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June 1988

jct JOURNAL OF COATINGS TECHNOLOGY

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66th ANNUAL MEETING
53rd PAINT INDUSTRIES' SHOW
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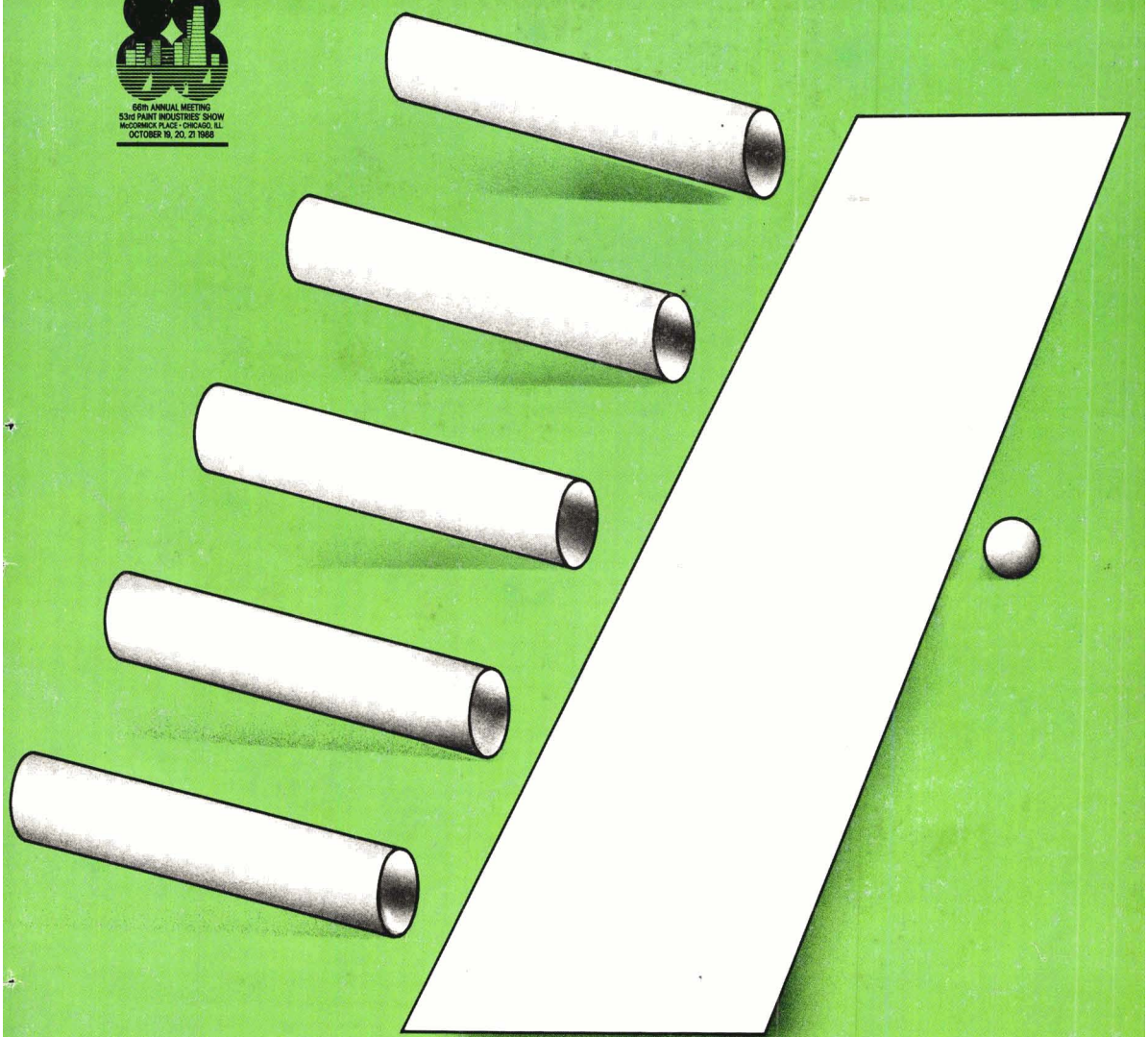
OCTOBER 19, 20, 21 1988



