant Silicones"—Ronald E. Lowrance, Wacker Silicones.

Rocky Mountain

(Mar. 11)—"Anti-Microbials/Mercury Replacement"—Martin Landau, Hüls America.

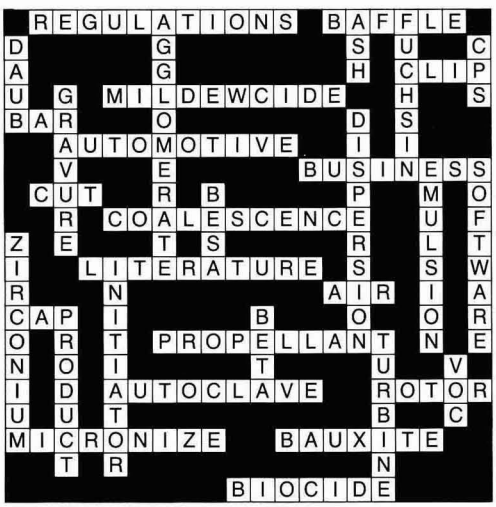
(Apr. 8)—"Pigmented Coatings Problems and Solutions Associated with Particular Size"—Elio Cohen, Daniel Products Co.

(May 6)—"Rama-Poly Alka-Methacrylate"—Joachim Buchse, Rohm Tech.

Toronto

(Jan. 14)—"Polyfunctional Isocyanate Oxazolidine Resins for Automotive Clear Coat Applications"—Bernard Taub, Reichhold. Cambridge Hotel.

(Feb. 11)—"Experimental Design in High Solids Polyurethane Coatings"—Sherri Basner, Air Products. St. James Campus, George Brown College.



Solution to December's *"CrossLinks"*

Book Review

ADDITIVES FOR WATER-BASED COATINGS

Edited by
D.R. Karsa

Published by
The Royal Society of Chemistry
Thomas Graham House
Science Park
Cambridge CB4 4WF
England

Reviewed by
Stanley LeSota
Rohm and Haas Co.
Spring House, PA

There is a considerable amount of high technology that goes into a can of paint. Much of this can be attributed to the sophisticated additives that impart the many desirable properties that have improved water-based paints considerablly—especially over the last decade.

Paints can now be applied at a greater film thickness without spattering by the use of associative thickeners. Greater opacity can be attained with air by replacing some of the titanium dioxide with microvoids. More opacity can be obtained from pigments by using the more recently developed efficient dispersants. Greater wet adhesion can be imparted to these paints—even over chalky surfaces. Water resistance can be improved by ionically crosslinking the water sensitive carboxyl groups with zirconium or zinc compounds. Certain clays can be used to impart thixotropy to paints to prevent settling, sagging, and syneresis. Coalescents are used to aid latex film formation and improve film integrity and its attendant improved resistance properties. Glycols are used to impart a longer wet edge to keep the paint film wet longer so it can be applied more uniformly. Microbiocides are used for in-can stability of the wet paint and resistance to bacteria, fungi, and algae in the dry paint film. Since these water-based paints are sometimes applied to ferrous metals, they require corrosion inhibitors. Surfactants needed to prepare the latex and to wet pigments and substrates are prone to foaming and require highly specific foam control agents.

All these additives result in a number of complex interactions, compatibility and stability problems, and require a considerable amount of sophisticated formulation.

This book covers most of these additives thoroughly and is a good update of what is now available to impart these important paint properties. There are separate chapters by different authors covering each additive. Some are more fundamental and describe mechanisms; others are more application oriented. This book strikes a good balance between the practical and the theoretical and there are no mind-boggling mathematical formulas.

Elections

C-D-I-C

Active

Hensley, Mike—Potter Paint Co. of Indiana, Cambridge City, IN.
Ledford, John M.—Akzo Coatings, Columbus, OH.
Linebarger, Jon S.—MAB Paints, Terre Haute, IN.
Palmer, Gary L.—Vance Laboratories, Carmel, IN.
Patterson, Joseph R.—Akzo Coatings, Rockwood, TN.
Smith, Roger M.—Akzo Coatings, Columbus.

Associate

Becker, Alan J.—Schering Berlin Polymers, Inc., Dublin, OH.
Yafanaro, John D.—Kish Crosby, Mayfield Heights, OH.

CHICAGO

Active

Boyd, Scott A.—Valspar Corp., Wheeling, IL.
Czajka, Ted L.—Valspar Corp., Wheeling.
Chiarelli, Phyllis R.—Valspar Corp., Wheeling.
Derbas, John M.—Akzo Coating Inc., Zion, IL.
Fasching, Douglas A.—Valspar Corp., Wheeling.
Galbraith, Ron—Crosfield Chemicals, Joliet, IL.
Garrow, Marlene J.—Valspar Corp., Wheeling.
Johnson, Sherlee E.—Valspar Corp., Wheeling.
Jones, Arthur T.—ANGUS Chemical Co., Northbrook, IL.
Kisha, Laurence W.—Sherwin-Williams Co., Chicago, IL.
Knier, Steve L.—Valspar Corp., Wheeling.
Hagen, Kenneth D.—Valspar Corp., Wheeling.
Mall, David D.—Mautz Paint Co., Madison, WI.
Nesom, Wilson F.—S.C. Johnson Wax, Racine, WI.
Richards, Vance—Ace Hardware Paint Div., Matteson, IL.
Richardson, Thomas W.—Henkel Corp., Countryside, IL.
Ruda, Robert C.—Crosfield Chemicals, Joliet.
Soleim, James C.—Valspar Corp., Wheeling.
Tietz, Anna T.—Sherwin-Williams Co., Chicago.

Associate

Blaustone, Suzanne—K.J. Quinn & Co., Chicago, IL.
Boschan, Alan—Harcros Chemicals Co., Chicago.
DeVaney, John G.—Cabot Corp. Cab-O-Sil Div., Ogden Dunes, IN.
O'Brien, James P.—ANGUS Chemical Co., Northbrook, IL.
Saunders, Craig A.—Atochem North America, Schaumburg, IL.
Schroeder, J. Patrick—Atlas Electric Devices, Chicago.
Truszkowski, William A.—Mozel Inc., Chicago.

Educator/Student

Cash, Ronald T. Jr.—University of Illinois, Arlington Heights, IL.

CLEVELAND

Active

Kluse, Christopher—Cleveland Black Oxide, Cleveland, OH.

Associate

Maio, Nick—Rohm and Haas Co., Westlake, OH.
Ruerson, Paul—Degussa Corp., Akron, OH.
Stasen, Edward R.—The Hall Chemical Co., Wickliffe, OH.
Tsangeos, Michael S.—Donald McKay Smith, Rocky River, OH.

Retired

Brodie, Mary G.—Strongsville, OH.
Keene, Tom H.—Bedford Heights, OH.

DETROIT

Active

Chwalibog, David M.—The R.J. Marshall Co., Southfield, MI.
DelFranco, Guy R.—Pfizer Minerals, Rochester, MI.
Golden, Timothy P.—Monsanto Chemical Co., Auburn Hills, MI.
Lambe, James M.—Peninsula Polymers, Grand Rapids, MI.
Ledingham, Daniel R.—BASF, Detroit, MI.
McGhee, Mario—BASF, Detroit.
Newman, Jeff—Peninsula Polymers, Grand Rapids.

Associate

Barrett, David L.—Cargill, Carpentersville, IL
Hense, Debora L.—PRA Laboratories, Ypsilanti, MI.
Kesler, Wallace L.—PRA Laboratories, Ypsilanti.
Lannefors, Hans O.—Flakt Alpha Division, Madison Heights, MI.
Stein, Diane L.—PRA Laboratories, Ypsilanti.

KANSAS CITY

Active

Bailey, William P.—Davis Paint Co., N. Kansas City, MO.
Freeman, Hylen K.—Cook Paint & Varnish, Kansas City, MO.
Giudici, Daniel G.—Farmland, Kansas City.
McCampbell, Shawn B.—Prosoco Inc., Kansas City.
Morgan, Frances W.—Carter Waters Corp., Kansas City.
Nickols, Richard L.—KC Coatings, Overland Park, KS.
Ward, Michael E.—Davis Paint Co., Kansas City.

LOS ANGELES

Active

Abad, Glen S.—Northrop Aircraft Div., Hawthorne, CA.
Crick, Denese R.—Specialty Finishes Co., Fontana, CA.
Dalton, Randall S.—Ellis Paint Co., Bellflower, CA.
Davis, Paul Gregory—Multi-Chemical Products, S. El Monte, CA.
Panganiban, Marlene N.—Surface Protection Industries, Inc., Los Angeles, CA.
Reyes, George A.—Dunn Edwards Corp., Los Angeles.
Shapiro, Nat—Henry Co., Huntington Park, CA.

Associate

Belanger, Ronald E.—Precision Labs, Orange, CA.
Challinor, John E.—Swansea Minerals Inc., Scottsdale, AZ.
Lynch, Orville—Summit Environmental, Alhambra, CA.
Oldham, Michael E.—K-Kem Corp., Tustin, CA.
Potts, Hilary A.—Union Carbide Chemicals & Plastics Co. Inc., Long Beach, CA.

LOUISVILLE

Active

Fanslau, Robert D.—Valspar Corp., Louisville, KY.
Gaba, William R.—Valspar Corp., Louisville.
Weis, Robert O.—United Catalyst, Louisville.

Associate

Howard, Michael W.—P.B. & S. Chemical Co., Georgetown, KY.

NEW YORK

Active

Mehta, Ashok K.—Benjamin Moore, Newark, NJ.

Retired

Burlage, John W.—Colonia, NJ.

NORTHWESTERN

Active

Chattopadhyay, Ashok K.—Valspar Corp., Minneapolis, MN.
Evanson, Kevin W.—Valspar Corp., Minneapolis.
Landeis, Kelvin L.—Valspar Corp., Minneapolis.
Waelhof, Edwin D.—Valspar Corp., Minneapolis.