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JUNE 1988

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VOLUME 60 NUMBER 761

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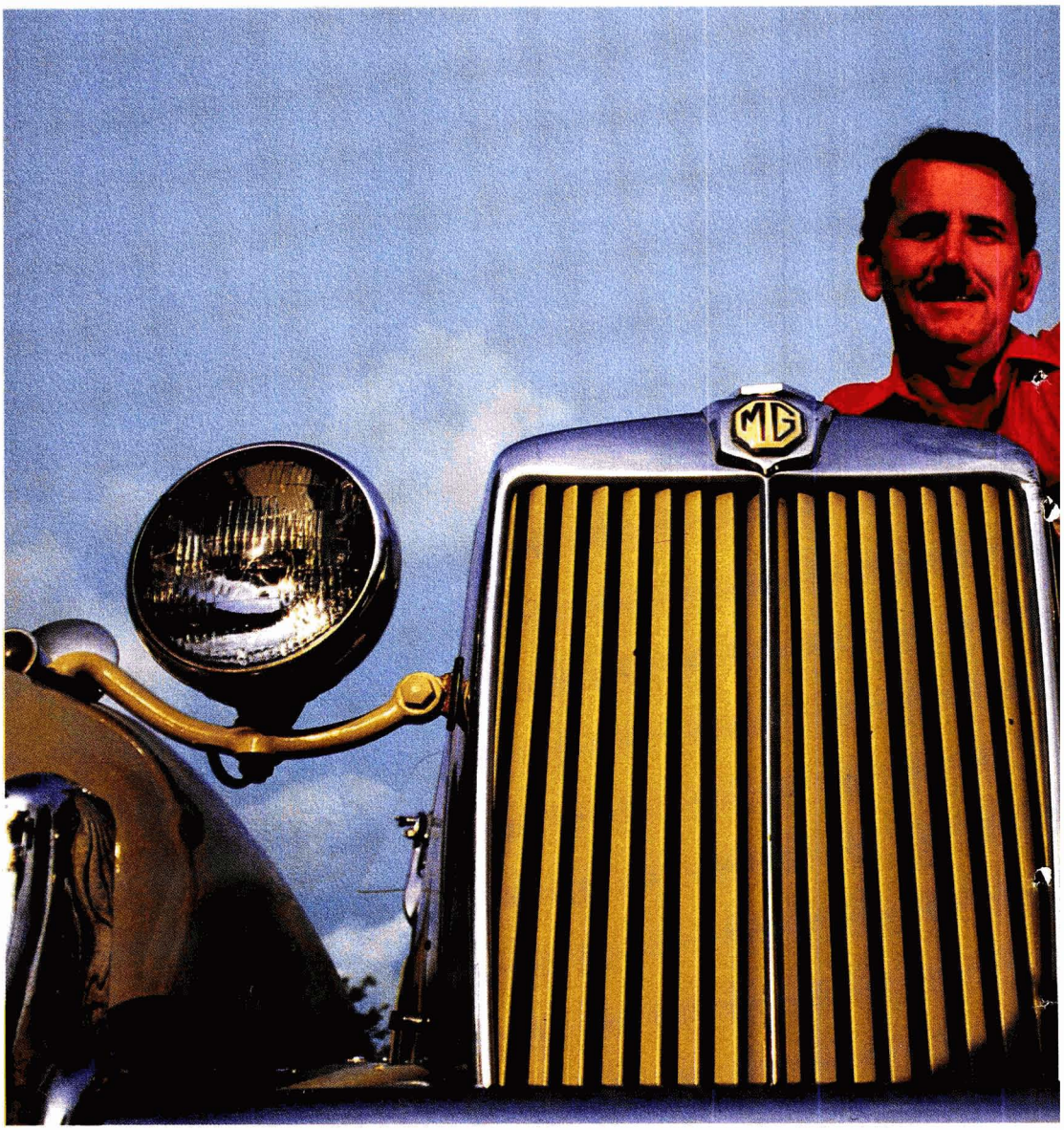
Lloyd McCrary helped a dollar contract. But he still can'



coil coater save a multimillion t get his car to run right.

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

Comment

Some Thoughts on the Spirit of "Candoitism"

In the Federation, as in any professional organization, committee members are the "can do it" people. They are the dedicated individuals whose volunteer efforts over the years have contributed significantly to the well-being of the membership and the industry.