Educator/Student

Chubin, David E.—North Dakota State University, Fargo, ND.

PITTSBURGH

Active

Boes, Melissa A.—Valspar Corp., Pittsburgh, PA.
Cimini, Stephen M.—Valspar Corp., Pittsburgh.
English, William H.—PPG Industries, Allison Park, PA.
Patrick, Howard J.—Ranbar Technology Inc., Pittsburgh.

Associate

Alessandro, Carl J.—Byk-Chemie, Strongsville, OH.
Daye, Joanie G.—Air Products, Wexford, PA.
Esckilsen, Bradley A.—Union Carbide Chemicals & Plastics Co. Inc., Zelienople, PA.
Klaus, Joseph C.—Klaus Equipment, Pittsburgh, PA.

ST. LOUIS

Active

Gelhot, Terry M.—Carboline, St. Louis, MO.
Roley, Mary E.—Carboline, St. Louis.
Schneider, Daniel F.—Carboline, St. Louis.
Woodard, Dion D.—Sinnett-El Paco, Maplewood, MO.

Associate

Tolle, Thomas—Burgess Pigment Co., Geneva, IL.

SOUTHERN

Active

Howard, William H.—Burk-Hall Paint, Memphis, TN.
Nemes-Nemeth, Ilona—Sherwin-Williams Co., Fountain Inn, SC.
Setser, William G.—Indurall Coatings, Birmingham, AL.

Associate

Stewart, Rick—Armstrong Containers, Atlanta, GA.
Suddoth, Scott—C.P. Hall, Cordova, TN.

TORONTO

Active

Angelo, Miranda—K.G. Packaging, Ltd., Concord, Ont.
Aroella, Tom—Benjamin Moore & Co., Ltd., Toronto, Ont.
Asarawala, Arun D.—Valspar Inc., Westhill, Ont.
Beyette, Robert A.—Bapco Inc., Concord.
Butler, Mike D.—CIL Paints, Toronto.
Chip, Gerald—Tioxide Canada Inc., Scarborough, Ont.
Clarke, Gillian A.—ICI Autocolor, Toronto.
De Valk, Peter J.—Sico Industries Inc., Etobicoke, Ont.
Deefholts, Ed R.—Sico Inc., Etobicoke.
Ebner, Peter—Bayer Canada Inc., Etobicoke.
Fong, Dominic K.—Fasson Canada Inc., Ajax, Ont.
Godfrey, Neville A.—Sico Inc., Etobicoke.
Hervias, Maria R.—Sico Inc., Etobicoke.
Johnstone, John A.—Bapco Inc., Concord.
Lim, Chow Kwok—Sico Inc., Etobicoke.
Luud, Rein—CIL Paints, Toronto.
Markus, Peter F.—DeSoto Coatings Ltd., Etobicoke.
Mudhar, Kamlaish K.—Valspar Inc., Westhill.
Nakamura, Ron H.—PPG Canada Inc., Mississauga, Ont.
Polidano, Joseph—CIL Paints, Toronto.
Rankin, Jim—CIL Paints, Toronto.
Rowe, Peter G.—B.F. Goodrich Canada Inc., Waterloo, Ont.
Shah, Arvind C.—Sico Inc., Etobicoke.
Singleton, Paul A.—Bayer Canada Inc., Etobicoke.
Snopek, Stan—ICI Autocolor, Toronto.
Vehra, Mohammad Azim—Sico Inc., Etobicoke.
Williams, Gary—CIL Paints, Toronto.

Associate

Ashworth, C. Adam—Canada Square Resins, Toronto, Ont.
Bhesania, Mike K.—Stormont Chem. Ltd., Toronto.
Burnside, David G.—Canada Square Resins, Toronto.
Levert, J. Raymond—Unimin Canada Ltd., Toronto.
McDermott, Terry T.—Hoechst Canada Ltd., Toronto.
O'Halloran, John E.—Sonic Automobile Ent., Pickering, Ont.
Peirson, Scott CB—Grenhall Chemicals, Brampton, Ont.
Perry, Thomas G.—Eagle Picher (Canada) Ltd., Thornhill, Ont.
Richmond, Grant—Ashland Chemicals, Mississauga, Ont.
Thomas, David—Hempel, Dammam, Saudi Arabia.
Woolven, J. David—Dominion Colour Corp., Toronto.

People


J.S. Ostrowski


R.E. Dodge


J.E. Mann


J.C. Hanley

John S. Ostrowski, Vice President for Research and Development, for The Dexter Corporation's Packaging Products Division, Waukegan, IL, has been presented with the Creative Education Foundation's 1990 Colleague Award for Service and Commitment. The award recognizes his 15 years of significant contributions to the Foundation's "Creative Thinking in Research and Development" program. Mr. Ostrowski is a member of the Chicago Society.

The Division also announced the appointment of **Allen S. Fox** to the position of Director of Technology Transfer and Pilot Plant Engineering. He will be responsible for all R & D plant support activities.

Toyoh Kakiuchi has been named to the newly created position of Vice President and General Manager. Since 1974, Mr. Kakiuchi has been Managing Direction of Dexter Midland Inc. (DMKK), Tokyo—The Dexter Corporation's joint venture there with Rock Paint Company.

In other news from Dexter, the Water Management Systems Division-North America group, headquartered in Chagrin Falls, OH, has appointed **James A. Marcrum** as President. He succeeds **T. Daniel Clark**, who was named Vice President/Corporate Development, The Dexter Corporation.

Also, **Theodore M. Gawlicki** has been promoted to Vice President of the Specialty Materials & Services Group of Dexter. Mr. Gawlicki joined Dexter in 1989 as Director of Business Development for the group.

Unichema North America, Chicago, IL, has named **Dale Moline** as Vice President/Sales. In his new position, Mr. Moline has overall responsibilities for the sales of Unichema's full line of oleochemical products within North America.

Ashland Chemical, Inc.'s Industrial Chemicals & Solvents Division, Columbus, OH, has added three market technical specialists to serve its paint and coatings customers. **Nick Tamerlano**, based in Cleveland, OH, will provide on-site technical service to customers throughout Ohio, Michigan, Pennsylvania, and New York. Working out of Louisville, KY, **Kris Grauer** will serve clients in Kentucky, Tennessee, Georgia, and Florida. **Pat Yglesias** will be located in Chicago, IL, and work with customers in Chicago, Milwaukee, WI, South Bend, IN, St. Louis, MO, and Kansas City, MO markets. Ms. Yglesias is a member of the Chicago Society and Mr. Grauer serves as Vice President of the Louisville Society.

The position of District Accounts Manager for Virginia, North Carolina, South Carolina, and the Northeast portion of Tennessee for S.C. Johnson Wax Specialty Chemicals Division, Racine, WI, has been filled by **Roland E. Dodge**. Mr. Dodge will provide sales support for the Joncryl and Jonwax lines in his territory.

Janet E. Mann has joined the staff of ANGUS Chemical Company, Northbrook, IL, as Vice President/Marketing. In this position, she will be responsible for the company's nitroparaffins business in new market areas. Before joining ANGUS, Ms. Mann was the General Manager of Fine & Functional Chemicals at Akzo Chemicals.

The appointment of **Wendell C. Forster** to Account Manager has been announced by McWhorter, Carpentersville, IL. He will handle the company's full line of resins throughout the Los Angeles area. Mr. Forster brings over eight years of coatings experience to this position. He is a member of the Los Angeles Society.

In addition, **Paul Labell** has been promoted to Account Manager for Minnesota, Wisconsin, and the Chicago Metro area. Mr. Labell had previously served with McWhorter's Customers Service Department.

Ronald H. Yocum has been elected to the new position of Executive Vice President for Quantum Chemical Corporation, New York, NY. Dr. Yocum will remain President of the USI Division, a position he has held since 1989, when he was also elected Vice President of Quantum.

Also, **Constantine J. Vitsas** has been appointed National Accounts Manager/Chemicals for Quantum's USI Division. In this position, Mr. Vitsas will be responsible for the sale of ethyl alcohol, vinyl acetate monomer, and acetic acid to customers with multiple plants.

The promotion of **Joseph C. Hanley** to Vice President/Sales has been announced by Columbian Chemicals Company, Atlanta, GA. Mr. Hanley will continue to be responsible for the North American sales organization of the company and will add the worldwide sales organizations and distributor programs for all of Columbian's business areas to his portfolio.

David W. Till has been promoted to the position of Director/Quality Assurance-Worldwide for Columbian. Mr. Till has been with the company since 1968 and has held a series of positions in the laboratory, operations, and quality assurance.

Also, **John G. Pimblott**, with Columbian since 1977, has been named Manager/Quality Assurance-Europe, reporting to Mr. Till. Quality Assurance Managers at all of the company's European operations will report to Dr. Pimblott.

Rhône-Poulenc's Container Coatings Business, Louisville, KY, has appointed **John Grubesic** to the newly created position of Manager/Technical Service. Mr. Grubesic joined the company in 1988 as Account Executive for the Eastern Region.

Kurt Frischmann, formerly Senior Account Manager for the Coatings Division of CIBA-GEIGY, Chicago, IL, has been named National Sales Manager/Coatings for the company's Plastics Division, Hawthorne, NY. Mr. Frischmann will focus the efforts of the sales team on specialty resins and hardeners designed for coatings and civil engineering as well as solid, liquid, and solution epoxy resin materials.

Stephen N. Belote has been appointed Manager/Chemicals, New Products at Eastman Chemical Products, Inc., Kingsport, TN. He replaces **Michael Palmer** who has been appointed Manager/Products Stewardship.

The E.T. Horn Company, La Mirada, CA, has named **Edward E. Gray** as Account Manager in Southern California. His primary responsibility will be servicing the coatings and ceramics industries. Mr. Gray work for Engelhard-Harshaw for 46 years prior to joining E.T. Horn. He is a member of the Los Angeles Society.

Also, **Jeanne R. Doolittle** has been appointed to the position of Account Manager for Southern California for E.T. Horn. Her duties will include the servicing of the construction products and coatings industries. Prior to joining the company, Ms. Doolittle was employed by Core Laboratories and Unocal Corporation. She is a member of the Los Angeles Society.

Most recently serving as Director of Business Development at Leica USA, Deerfield, IL, **Clark Hewitt** has become Director of Marketing for J&W Scientific, Folsom, CA. Mr. Hewitt will direct the company's marketing and sales operations, as well as new product development and technical services.

Hercules Incorporated, Wilmington, DE, has announced that **Thomas L. Gossage**, Corporate Senior Vice President and President, of Aqualon Company, has been elected by the company's Board of Directors as Chairman and Chief Executive Officer, effective January 1, 1991. He succeeds **David S. Hollingsworth**, who had previously announced his plans to retire in early 1991.

Robert Zussman has joined the staff of Troy Corporation, Newark, NJ, as Quality Control Manager. Mr. Zussman brings with him more than 26 years of experience in the chemical industry, largely in the quality control field.

Lonza Inc., Fair Lawn, NJ has reorganized it Chemicals Group into four business units: Performance Chemicals, Functional Chemicals, Inorganic Chemicals, and Organic Chemicals. The following General Managers have been appointed: **William W. "Skip" Huisking, Jr.**—Performance Chemicals; **Milton A. Berube**—Functional Chemicals; **Robert Terranova**—Inorganic Chemicals; and **Richard E. DelGiorno**—Organic Chemicals.

Edward N. Saccoccia has been named Manager of Corporate Environmental Systems for Liquid Carbonic Industries Corporation, Chicago, IL. In his new position, Mr. Saccoccia will be responsible for development and installation of a company-wide environmental compliance system.

Darlayne Glesias has been appointed Marketing Director within Degussa Corporation's Aerosil and Specialty Products business unit, in Dublin, OH. Ms. Glesias joined Degussa in 1984 following six years with Sun Chemical Corporation, Carlstadt, NJ. She is a member of the organization Women in Coatings.

National Decorating Products Association, St. Louis, MO, has announced the retirement of **Lillian Smysor**, Convention Manager. Her vacancy will be filled by **Ruth Wilms**, Assistant Convention Manager and Manager of the Southern and Western regional trade shows. **Noemi Weil**, former Production Manager for *Decorating Retailer* magazine, will assume Ms. Wilms' position.

Peter Yurcisin, formerly Director of Standardization and Data Management with the United States Department of Defense, has been named Senior Vice President and General Counsel of the American National Standards Institute (ANSI), New York, NY. Mr. Yurcisin succeeds **William H. Rockwell**, who retired at the end of 1990.

Unocal Polymers, Schaumburg, IL, has announced the appointment of **James Strickler** to Market Manager for the paper and paperboard industry. An 11-year veteran of the paper industry, Mr. Strickler previously held sales and product management positions for Gen Corporation's styrene butadiene emulsion operations.

Hüls America Inc., Piscataway, NJ, has named **Gary D. Kudwitt** Manager/Marketing within the Silanes and Silicones group. He will be responsible for sales and marketing of silanes and silicones to the U.S. fiberglass and other selected markets.

Western Coatings Societies' Symposium to Explore "Coatings Science for the 90s," February 18-20

The Western Coatings Societies' 20th Biennial Symposium and Show will be held at the San Francisco Hilton Hotel, San Francisco, CA, on February 18-20, 1991. The event is cosponsored by the Golden Gate, Los Angeles, Pacific Northwest, and Rocky Mountain Societies for Coatings Technology.

The theme of this 20th symposium is "Coatings Science for the Nineties." Special program sessions will feature: "Coatings Chemistry and the Law," "Regulation and Industry Responses," "Computer Aids for the Coatings Chemist," and "How to Fight Chemophobia."

Jerome Crowley, of the O'Brien Corporation and President of the National Paint and Coatings Association, will present the Keynote Address on February 18.

The afternoon program session on Feburary 18 will be highlighted by a panel session featuring Mike Allen, of the California Paint Council; Ned Kisner, of Program Advocating Responsible Legislation for the Environment (PARLE); and Robert Wendoll, of El Rap. Their topic of discussion will focus on how environmental issues affect the paint industry.

A special session on "Effective Communications with the News Media" will detail an approach to news media communication that, in the past, has worked effectively. It starts with understanding how the news media works, and covers the specifics of how to respond to interview questions and debate situations. Videotaped examples of corporations in good and bad media postures will be shown. Effective strategies to lessen the impact of editing will be examined. In conclusion, an overall critique of the chemical industries' news media communication in the past will be offered along with a future plan of action.

Technical Program

The symposium will feature the following presentations:

FEBRUARY 18

"Waterborne Nitrocellulose for Wood Coatings"—C.M. Winchester, of Aqualon

"Lithophone: Back to the Future—A Modernized White Pigment"—M. Issel, of Sino-American Minerals & Metals

"Improved Rheological Characteristics of Water-Reducible Formulations with Hydrophobic Fumed Silicas"—M. Nargiello, of Degussa Corporation

"Improved Procedures for Short-Term Evaluation of Protective Coatings for Steel"—B.R. Appleman, of Steel Structures Painting Council

"Formulating Exterior Latex House Paint"—T. Broome, of J.M. Huber Company

"Polymers and Coatings"—M.T. Willis, of State University of Cal Poly San Luis Obispo

"PARLE, Environmental Issues"—Ned Kisner, of PARLE

"High Solids Polyorganosiloxane Polymers for High Temperature Applications"—W.A. Finzel, of Dow Corning Corporation

"El Rap"—R. Welldon, of El Rap

"Identification of Pigments with Modern Instrumentation in a Paint Lab"—R. Kumar, of Hoechst Celanese

"Chemistry Industry Council"—Gerry Allen, of Eastman Chemical

"Flow Agents for High Solids Coatings"—M. Schnall, of Troy Chemical Corp.

"California Paint Council"—Mike Allen

FEBRUARY 19

"Automating Paint Manufacturing Processes with PCs"—C. Hudson, of Pacific Micro Software Engineering

"Quantifying Facts and Phobia"—A. Banoff, of *American Paint Journal*

"Online Information Retrieval. Answering Scientific and Business Questions from the Convenience of Your Office or Lab"—J.L. Grant, of Dialog Information Systems, Inc.

"Chemophobia, Cause or Effect"—M. Murphy, of *Metal Finishing* Magazine

"Statistical Quality Control in Coatings Production"—J. Cawley, of NW Analytical

"Rhetoric of Technical Communications"—A. Shaw, of Shaw Consulting

"Quality Improvement through Employee Involvement"—K. Mercer, of The Glidden Company

"Effective Communications with the News Media—You Can Win!"—D. Greene, of David Greene and Associates

"Rheology Modifiers: Modeling Their Performance in High Gloss"—T. Maver, of Rohm and Haas Company

"Spray Polyurea—100% Solids High Performance Elastomer Systems"—D. Primeaux, of Texaco

"Rheological and Applied Properties of Latex Paints Thickened with Conventional and Hydrophobically-Modified Hydroxyethylcellulose"—W. Vanderslice, of Aqualon

"What the Latex Paint Formulator Should Know About Polymer Emulsions"—R.R. Brown, of Unocal

FEBRUARY 20

"U.S. Patent Protection for Coatings"—R.S. Berman, of Spensley, Horn, Jubas, and Lubitz

"Two Component Isopolyester Urethane Coatings for Plastics"—S. Simpson, of Amoco

"Patents and Trademarks. A Japanese Perspective"—K. Kamasuki, of Spensley, Horn, Jubas, and Lubitz

"Utilization of Hydroxy Terminated Polybutadine in Air Dry Rust Inhibitive Primers"—J. Salitros, of Atochem

"Trademarks for the Coatings Industry"—R. Zaitlen, of Spensley, Horn, Jubas, and Lubitz

"Contamination in Coatings Manufacturing Processes"—H. Machemer, of Troy Chemical Corporation

Spouses' Program

The spouses' program will feature an official spouses luncheon on February 19, at Gabbiano's Restaurant. A Chinese cooking demonstration will be held on February 20. In addition, two optional tours are available: a Victorian house tour and a walking tour of the backstreets of Chinatown.

The speaker for the Spouses' Luncheon is Laurel Pallock, Director of Mediation Service in the San Francisco District Attorney's Consumer Protection Unit. Ms. Pallock will focus on "Consumer Scams," offering advice to how to be better protected.

Registration

Advance registrations will be accepted until February 4. Advanced full-time registration is $110. Spouses registration is $100. A $10 per day fee is charged for an exhibits-only registration.

For more information on registration, contact Debbie Callen, E.T. Horn Co., 2135 Frederick St., Oakland, CA 94606.

REGISTRATION APPLICATION

Western Coatings Societies' 20th Biennial Symposium and Show

HILTON HOTEL
SAN FRANCISCO, CALIFORNIA
FEBRUARY 18, 19, 20, 1991

"Coatings Science for the Nineties"

Registration fees are payable to the **Western Coatings Symposium (WCS).** Mail to: **c/o E.T. Horn Company, 2135 Frederick Street, Oakland, CA 94606.** All checks must be payable in U.S. Funds. Any that are not will be returned. DEADLINE DATE FOR ADVANCE REGISTRATION IS **FEBRUARY 4, 1991.** DO NOT INCLUDE HOTEL ACCOMMODATION FEES WITH THIS APPLICATION.

REGISTRATION FEES:

☐	FULL ADVANCE REGISTRATION	$110
☐	FULL ON SITE REGISTRATION	$120
☐	DAILY REGISTRATION (EXHIBITS & PAPERS ONLY)	$10

INFORMATION FOR REGISTRATION BADGE:

NICKNAME

FIRST NAME LAST NAME

COMPANY

STREET

CITY STATE *(U.S. only)* ZIP

SOCIETY AFFILIATION TELEPHONE NO.

Full Registration includes all technical sessions, exhibits, industry luncheon, and dinner banquet.