At both the local and national level, committee work encompasses a wide range of activities, to which a goodly number of members give freely of their time and talents. In return, they find committee service to be personally rewarding. They enjoy the opportunity to work on meaningful projects with their peers from various segments of the coatings spectrum, and to savor the accomplishment of bringing such projects to successful conclusions.

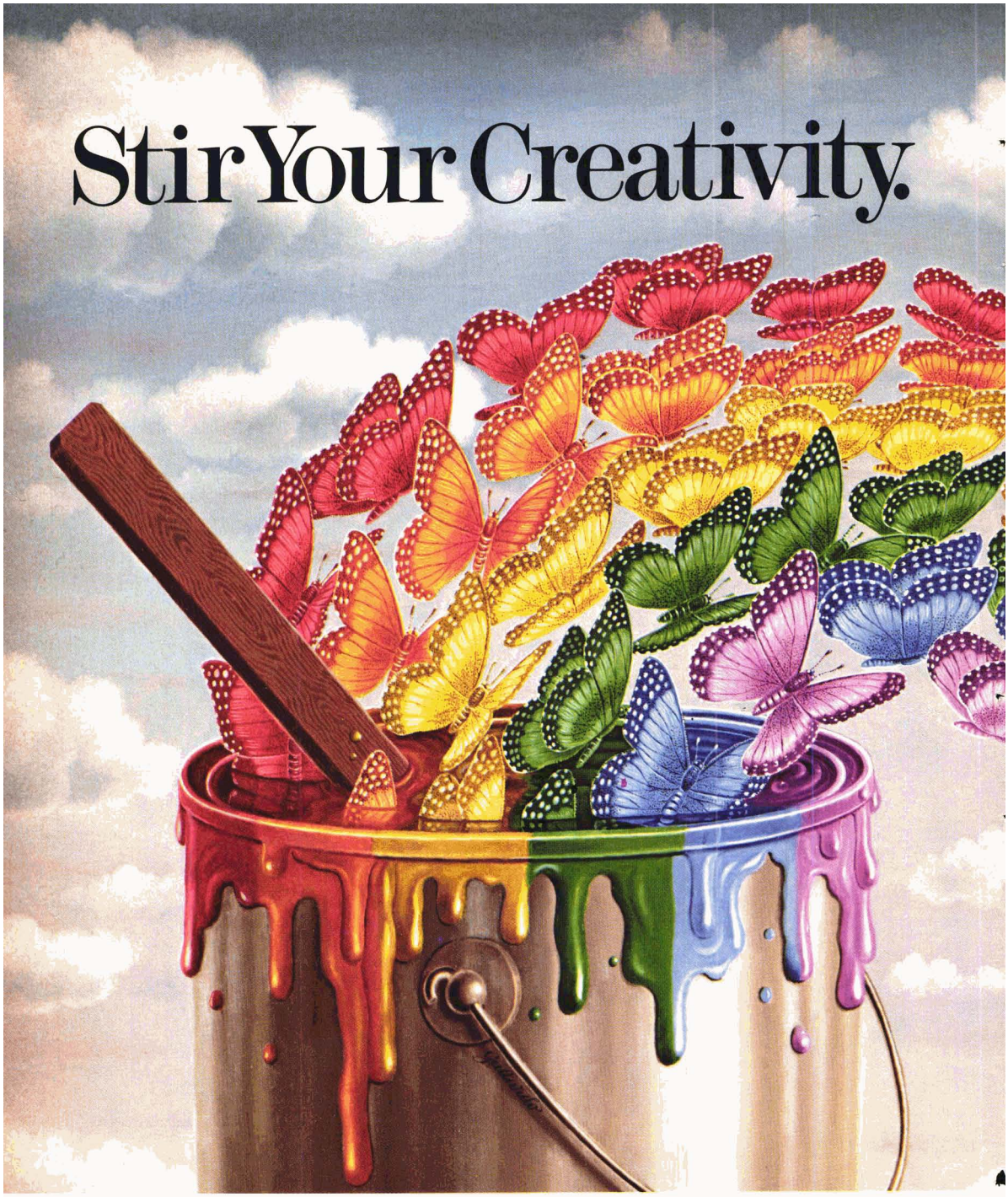
All of which serves as a reminder that now is the time when committees are being staffed for the coming meeting year, and chairmen are on the lookout for volunteers willing to lend a hand.