SPOUSE'S REGISTRATION AND INFORMATION FOR REGISTRATION BADGE:

☐	FULL ADVANCE SPOUSE REGISTRATION	$110
☐	FULL ON SITE SPOUSE REGISTRATION	$120

NICKNAME

FIRST NAME LAST NAME

Full Spouse Registration includes spousal tour and lunch, dinner banquet, and exhibits. (Does not include industry luncheon.)

ADDITIONAL TICKETS:

☐	DINNER BANQUET	$75	each ticket. Includes dinner, entertainment, tax, and tip.
☐	INDUSTRY LUNCHEON	$35	each ticket. Includes lunches, speaker, tax and tip.
☐	SPOUSAL PROGRAM	$35	each ticket. Includes spousal lunch and tour.

FEES ENCLOSED:

A CHECK MADE PAYABLE TO WCS IN THE AMOUNT OF:

$_____ IS ENCLOSED. SHOW REGISTRATION FEES ONLY. DO NOT INCLUDE HOTEL ACCOMMODATION FEES IN THIS CHECK AMOUNT.

CANCELLATION POLICY: Requests for cancellation will be honored in full ONLY if received by February 4, 1991. No refunds will be made after this date. All cancellation requests must be in writing.

18th Annual Waterborne, Higher-Solids, & Powder Coatings Symposium Scheduled for February 6-8, in New Orleans, LA

The 18th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium, cosponsored by the Southern Society for Coatings Technology and the University of Southern Mississippi, will be held February 6-8, at the Hyatt Regency Hotel, in New Orleans, LA.

The Symposium will focus on the chemistry, formulation, and new developments in waterborne, higher-solids, and powder coatings. Featured presentations are:

Plenary Lecture, "Powder Coatings for the 1990s"—C. Danick, of Cargill, Inc.

"New Alternative Crosslinkers for Hydroxyl Polyesters"—R. Miller and T. Borghard, of CIBA-GEIGY Corporation

"Flamesprayed Thermoplastic Powder Coatings"—E.R. George, of Shell Development Company

"Synthesis and Toughening of Fluorine Containing Thermosetting Powder Coatings"—J.G. Hilborn, J.L. Hedrick, and J.W. Labadie, of AB Wilhelm Becker

"New Polyester Intermediates for Powder Coatings"—L.K. Johnson and W.T. Sade, of Eastman Chemical Products, Inc.

"Hydroxyalkylamide Crosslinkers for Powder Coatings"—K. Wood and D. Hammerton, of Rohm and Haas Company

"Novel Terephthalate Based Polyester Resins"—C.J. Sullivan, of ARCO Chemical Company

"New Polyesters for Highly Weatherable Powder Coatings"—C. Corbalis, R. Miller, L. Kapilow, and F. Cheng, of CIBA-GEIGY

"Templating of Plastics for Coatings"—J.O. Stoffer, L. Wang, and P. Laoharajanaphand, of University of Missouri-Rolla

"Organoclay in High-Solids Alkyd Gloss Paint"—H. Goodman, A.R. Fugler, R. Rowe, and B.R. Waters, of ECC International Ltd.

"New Reactive Diluents for High-Solids Coatings"—S. Dirlikov, P. Muturi, D-Q. Wang, and I. Frischinger, of Eastern Michigan University

"A Morphological Study of Polyurethane Dispersions"—A. Parker, G. Pariente, G. Quinting, P. Yang, S. Rhoades, D. Wolff, and T. Yokoyama, of The Sherwin-Williams Company

"A Strategy for Development of Technologically Sound, Waterborne Silicone Heat-Resistant Coatings"—J.W. Adams, of Tego Chemie Service USA

"Waterborne Silicone Organic Hybrids"—D. Narula, of Dow Corning Corporation

"Silicone Rubber Latex Technology"—D.T. Liles and H.V. Lefler, of Dow Corning

"Solvent Distribution Studies for the Coatings Formulator: Waterborne Container and General Industrial Coatings"—J. Bodwell, D.C. Dehm, and M.P. Law, of ARCO Chemical Company

"Novel Low VOC Waterborne Epoxy Resins with Improved Formability"—D.S. Treybig, B. Dubois, D.S. Wang, and P.S. Sheih, of Dow Chemical USA

"Visualizing Dispersion Morphology via Ultra-Rapid Freezing/Transmission Electron Microscopy"—M.A. Hansen and S.E. Slavin, of Rohm and Haas Company

"A New Generation of Water Dilutable Baking Enamels"—U. Nagorny, of Henkel Corporation

"Water-Reducible Unsaturated Polyester Polymers as Binders for UV-Curable Furniture Coatings"—M.J. Dvorchak and B.H. Riberi, of Mobay Corporation

"Non-VOC Modifier to Improve the Gloss of Waterborne Coatings"—F. Giles Jr., of Union Carbide Chemicals and Plastics Company, Inc.

"Hydrolytic Stability of Vinyl Ester Copolymers"—O.W. Smith, P.S. Martin, and D.R. Bassett, of Union Carbide Chemicals and Plastics Company, Inc.

"Polyurethane Dispersions for Waterborne Basecoat Applications"—R.W. Rumer and R.R. Roesier, of Mobay Corporation.

"Evaluation of a New Family of Wax Emulsions"—P.M. Wiseman and K.G. Metzger, of Michelman, Inc.

"Aluminium Flakes in Waterborne Coatings—Antagonism or Reality?"—R. Besold, of Eckart Werke

"Aluminum Pigment Technology for Waterborne and Powder Coatings in the 1990s"—D.P. Chapman, of Silberline Manufacturing Company, Inc.

"Waterborne Paint Circulation"—P.J. Bankert, of Graco, Inc.

"Low VOC Surfactantless Alkyd Emulsions"—J.W. Gooch and A. Hofland, of Georgia Institute of Technology

"Waterborne Nitrocellulose for Wood Coatings"—E.C. Linsay, S.M. Ahmed, W.A. Kraus, C.M. Winchester, and D.M. Zavisza, of Aqualon Company

"New Waterborne Water Repellents"—D.J. Love, of Rhone-Poulenc Chemicals.

Prior to the symposium, two short courses will be held on February 4-5:

"Modern Coatings Technology"—will provide contemporary information regarding coatings design, formulation, and testing. The lectures are designed to clearly delineate formulation/performance relationships and to convey appropriate methods for technological development of superior yet cost-effective coatings.

"Water-Soluble Polymers"—is organized specifically for industrial scientists and will emphasize synthesis, structural methods of identification, solution properties, and rheological behavior.

Short course registration fee (advance) of $495 includes instruction, preprinted notes, and continental breakfasts.

Registration fee (advance) for the symposium is $395. For those attending both a short course and the symposium, a reduction of $100 in the short course is offered.

Information is available by contacting the University of Southern Mississippi, Department of Polymer Science, P.O. Box 10076, Southern Station, Hattiesburg, MS 39406-0076.

NDSU Announces Spring Short Course Schedule

North Dakota State University (NDSU), Fargo, ND, has announced its preliminary coatings science short course schedule for June. "High Solids and Low VOC Coatings" will be held June 10-14 and "Coatings Science" is slated for June 17-28.

The two courses are sponsored by the Department of Polymers and Coatings and NDSU Extension Service Continuing Education.

The "High Solids and Low VOC Coatings" class will be conducted at a research level with emphasis on how organic, physical, and polymer chemistry concepts are being applied to practical problems. Recent developments will be stressed.

The following topics will be addressed during the "High Solids" course: rheology of clear and pigmented coatings, polymers and oligomers, selection of curing agents and catalysts, analysis of coatings, properties of coating films, and the modern aspects of waterborne coatings.

Integrated coverage of the scientific foundation of coatings technology with examples of their application will be highlighted during the "Coatings Science" short course.

"Coatings Science" topics include: chemistry of resins and crosslinkers, physical chemistry governing coatings behavior, coatings formulation and application, and low VOC coatings. Lectures on current research topics will be presented.

For more information and a brochure describing these courses in more detail, contact Janalee Brandt, Administrative Assistant, or Louis D. Schindler, Program Coordinator, NDSU Extension Service Continuing Education, NDSU, P.O. Box 5819, Fargo, ND 58105.

For additional information on program content, contact Profs. Marek W. Urban or Gordon P. Bierwagen, at NDSU, Fargo, ND 58105.

SSPC Spring Conference Highlights Announced

The Steel Structures Painting Council, ASTM Committee D-1, the National Institute of Standards and Technology, Naval Civil Engineering Laboratory, Paint Research Association (UK), and the National Association of Corrosion Engineers are sponsoring a conference on "Coating Evaluation and Durability," at the Westin William Penn Hotel, in Pittsburgh, PA, on April 29-May 3.

The purpose of the conference is to assess the state of the technology in performance evaluation of coatings, and to set directions for establishing an industry-wide consensus on standard methods for testing coatings, characterizing their condition, using statistics to interpret test data, and reporting results.

The conference will be comprised of approximately 10-12 papers, two concurrent full-day courses on performance evaluation methods and technology, three to four workshop sessions, and an exhibit of products and services for performance evaluation of coatings.

Seminar themes include: "Accelerated Laboratory and Field Testing," "Statistical Methods and Techniques of Evaluation," and "Coating Characterization Techniques."

Featured topics of discussion during the "Accelerated Laboratory" session will be: cyclic versus non-cyclic, accelerated exterior exposure, developing standard cycles, suitability and validity of adding UV, and validity of defects (i.e., scribing).

"Statistical Methods" will focus on: replication and design, predictive methods, reliability life testing, reference paints, long-term performance evaluation, and other statistical methods.

The last session, on "Coating Characterization," will explain: electrochemical (e.g., impedance spectroscopy), mechanical, spectroscopic (e.g., FTIR), and special (e.g., imaging) techniques.

Two courses on performance evaluation will tentatively be held concurrently during the conference. The first course will deal with "Developing a Coating Performance Evaluation Program." Topics to be discussed include: experimental design, panel preparation, laboratory accelerated testing, exterior exposure testing, and interpretation of results.

The second course is "Technology for Characterizing Protective Coatings." The class will cover electrochemical techniques; statistics and modeling; spectroscopic techniques; and specialized topics, such as electron spin resonance, plasma erosion, and imaging techniques.

A proceedings containing the conference papers will be distributed to all attendees following the conference.

For additional information, contact Rose Mary Surgent, Meetings Manager, Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh, PA 15213-2683.

State University of New York Sets Short Courses To Be Held March 18-20, in Orlando

The Institute of Materials Science, State University of New York, New Paltz, NY, will present a short course on "Polymer Blends and Alloys: Phase Behavior, Characterization, Morphology, Alloying Technology," in Orlando, FL, March 18-20.

The course emphasizes the fundamental theories and the practical consequences of miscibility, phase behavior, morphology and characterization techniques. Also included are a comprehensive review of the science and technology of polymer blends, new applications, and case histories that led to successful commercial products.

Topics to be discussed include: miscibility in polymer blends; high temperature miscible blends; processing effects on morphology and mechanical properties; compatibilizers for polymer blends; chemistry for compatibilization of polymer blends/alloys; mechanical properties of high impact polymers; review and recent advances of polymer blends; relationship to material properties; control of morphology and mechanical properties through reactive compounding; effects of chemical interactions in polymer blends; blends of block copolymers with other polymers and resins; physical and mechanical properties of impact modified PC/PET blends; and polymer blends containing acrylonitrile-butadiene-styrene (ABS polymer).

The series of lectures is designed for scientists and engineers who are, or will be, involved in the research and development, the manufacturing, or the applications of polymer blends and alloys.

For more information, write Institute of Materials Science, CSB 209, State University of New York, New Paltz, NY 12561.

* * *

In addition, the Institute of Materials Science, State University of New York, will present a short course on "Crosslinked Polymers: Chemistry, Properties, and Applications," in Orlando, FL, March 18-20.

The objectives of this course are to acquaint scientists with the latest developments in various aspects of crosslinked polymers. The emphasis will be on the discussion of chemistry, processes, applications, and fundamental principles unique to network polymers. Technologically most important classes of crosslinked polymers will be covered in greater detail. A comprehensive list of literature references for the past five years will be provided.

Topics to be discussed include: introduction to crosslinked polymers and interpenetrating networks; chemistry of polyurethanes polymers; applications and processing of polyurethanes; crosslinking of acrylic polymers; waterborne crosslinking polymers; application of polymers in electronics; UV curing of polymers; unsaturated polyester resins: chemistry and properties; unsaturated polyester resins: processing and applications; epoxy resins: materials; and epoxy resins: applications.

The course is designed for scientists and engineers who are already involved in the formulation or use of thermosetting systems (e.g., adhesives, composites, coatings, electronics, printing inks, etc.) and would like an update on the fundamental research and technology of these systems.

For more information, write Institute of Materials Science, CSB 209, State University of New York, New Paltz, NY 12561.

CALL FOR PAPERS

Fifth International Conference On Crosslinked Polymers June 5-7, Luzern, Switzerland

The Organizing Committee of the fifth international conference on "Crosslinked Polymers," to be held June 5-7 in Luzern Switzerland, invites contributions. A major feature of the meeting will be the presentation of the majority of papers via the poster sessions. These will be introduced by rapporteurs who will highlight major themes from the posters, and will be followed by plenary discussion sessions led by specialists in the subject areas. In addition, there will be a limited number of invited and contributed oral papers. Titles and a one-page abstract should be submitted by April 1, 1991 to: Prof. Angelos V. Patsis, Director, Institute in Materials Science, CSB 209, State University of New York at New Paltz, New Paltz, NY 12561.

Du Pont Quality Management Services Releases Seminar Schedule for 1991

Du Pont Quality Management Services, Wilmington, DE, is offering a series of seminars this year. The programs are part of the Product Quality Management Series offered by Du Pont.

"Strategy of Experimentation" is scheduled for: January 29-31—Orlando, FL; February 19-21—Wilmington; March 20-22—Houston, TX; April 16-18—San Diego, CA; May 21-23—Wilmington; June 11-13—Boston, MA; July 16-18—Chicago, IL; September 10-12—Wilmington; October 22-24—Boston; and November 19-21—Wilmington.

"Strategy of Formulations Development" will be conducted: March 19-21—Wilmington; June 18-20—Chicago; September 17-19—Washington, D.C.; and November 19-21—Wilmington.

The course "Experimentation with Robust Product Design" will be held in Wilmington on the following dates: March 5-7, June 11-13, September 25-27, and December 4-6.

Dates and locations for "Leadership of Continuous Improvement" are: January 29—Wilmington; February 12—Atlanta, GA; March 12—Houston; April 16—Wilmington; May 14—Princeton, NJ; June 18—Chicago; July 23—Washington, D.C.; August 20—Wilmington; September 17—San Francisco, CA; October 15—Boston; November 3—Wilmington; and December—Orlando.

"Fundamentals of Continuous Improvement" is slated for: January 31—Wilmington; February 13—Atlanta; March 13—Houston; April 18—Wilmington; May 15—Princeton; June 19—Chicago; July 24—Washington, D.C.; August 22-Wilmington; September 18—San Francisco; October 16—Boston; November 7—Wilmington; and December 4—Orlando.

The seminar on "Solving Tough Quality Problems" is scheduled for: February 5-6—New Orleans, LA; May 13-15—Washington, D.C.; and October15-16—Wilmington.

The dates and locations for "Statistical Process Control" are: February 12-15—Wilmington; April 16-19—Washington, D.C.; July 16-19—Wilmington; September 17-20—Houston; and November 12-15—Wilmington.

"Focus on Data" is slated for: February 12-14—Orlando; May 14-16—Wilmington; and September 24-26—Williamsburg, VA.

Also, the seminar on "Quality Technology for Managers" can be arranged to be conducted on-site for groups of up to 40.

Direct inquiries to Marg Frank, Du Pont Quality Management Services, Linden Park, Rm. 468, P.O. Box 6091, Newark, DE 19714-6091.

V-O-C Is Theme for 21st Western Coatings Symposium

The 21st Western Coatings Societies Symposium and Show will be held during the week of March 23-26, 1993. General Chairman Geneva Wells, of H.M. Royal, has announced that the theme, "V-O-C," does not, in this case, relate to volatile organic compounds. Instead, the theme for the new decade to be explored at the symposium is "Visions—Opportunities—Challenges."

Assisting Ms. Wells are the following chairpersons: *Co-Chairman*—Sandra Dickinson, Harcros Chemicals; *Advisor*—Andrew Ellis, Kronos, Inc.; *Exhibits*—Bill Zimmerman, of Sinclair Paint Company; *Registration*—James Hall, Major Paint Company; *Technical*—John Kulnane, Ameritone Paint, Co..; *Entertainment*—Bruce Cotton, Pluess Staufer; *Publicity*—Melinda Rutlidge, Rheox Inc.; *Printing*—Ron Elliott, J.R. Elliott Enterprises; and *Secretary-Treasurer*—Dick Sutherland, E.T. Horn Co.

HunterLab Announces Spring Color and Appearance Slate

"Color and Appearance" seminars, running from January through June, have been scheduled by HunterLab, Reston, VA.

The seminar has been revised for 1991. The introductory program will emphasize practical solutions and techniques of color and appearance control. Topics to be covered include: understanding appearance, color scales, tolerance selection, instrument geometries, and practical applications. An optional second day offers a hands-on laboratory session.

Course dates and sites are as follows: January 16-17—Wilmington, DE; January 29-30—Long Island, NY; February 6-7—Los Angeles, CA; February 27-28—Charlotte, NC; March 6-7—Toronto, Ont., Canada; March 13-14—San Francisco, CA; March 20-21—Seattle, WA; April 3-4—Chicago, IL; April 10-11—Atlanta, GA; April 17-18—Dearborn, MI; April 24-25—Minneapolis, MN; May 8-9—Cleveland, OH; and May 29-30—Montreal, Ont., Canada.

For more details on the color seminar, contact Hunter Associates Laboratory, Inc., Educational Services Dept., 11491 Sunset Hills Rd., Reston, VA 22090.

"Understanding Basic of Coatings" Course To Be Offered at Fairleigh Dickinson University

The second semester of the course, "Understanding the Basics of Coatings" is being offered by the Joint Education Committee of the New York Society for Coatings Technology and the Metropolitan New York Paint & Coatings Association. The course, designed for persons who have had no previous courses in chemistry, as well as those technologists with some prior training, is being offered on Wednesday evenings for 15 weeks, beginning on February 6, 1991. The location will be Fairleigh Dickinson University, in Rutherford, NY.

Emphasis will be placed on paint formulation and calculations, dispersion techniques, application equipment and test methods. The instructor will be Don Brody, who has been teaching this course for the past 20 years.

Registration applications must be received by January 23, 1991. For information, contact Mildred Leonard, NYSCT Office, Rm. 208, 520 Westfield, Ave., Elizabeth, NJ 072087.

Fundamentals of Color Seminar Schedule Set

Macbeth, Division of Kollmorgen Instruments Corporation, Newburgh, NY, has announced the 1991 schedule for "The Fundamentals of Color " seminar.

Seminar dates and locations are: January 17-18—San Jose, CA; February 7-8, Seattle, WA; February 14-15—Cincinnati, OH; March 7-8, Dallas, TX; March 21-22—Rochester, NY; April 4-5—Cherry Hill, NJ; and April 18-19—Neenah, WI.

The two-day seminar is designed to serve as an introduction to the basic principles of color science. The symposium is oriented toward people involved in the design, production, quality control, or inspection of materials for which color is important. A general understanding and appreciation of the theory and practice of the science of color is the main objective by course end.

The seminar will include lectures and practical demonstrations in the use of visual standards, controlled lighting and viewing conditions, and color measurement instrumentation.

The afternoon of the seminar's second day is an informal workshop, with equipment for viewing colors, measuring colors, and computing mixtures of coloring materials.