So, if you'd like to participate, make your availability and interest known. Get involved, and you'll find that committee service is one of those satisfying endeavors in which the more you put in, the more you get out.

Thomas A. Kocis

Thomas A. Kocis,
Contributing Editor

Stir Your Creativity.



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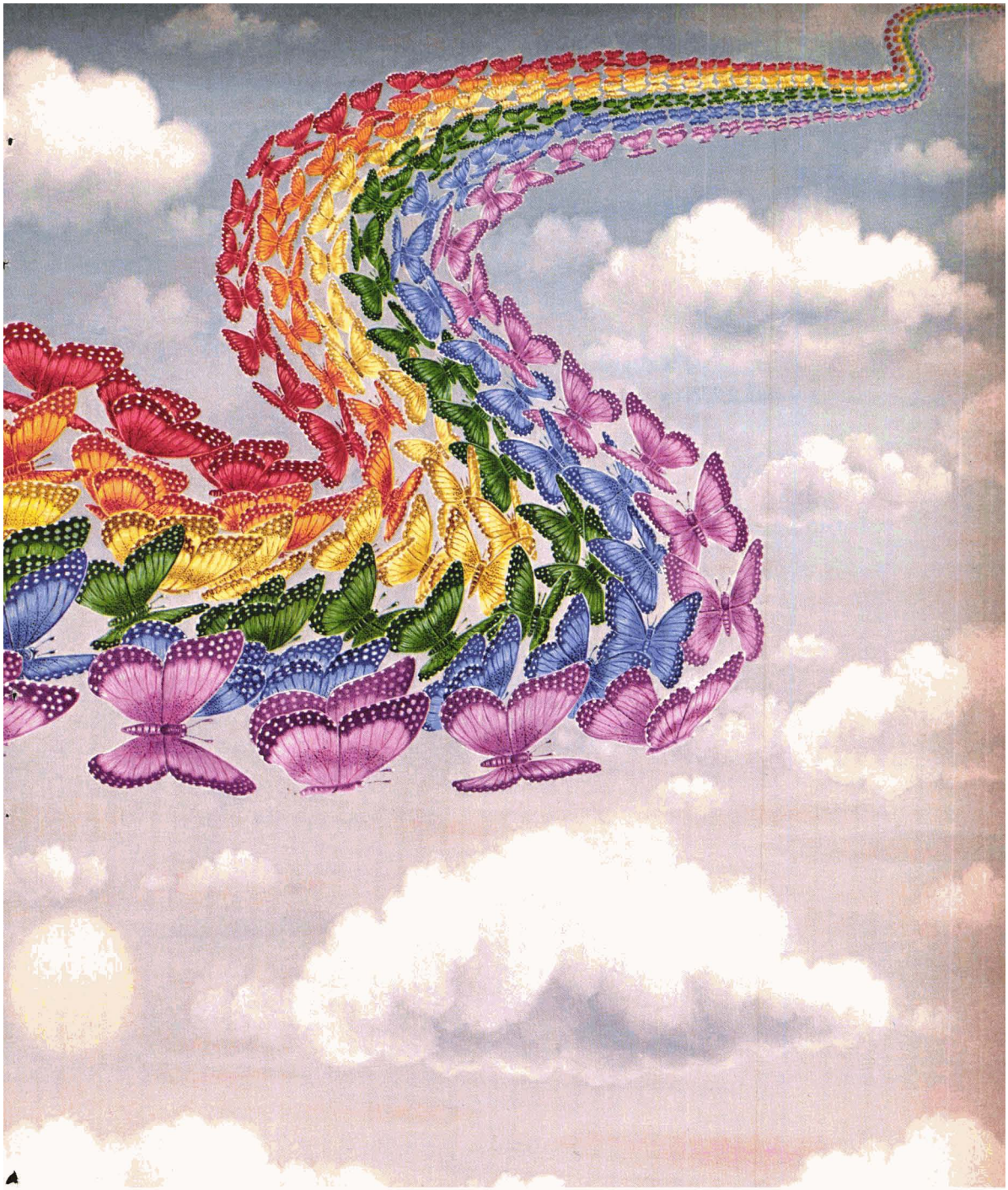

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Abstracts of Papers in This Issue

ISOPARAFFINS IMPART BENEFICIAL PROPERTIES TO COATINGS—S.J. Storfer, J.T. DiPiazza, and R.E. Moran

Journal of Coatings Technology, 60, No. 761, 37 (June 1988)

Synthetically produced isoparaffins possess lower surface tensions than most other solvents. Employment of these isoparaffinic solvents in solvent blends and in paint formulations reduces their surface tensions, which enhances their ability to wet substrates.