Additional information is available from Wanda Smith, Macbeth, P.O. Box 230, Newburgh, NY 12551-0230.

Literature

Fluids Analyzer

A laboratory instrument that measures both the apparent extensional and high rate shear viscosities of fluids has been introduced through literature. By measuring the extensive viscosity of fluids such as inks, paints, coatings, detergents, oil, and others, the user reportedly can learn how extensive flow influences the behavior of these fluids during processing. For more detailed information on the Fluids Analyzer (RFX), contact Rheometrics, Inc., One Possumtown Rd., Piscataway, NJ 08854.

Solvent Recovery Systems

A condensed, full-color brochure describing a full line of on-site solvent recovery systems for a wide range of applications has been released. Product summaries include capacity, boiling points of solvents handled, and major features such as patented disposable liners, automatic fill systems, and optional vacuum units. Write Elizabeth Miller, Product Manager, Siva International Inc., 405 Eccles Ave., S. San Francisco, CA 94080 for a copy of the publication.

Mill Media

A four-page brochure featuring a line of small mill media has been issued. Complete descriptions and specifications are presented. Free copies of the publication are available from Tom Weiss, Quackenbush Co., 500 E. Main St., Lake Zurich, IL 60047.

Computerized Accelerated Weathering

Literature is available on a computer interface system that links the office to a weather laboratory. Numerous warning and ălarm features allow you to configure the program to alert you before a test parameter exceeds tolerance. For more information on the AtlaSoft™ System, write Atlas Electric Devices Co., 4114 North Ravenswood Ave., Chicago, IL 60613.

Side-Entering Mixers

A four-page brochure highlighting a company's line of side-entering, heavy-duty mixers has been printed. For a copy of Bulletin B-526, "NSE Series Side-Entering Mixers," contact Betty Felix, Lightnin, 135 Mt. Read Blvd., Rochester, NY 14611.

Polypropylene Wax

A micronized polypropylene wax designed for use in water reducible interior or exterior paints and coatings has been introduced through literature. The product can be used alone or in combination with silica flatting agents to reduce gloss and improve metal marking and abrasion resistance. More detailed information on Micropro 440W can be obtained by contacting Micro Powders, Inc., 580 White Plains Rd., Tarrytown, NY 10591.

Data Acquisition Systems

An eight-page, three-color bulletin covering an entire spectrum of instruments for industrial or laboratory applications—from single pen recorders, through hybrid recorders, to sophisticated data acquisition systems—has been released. Included with the guide is a "decision tree" application checklist—which can be filled out, following a step-by-step outline. Copies of the guide "Recorder & Data Acquisition Selection Guide," identified as CO.7140 FL, are available from Leeds & Northrup, Sumneytown Pike, P.O. Box 4, North Wales, PA 19454-0904.

Ceramic Fiber

A one-page product specifications sheet presenting detailed information on a recently introduced ceramic fiber has been released. The literature outlines chemical and physical properties of the product that is comprised of fibers chopped fine enough to permit spraying through standard-sized orifices. A copy of the bulletin on Fiberfrax® HSA-R™ ceramic fiber is available by contacting Tammy S. Parker, Product Manager, The Carborundum Co., Fibers Div., P.O. Box 808, Niagara Falls, NY 14302-0808.

Microscope

The introduction of a field emission scanning auger microscope has been made through literature. Features include a magnetic sample introduction system for sample handling and an enhanced ultrahigh vacuum environment which permits ion beam auger depth profiling. Write Steve Deppa, Perkin-Elmer, Physical Electronics Div., 6509 Flying Cloud Dr., Eden Prairie, MN 55344 for further details on the PHI 670 Auger Nanoprobe.

Water Reducible Enamel

A high quality, high performance, volatile organic compound (VOC) compliant baking enamel for the electronic and general metal industry for smooth or textured coatings is the subject of recently released literature. The product is designed to meet the stringent performance requirements of the electronics cabinetry and business machine industry. Inquiries for additional information should be identified as "Kem Aqua® 1700T and mailed to the Sherwin-Williams Stores Group, c/o Robert Silverman Co., 1375 Euclid Ave., Cleveland, OH 44115.

Stripping Oven

A data sheet has been published on an oven—a microprocessor based ramp and soak type temperature controller—that is designed to strip coatings, paint, rubber, and polymers from metal parts, racks, and fixtures. For more information, contact Armature Coil Equipment, Inc., 4725 Manufacturing Rd., Cleveland, OH 44135-2696.

Aqueous Polyurethane Dispersions

The development of two waterborne polyurethane dispersions for the adhesives and coatings markets has been announced in literature. The products are high-performance, solvent-free systems designed for a number of applications, including a structural adhesive for plastics, wood, rubber, textiles, and a variety of flexible substrates. Contact Ramesh Mehta, Commercial Development, H.B. Fuller Co., Willow Lake Laboratory, 1200 Wolters Blvd., Vadnais Heights, MN 55110 for further details on NP-4003 and NP-4004 aqueous polyurethane dispersions.

Label Printer/Applicator

A brochure detailing an on-line label production and application system that reportedly delivers high-performance, low cost automated carton labeling has been issued. The bulletin explains that the system allows the user to select either direct thermal or thermal transfer printing and show three label application options: brush-on, tamp-on, and dual panel. Contact Mark Bjerkestrand, Labeling Systems Product Manager, Diagraph Corp., 3401 Rider Trail South, St. Louis/Earth City, MO 63045 for more information on the Diagraph Performance Series® PA/2000 Label Printer/Applicator.

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422 (215) 940-0777, FAX: (215) 940-0292.

1991

(May 13-17)—Federation "Spring Week." Seminar on the 13th and 14th; Board of Directors Meeting on May 15; and Society Officers Meeting on May 16. Sheraton Society Hill Hotel, Philadelphia, PA.

(Nov. 4-6)—69th Annual Meeting and 56th Paint Industries' Show. Convention Center, Toronto, Ontario, Canada.

1992

(Oct. 21-23)—70th Annual Meeting and 57th Paint Industries' Show. McCormick Place, Chicago, IL.

1993

(Oct. 27-29)—71st Annual Meeting and 58th Paint Industries' Show. World Congress Center, Atlanta, GA.

SPECIAL SOCIETY MEETINGS

1991

(Feb. 6-8)—Southern Society. 18th Annual Water-Borne, Higher-Solids, and Powder Coatings Symposium. Co-sponsored by the Department of Polymer Science at the University of Southern Mississippi (USM). Hyatt Regency Hotel, New Orleans, LA. (Robson F. Storey and Shelby F. Thames, Co-Organizers, WBHS&PC Symposium, Dept. of Polymer Science, USM, Southern Station, P.O. Box 10076, Hattiesburg, MS 39406-0076).

(Feb. 18-20)—Western Coatings Societies' 20th Biennial Symposium and Show. Hilton Hotel, San Francisco, CA. (Patricia Stull, Pacific Coast Chemicals, 2424—4th St., Berkeley, CA 94710).

(Mar. 13-15)—Dallas and Houston Societies. Southwestern Paint Convention. Dallas, TX.

(Apr. 3-6)—Southern Society Annual Meeting. The Peabody Hotel, Memphis, TN. (Vernon Sauls, McCullough & Benton, P.O. Box 272360, Tampa, FL 33688).

(May 2-4)—Pacific Northwest Society. Annual Symposium. Meridien Hotel, Vancouver, British Columbia, Canada. (John P. Berghuis, Kronos Canada, Inc., 3450 Wellington Ave., Vancouver, B.C., Canada V5R 4Y4).

(June 6)—Cleveland Society. 34th Annual Technical Conference. B.F. Goodrich R&D Center, Brecksville, OH. (Devilla Moncrief, Sherwin-Williams Co., Cleveland Technical Center, 601 Canal Rd., Cleveland, OH 44113).

(June 7-8)—Joint Meeting of the St. Louis and Kansas City Societies. Holiday Inn, Lake of the Ozarks, MO.

OTHER ORGANIZATIONS

1991

(Jan. 28-30)—"Concrete: Surface Preparation, Coatings and Linings, and Inspection Techniques." Symposium sponsored by National Association of Corrosion Engineers (NACE). J.W. Marriott Hotel, Houston, TX. (NACE Education and Training Dept., P.O. Box 218340, Houston, TX 77218).

(Jan. 28-Feb. 1)—American Electroplaters and Surface Finishers Society (AESF) Week featuring The Surface Finishing Electronics Applications Symposium. Hyatt Orlando Hotel, Kissimmee, FL. (AESF Education Services Dept., 12644 Research Pkwy., Orlando, FL 32826).

(Jan. 31)—Second Annual Painting and Decorating Contractors of California Inc. Trade Show. Center Plaza Holiday Inn, Fresno, CA. (Rickey Gamore, TAC Inc., 606 N. Larchmont Blvd., #4A, Los Angeles, CA 90004).

(Feb.)—Inter-Society Color Council Williamsburg Conference. Williamsburg, VA. (Louis A. Graham, Lou Graham & Associates, Inc., 1207 Colonial Ave., Greensboro, NC 27408).

(Feb. 3-8)—"Protective Coatings and Linings." Course sponsored by the National Association of Corrosion Engineers (NACE), London, England. (NACE Europe, P.O. Box 251, Guildford, Surrey, GU1 3DJ, United Kingdom).

(Feb. 3-8)—"Cathodic Protection: Theory and Data Interpretation." Course sponsored by the National Association of Corrosion Engineers (NACE), London, England. (NACE Europe, P.O. Box 251, Guildford, Surrey, GU1 3DJ, United Kingdom).

(Feb. 17-20)—14th Annual Meeting of The Adhesion Society, Bellview Biltmore Hotel, Clearwater, FL. (Howard M. Clearfield, IBM T.J. Watson Research Center, P.O. Box 218, M/S 38-145, Yorktown Heights, NY 10598).