In water-borne coatings, foam generation is reduced when isoparaffins are used at low concentrations, alone or together with conventional antifoam agents, with no sacrifice in odor or performance. Higher-boiling isoparaffins offer the added benefit of extending wet-edge time for these water-borne coatings.

INTRODUCTION OF A NOVEL, NONMETALLIC FUNGICIDE FOR THE COATINGS INDUSTRY—D.L. Dalton

Journal of Coatings Technology, 60, No. 761, 45 (June 1988)

Paint films are subject to fungal attack, which leads to cosmetic disfigurement, deterioration of the paint itself, and possible loss of adhesion. Fungicides are incorporated into coatings to prevent these deleterious effects and to prolong the life and usefulness of the paint. Of the organic fungicides used today, the leading products have come from the agricultural chemical market and were not designed for use in coatings. They present a variety of negative attributes and exhibit side-effects in the coating formulation. Consequently, coating manufacturers have had either to formulate around these shortcomings or offer an exterior coating with less than optimum characteristics. At the present time, coatings manufacturers are still looking for an improved paint mildewcide.

After many years of development work, a new fungicide based on novel chemistry specifically designed for use in coatings to protect against mildew defacement has been introduced. This paper reveals the chemistry of this new compound, the developmental history, and the superior performance characteristics through the presentation of both laboratory and field evaluation data. Comparisons with fungicides currently on the market are shown. The form in which the compound will be commercially available is reviewed, as well as its favorable toxicity profile.

APPLICATIONS OF DMA AND TGA TO QUALITY AND PROCESS CONTROL IN THE MANUFACTURE OF MAGNETIC COATINGS—R.B. Prime, et al.

Journal of Coatings Technology, 60, No. 761, 55 (June 1988)

The manufacture of high technology products requires rigid controls at all steps of the process. This paper describes the application of dynamic mechanical analysis (DMA) and thermogravimetric analysis (TGA) to the manufacture of magnetic media. Applications include the incoming inspection of a phenolic resole resin, and process controls of the coating preparation and cure steps. DMA and TGA are shown to be effective in measuring the lot-to-lot variation of the phenolic resin. Process control of the coating ink includes measurement of pigment volume concentration (PVC) and percent solids by TGA, and the glass transition after controlled cure by DMA. Application of DMA to monitor the manufacturing cure process is also described.

AN EXAMPLE OF SPHERICAL AGGLOMERATION OF PIGMENT IN LATEX PAINT—R.E. Smith

Journal of Coatings Technology, 60, No. 761, 61 (June 1988)

Spherical agglomeration, as defined by the mineral refining industry, can result from adsorption of a surfactant and a hydrocarbon solvent onto solid particles dispersed in an aqueous medium. Bridging of the particles by the hydrocarbon leads to separation as unique, large, spherical agglomerates. Such behavior was observed in a water-based latex paint where preferential agglomeration of a particular pigment, yellow iron oxide, caused an undesirable loss of tinting strength with increased shaking time. The pigment agglomerates were studied after separation by dilution and decanting. The problem was avoided by making the pigment less hydrophobic.

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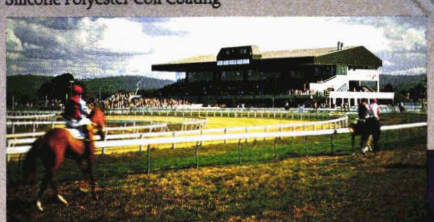

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Professor Dr. Werner Funke, of University of Stuttgart, To Present 1988 Mattiello Lecture at FSCT Annual Meeting

The Federation of Societies for Coatings Technology is pleased to announce that Prof. Dr. Werner Funke, Professor for Polymer Chemistry at the University of Stuttgart, West Germany, will present the Joseph J. Mattiello Lecture during the 66th Annual Meeting of the Federation, to be held at McCormick Place North, Chicago, IL, on October 19-21.