(Feb. 17-22)—"Basic Coating Inspection." Session I of the International Coating Inspector Training and Certification Program. Sponsored by the National Association of Corrosion Engineers (NACE), Sheffield, England. (NACE Europe, P.O. Box 251, Guildford, Surrey, GU1 3DJ, United Kingdom).

(Feb. 17-22)—"Intermediate Coating Inspection." Session II of the International Coating Inspector Training and Certification Program. Sponsored by the National Association of Corrosion Engineers (NACE), Sheffield, England. (NACE Europe, P.O. Box 251, Guildford, Surrey, GU1 3DJ, United Kingdom).

(Feb. 19-22)— PDCA Annual Convention and Paint and Paper Pro Show. Sponsored by Painting and Decorating Contractors of America (PDCA). Atlanta Marriott Marquis, Atlanta, GA. (PDCA, 3913 Old Lee Highway, Ste. 33-B, Fairfax, VA 22030).

(Mar. 11-15)—62nd Introductory Short Course on the Basic Composition of Coatings. Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma R. Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Mar. 11-15)—Corrosion/91. Sponsored by National Association of Corrosion Engineers (NACE). Cincinnati Convention Center, Cincinnati, OH. (NACE, P.O. Box 218340, Houston, TX 77218).

(Mar. 18-20)—"Polymer Blends and Alloys: Phase Behavior, Characterization, Morphology, Alloying Technology." Short course sponsored by The Institute of Materials Science, State University of New York (SUNY), New Paltz, NY. (Institute of Materials Science, SUNY, New Paltz, NY 12561).

(Mar. 18-20)—Fourth Annual Conference on Lead Paint Removal from Industrial Structures. Sponsored by Steel Structures Painting Council (SSPC). Omni Charlotte Hotel, Charlotte, NC. (Rose Mary Surgent, SSPC Meetings Manager, SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683).

(Mar. 19-21)—"farbe + lack 91." The First Congress Exhibition for the Coating, Printing Inks, Adhesives, and Sealants Industry. Sponsored by *farbe + lack*. Nuremberg Exhibition Grounds, West Germany. (Klaus Geissler, Manager, Events Division, Curt R. Vincentz Verlag, Postfach 62 47, 3000 Hannover 1, West Germany).

(Mar. 25-29)—22nd Introductory Short Course on Paint Formulation. Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma R. Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Mar. 26)—"Screen Process Symposium." Sponsored by the Society of British Printing Ink Manufacturers and the Screen Process Technicians Association. Runnymede Hotel, Egham, England. (Chris Pacey-Day, The Oil & Colour Chemists' Assoc., Priory House, 967 Harrow Rd., Wembley, Middlesex, England HA0 2SF.)

(Apr. 3-5)—Hazardous Materials Management Conference and Exhibition/Central (HazMat/Central '91). O'Hare Exposition Center, Rosemont, IL. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E—Ste. 408, Glen Ellyn, IL 60137-5835).

(Apr. 8-12)—Advanced Technology Short Courses on "Advanced VLSI Processing Devices and Technology." Hotel Il Ciocco, Pisa, Italy. (Tina Persson, Marketing Manager, CEI-Europe/Elsevier, P.O. Box 910, S-61225 Finspong, Sweden).

(Apr. 9-10)—"Environmental Regulations: A New Ball Game." Annual symposium sponsored by The Washington Paint Technical Group. Washington, D.C. (Mary McKnight, United States Department of Commerce, National Institute of Standards and Technology, Gaithersburg, MD 20899.)

(Apr. 15-17)— Surface Coating 1991. Sponsored by Chemical Coaters Association. Indian Lakes Resort, Bloomingdale, IL. (Chemical Coaters Assoc., P.O. Box 44275, Cincinnati, OH 45244).

(Apr. 22-25)—The Euro-Asian Interfinish Isreal 1991. Conference sponsored by the Metal Finishing Society of Isreal. Herzlia, Isreal. (Secretariat, Ortra, Ltd., 2 Kaufman St., Tel-Aviv 61500, Isreal).

(Apr. 22-26)—"Applied Rheology for Industrial Chemists." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Apr. 25-27)—Second Annual "Surfaces '91" Trade Show. Sponsored by The Western Floor Covering Association. Las Vegas Convention Center, Las Vegas, NV. (Sheila Harman, B.P. Rice & Co., Inc., 13079 Artesia Blvd., Ste. 228, Cerritos, CA 90701-3312).

(Apr. 29-May 3)—Evaluation and Durability Conference. Co-sponsored by Steel Structures Painting Council (SSPC), Pittsburgh, PA. (SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683).

(May)—ASTM Committee B-8 on Metallic and Inorganic Coatings meeting. Atlantic City, NJ. (George A. DiBari, International Nickel Co., Park 80 West—Plaza Two, Saddle Brook, NJ 07662).

(May 6-10)—"Dispersion of Pigments and Resins in Fluid Media." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(May 12-15)—AOCS 82nd Annual Meeting & Expo. Sponsored by The American Oil Chemists' Society. Chicago Marriott Hotel, Chicago, IL. (Myra Barenberg, AOCS, P.O. Box 3489, Champaign, IL 61826-3489).

(May 15-17)—Sixth Annual Conference of the Architectural Spray Coaters Association (ASCA). Loews Ventana Canyon Resort, Tucson, AZ. (ASCA, 230 W. Wells St., Ste. 311, Milwaukee, WI 53203).

(May 20-24)—"Adhesion Principles and Practice for Coatings and Polymer Scientists." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(May 29-31)—Fourth International Symposium on Polymer Analysis and Characterization; June 1-2—Short course "Major Polymer Characterization Techniques and Methods." Baltimore Inner Harbor, MD. (Judith A. Watson, Professional Association Management, 750 Audubon, East Lansing, MI 48823).

(June 3-7)—22nd Annual Short Course on "Advances in Emulsion Polymerization and Latex Technology." Sponsored by Lehigh University, Bethlehem, PA. (Mohamed S. El-Aasser, Emulsion Polymers Institute, Lehigh University, 111 Research Dr., Bethlehem, PA 18015).

(June 5-7)—5th International Conference on Crosslinked Polymers. Sponsored by State University of New York (SUNY). Luzern, Switzerland. (Angelos V. Patsis, Institute in Materials Science, SUNY, New Paltz, NY 12561).

(June 10-14)—"High Solids and Low-VOC Coatings." Short course sponsored by North Dakota State University (NDSU), Fargo, ND. (NDSU Continuing Education, P.O. Box 5819, University Station, Fargo, ND 58105-5819).

(June 12-14)—SURCON '91, "Developments in the Science of Surface Coatings." Moat House International Hotel, Stratford-upon-

Avon, England. (Simon Lawrence, CIBA-GEIGY Pigments, Hawkhead Rd., Paisley, Renfrewshire PA2 7BG, Scotland).

(June 17-28)—"Coatings Science." Short course sponsored by North Dakota State University (NDSU), Fargo, ND. (NDSU Continuing Education, P.O. Box 9, University Station, Fargo, ND 58105-5819).

(June 19-21)—First International Symposium on Environmental Effects on Advanced Materials. Sponsored by National Association of Corrosion Engineers (NACE). Catamaran Resort Hotel, San Diego, CA. (NACE Customer Service Dept., P.O. Box 218340, Houston, TX 77218).

(July 7-12)—Seventh International Conference on Surface and Colloid Science (ICSCS). Sponsored by the International Association of Colloid and Interface Scientists, Université de Technologie de Compiègne, France. (M. Clausse, Secretariat of the 7th ICSCS, c/o Wagons-Lits Tourisme, B.P. 244, 92307 Levallois-Perret Cedex, France).

(July 8-12)—17th International Conference in Organic Coatings Science and Technology. Sponsored by State University of New York (SUNY). Athens, Greece. (Angelos V. Patsis, Institute in Materials Science, SUNY, New Paltz, NY 12561).

(July 17-19)—Introductory Short Course on "Basic Coatings for Sales and Marketing Personnel." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Sept. 3-5)—2nd International Paint Congress. Sponsored by The Brazilian Association of Paint Manufacturers (ABRAFATI). Anhembi Convention Centre, São Paulo, Brazil. (Especifica S/C Ltd., Rua Augusta, 2516—2nd Floor, Ste. 22, 01412, São Paulo, SP, Brazil).

(Sept. 9-13)—63rd Introductory Short Course on "The Basic Composition of Coatings." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Sept. 10-12)—North American Hazardous Materials Management Conference and Exhibition. Sponsored by *HazMat World* magazine. Cobo Hall, Detroit, MI. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E, Ste. 408, Glen Ellyn, IL 60137).

(Sept. 24-26)—The Polyurethanes World Congress 1991. Co-sponsored by the European Isocyanate Producers Association and the Polyurethane Division of The Society of Plastics Industry (SPI), Inc. of the USA. Acropolis Arts & Convention Center, Nice, France. (Fran Lichtenberg, Polyurethane Div., SPI, 355 Lexington Ave., New York, NY 10017).

(Sept. 29-Oct. 2)—RADTECH Europe '91 Conference and Exhibition. Edinburgh Exhibition and Trade Centre, Edinburgh, Scotland. (Exhibit Manager, RADTECH 91, c/o FMJ International Publications Ltd., Queensway House, 2 Queensway, Redhill, Surrey, RH1 1QS, United Kingdom or Conference Secretary, RADTECH '91, c/o PRA, Waldegrave Rd., Teddington, Middlesex, TW11 8LD, England).

(October)—ASTM Committee B-8 on Metallic and Inorganic Coatings meeting. Philadelphia, PA. (George A. DiBari, International Nickel Co., Park 80 West—Plaza Two, Saddle Brook, NJ 07662).

(Oct. 2-4)—Hazardous Materials Management Conference and Exhibition/South (HazMat/South). Sponsored by *HazMat World* magazine. Georgia World Congress Center, Atlanta, GA. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E, Ste. 408, Glen Ellyn, IL 60137-5835).