Prof. Dr. Funke's presentation, "Microgels—Intramolecularly Crosslinked Macromolecules—Potent Components of Organic Coating," will be offered on Friday, October 21.

The lecture commemorates the contributions of Dr. Mattiello, who was instrumental in expanding the application of the sciences in the decorative and protective coatings fields. Dr. Mattiello, who served as President of the Federation in 1943-44, was Vice President and Technical Director of Hilo Varnish Corp., Brooklyn, New York, when he died in 1948.

The lecturer is chosen from among those who have made outstanding contributions to science, and is selected to present a paper on a phase of chemistry, engineering, human relationships, or other sciences fundamental to paint, varnish, lacquer, or related protective or decorative coatings.

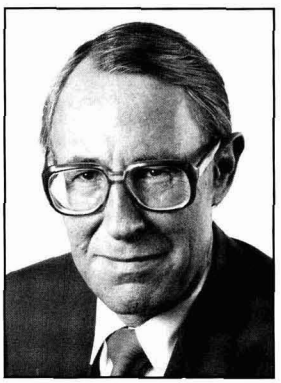
Early Career

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

Current Research

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

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



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

International Lecturer And Author

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

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

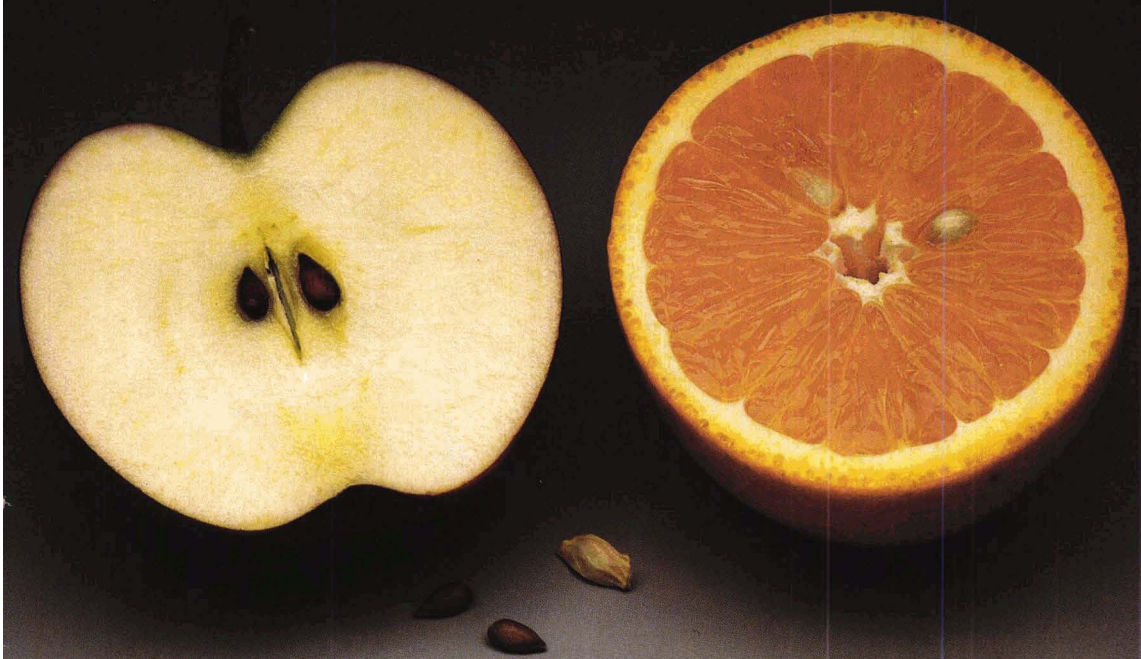
He received the GDCh Section Paints and Pigments Award in 1964, and the Killoidgesellschaft Richard Zsigmondy Award in 1965.

Technical Program Theme And Highlights

The theme of the Federation's Annual Meeting is "Performance *and* Compliance: The Challenge Intensifies." This theme underscores the impact of regulatory restrictions on the coatings industry, which must respond to the dual challenges of producing quality products while meeting increasingly restrictive compliance standards. Programming, to be held at McCormick Place-North Hall, will focus on such

(Continued on page 14)

Seeds are for apples and oranges.



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Werner Funke to Present Mattiello Lecture; 1988 Annual Meeting & Paint Show Highlights

(Continued from page 12)

areas as corrosion protection, aerosol coatings, "high tech" coatings research, and major regulatory issues affecting coatings formulation and manufacture.

Program Chairman Richard M. Hille, of General Paint & Chemical Co., Gary, IL, and his committee are developing a schedule of presentations which will include timely issues, including:

- Corrosion Seminar—"Regulation and Its Effect on Corrosion Protection"
- Manufacturing Seminar—"Productivity Measurement in Coatings Manufacture"
- Roon Award Competition Papers
- Constituent Society Papers.

Serving on the Program Committee are: George R. Pilcher (Vice-Chairman), Hanna Chemical Corp., Columbus, OH; Adrian Adkins, Olympic Homecare Products Co., Pleasanton, CA; Jay Austin, Halox Pigments Corp., Hammond, IN; Gary Gardner, Tnemec Co., Inc., N. Kansas City, MO; Richard J. Himics, Daniel Products Co., Jersey City, NJ; Gus W. Leep, Seymour of Sycamore, Inc., Sycamore, IL; and Joseph P. Walton, Jamestown Paint & Varnish Co., Jamestown, PA.

Paint Industries' Show

To be held in conjunction with the 66th Annual Meeting, the Paint Show will feature the products and services of over 230 suppliers to the coatings industry. Setting the record for exhibit space, the Paint Show will offer over 69,000 net square feet of booth space to attendees.

Currently, all available exhibit space is contracted, and over 7000 industry personnel are expected to attend. Exhibit hours will be 11:00 to 5:30 on Wednesday, October 19; 9:00 to 5:30 on Thursday, October 20; and 9:00 to 3:00 on Friday, October 21.

Registration Fees

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

Also, there will be a special advance registration fee of $25 for retired members and their spouses.

On-site registration will be $60 for full time and $40 for one day for members. Nonmember fees will be $75 for full time and $50 for one day. Spouses' activities will be $45 on-site.

Registration forms were mailed to members in March.

Hotels and Reservations

Federation headquarters will be the Chicago Hilton. Other cooperating hotels will be: Hyatt Regency Chicago; The Congress; Palmer House; Essex Inn; Best Western Inn; Days Inn; and

McCormick Center Hotel. All housing will be processed by the Chicago Convention Bureau, which will accept only the official housing form furnished by the Federation, which was mailed to all members in April.

Special Air Fares

United Airlines and Delta Air Lines, in cooperation with the FSCT, are offering a special discount fare which affords passengers a 40% minimum savings off their round trip, undiscounted day coach fares for travel to the Annual Meeting on the airlines' domestic systems. The discount from Canada is 35%.

To take advantage of the United Airlines discount, you must (1) travel between October 16-24, 1988; (2) phone 1-800-521-4041 for reservations. Immediately reference the FSCT file number: *8002D*. The special fares are available only through this number.

For those traveling on Delta Air Lines, the discount will be given if you: (1) travel between October 14-23, 1988; (2) purchase tickets at least seven days in advance; (3) phone 1-800-241-6760 for reservations. Immediately reference the FSCT file number: *U0235*. The special fares are available only through this number. For Delta Frequent Flyers, triple mileage is available if tickets are purchased with an American Express card.

Discounts on either airline are good for both direct and connecting flights to Chicago. If you use travel agents, have them place your reservations through the toll-free number to obtain the same fare advantages. Both Delta and United have a variety of other promotion fares, some of which may represent even greater savings. When you phone for reservations, ask for the best discount applicable to your itinerary.

Spouses Activities

The Spouses Program of Activities will begin on Wednesday, October 19, with a get-acquainted wine and cheese social in the Williford Room of the Chicago Hilton.

On Thursday, the spouses will tour the University of Chicago with a visit to the Museum of Science and Industry. The group will be treated to a private organ recital at the University's Rockefeller Chapel.

Luncheon will be served at the Ambassador West Hotel's elegant Guildhall. Following lunch, the attendees will be entertained by "Jan Hobson and Her Bad Revue," featuring local harmony and flashy piano, with songs spotlighting the '20's and '30's.