(Oct. 7-10)—"Introduction to Coatings Technology." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Oct. 16-18)—"Accelerated and Natural Weathering Techniques for Coatings and Polymers." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Oct. 21-25)—23rd Introductory Short Course on "Paint Formulation." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. (Norma Fleming, Sr. Continuing Education Coordinator, UMR, 119 M.E. Annex, Rolla, MO 65401-0249).

(Oct. 28-Nov. 1)—"Fundamentals of Chromatographic Analysis." Short course sponsored by Kent State University (KSU), Kent, OH. (Carl J. Knauss, Director, Cooperative and Continuing Education, Chemistry, KSU, Kent, OH 44242).

(Nov. 4-5)—"Electrochemical Impedance: Analysis and Interpretation." Symposium sponsored by ASTM Committee G-1 on Corrosion of Metals. San Diego, CA. (John R. Scully, Sandia National Labs., Org. 1834, P.O. Box 5800, Albuquerque, NM 87185).

(Nov. 6-8)—POWDEX. Organized by Cahners Exhibition Group. Georgia World Congress Center, Atlanta, GA. (Angela Piermarini, Show Manager, Cahners Exposition Group, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL 60017-5060).

(Nov. 8-12)—1991 International Surface Finishing & Coatings Exhibition (SF China '91) and the 1991 International PC Board Making & Electro-Chemicals Exhibition (PCB China '91). Shanghai Exhibition Center, Shanghai, P.R. China. (Sinostar International Ltd., 10A Harvest Moon House, 337-339 Nathan Rd., Kowloon, Hong Kong).

1992

(Feb. 23-26)—Williamsburg Conference, "Comparison of Color Images Presented in Different Media." Co-sponsored by the Inter-Society Color Council and the Technical Association of Graphic Arts, Colonial Williamsburg, VA. (Milton Pearson, RIT Research Corp., 75 Highpower Rd., Rochester, NY 14623).

(Oct. 25-30)—Fourth Corrosion and Protection Iberoamerican Congress and First Panamerican Congress on Corrosion and Protection. Mar del Plata, Argentina. (CIDEPINT, 52 entre 121 y 122, 1900 La Plata, Argentina, South America).

Advertisers Index

'Humbug' from Hillman

As the column for this first month of 1991 is being compiled (October 1990), I realize that it was approximately 10 years ago that the first H from H dared to appear in this esteemed Journal. As I might have expected we were relegated to the back of the book, where we have comfortably remained. I thought that it might be appropriate for my more recent readers and nostalgic for the veterans to republish the first attempt and thereby, tell again how "Humbug" was born. At my age I dare not plan for another ten years, so, for better or worse, let's take it a year or so at a time, with our readers' help and tolerance.

Some months ago at a Publications Committee meeting for the JCT, this big-mouth ventured the opinion that (as I have hinted in the past) the reading matter in this eminent magazine has tended to be somewhat ponderous and to the less erudite—somewhat obscure. I suggested, therefore, that it might be a delightful surprise to occasionally find a light comment and an amusing thought in its pages.

As always happens in such situations, I was promptly awarded the responsibility for a column that was to be devoted to the lighter side. As I don't see myself as a funny person or even an amusing one, I protested that my desire to be amused reflects no ability to amuse others—as you will see. Like so many others of you out there in readership land, I try desperately to remember jokes to tell at the next customer luncheon and after 15 minutes, can't remember the punch line.

My protests were of little avail and the members of the committee assured me that I would be fed ample funny material. So far, I've been on a starvation diet. The only funny thing we've had to offer in the JCT is Frank Borrelle's picture.

So—now I had a column to edit with no material and no title. Without any material, I decided to devote myself to the frustrating job of finding a heading and a column that could be considered "funny." While reading through the H's in that fascinating volume originally written by Webster, I came upon "Humbug." Definition 3 says—"Drivel, Nonsense." Thus, the title!

No sooner had I made the decision to explore the possibility of that as a lead line, along came a contribution of sorts from the aforementioned funny person—Frank Borrelle. I must say that it is more appropriate than hilarious. I would like to credit (?) the original author but somehow the name fortunately got lost in its route to a nameless friend of Sid Lauren, of Coatings Research, who sent it on to Frank.

Before I end this first attempt at a column and perhaps my writing career with this analytical masterpiece, I dare my readers to send me funny stuff for I will unhesitatingly feature the contributor's name.—*Herb Hillman*

A Key to Help You Understand Scientific Literature

When the author writes . . .

"IT HAS BEEN KNOWN THAT" . . .

He really means . . .

(I can't be bothered to look up the original article)

"OF GREAT THEORETICAL AND PRACTICAL IMPORTANCE" . . . (Interesting to me)

"THREE OF THE SAMPLES WERE CHOSEN FOR FURTHER STUDY" . . . (We couldn't make any sense out of the others)

"HANDLED WITH EXTREME CARE DURING THE EXPERIMENTS" . . . (Not dropped on the floor)

"TYPICAL RESULTS ARE SHOWN" . . . (The best results are shown)

"CORRECT WITHIN AN ORDER OF MAGNITUDE". . . (Wrong)

"PRESUMABLY AT LONGER TIMES" . . . (I didn't take the time to pursue it past five minutes)

"THE MOST RELIABLE VALUES ARE THOSE OF JONES" . . . (He was a student of mine)

"IT IS BELIEVED THAT" . . . (I think it's true)

"IT IS GENERALLY BELIEVED THAT" . . . (A couple of other guys think so too)

"IT MIGHT BE ARGUED THAT" . . . (I have thought of such a great answer to this argument that I will now raise it, even though it's not important)

"IT IS CLEAR THAT MUCH ADDITIONAL WORK WILL BE REQUIRED BEFORE COMPLETE UNDERSTANDING OF THIS PHENOMENON IS ACHIEVED" . . . (I don't understand our results)

"IT IS HOPED THAT THIS WORK WILL STIMULATE FURTHER WORK IN THE FIELD" . . . (This paper isn't very good, but neither are any of the others on this miserable subject)

"THANKS ARE DUE TO JOE GLOTZ FOR ASSISTANCE WITH THE EXPERIMENT AND TO JANE DOE FOR VALUABLE DISCUSSIONS" . . . (Glotz did the work and Doe explained it to me what it meant)

—Herb Hillman
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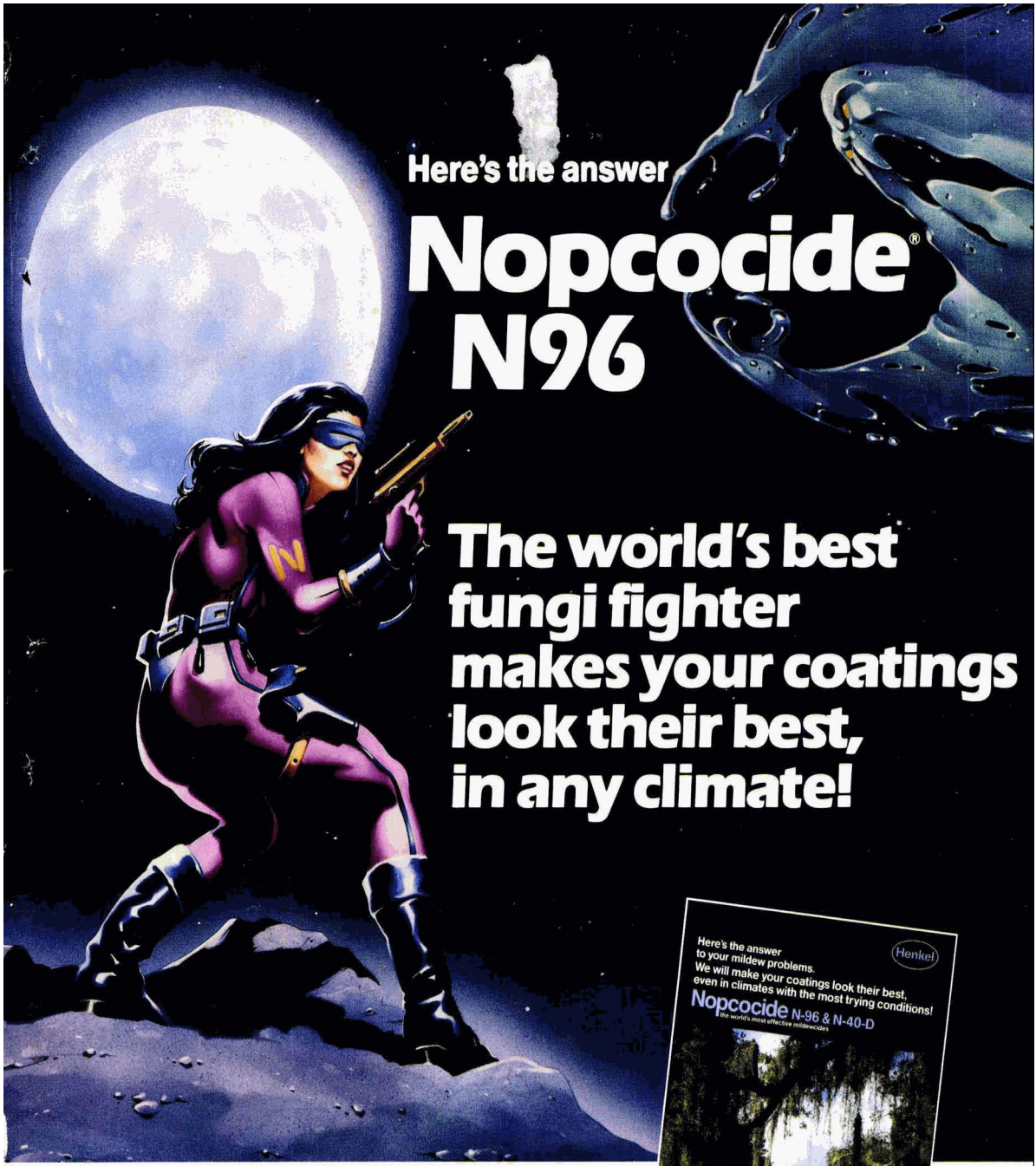

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