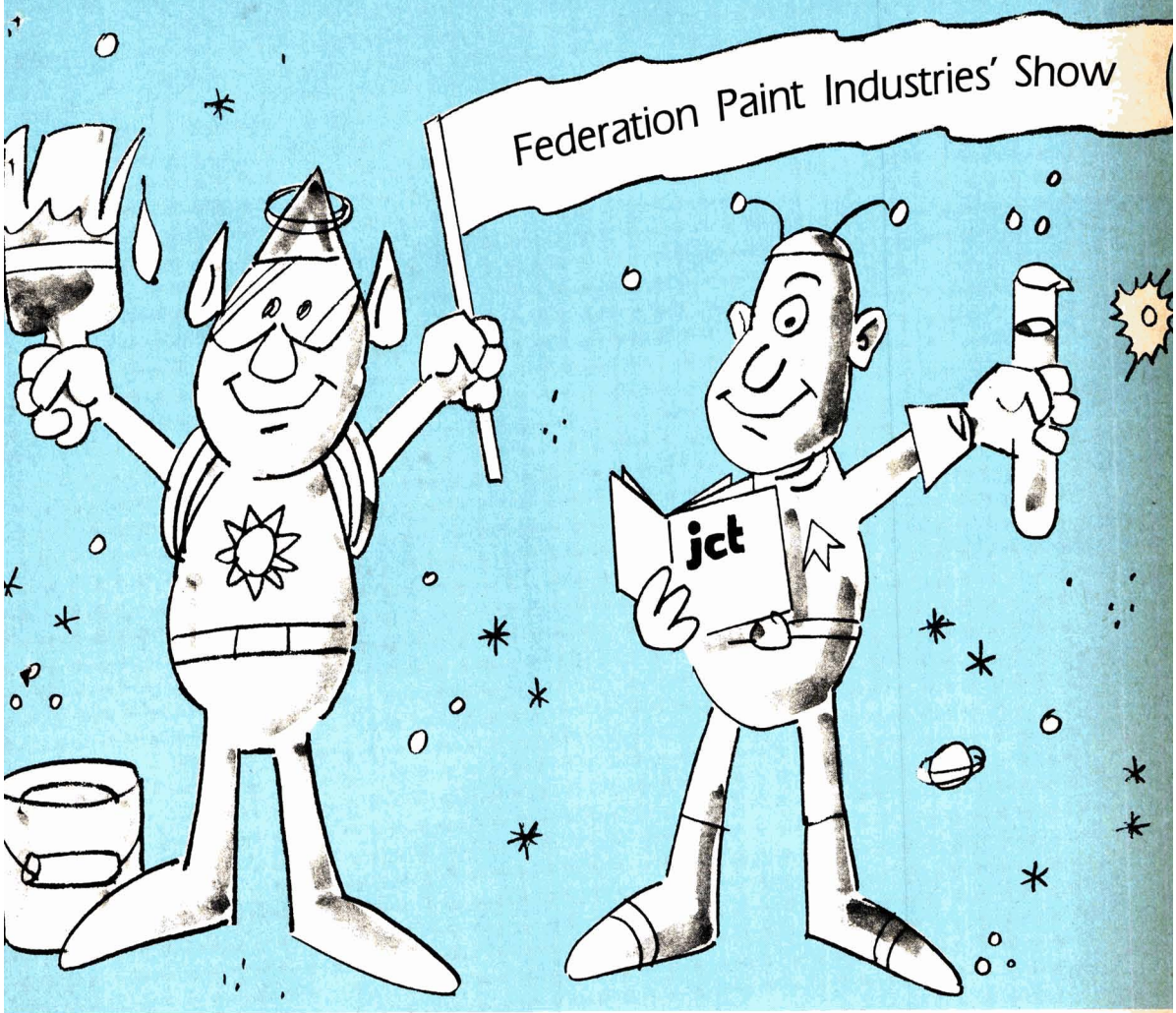
Host Committee

Co-chairmen of the 1988 Annual Meeting Host Committee are Audrey LeNoble, of Emco Chemical Distributors, Inc. and Rudolph Albrecht, of Ace Paint Div., Ace Hardware Corp. Assisting them are the following subcommittee chairmen: Information Services—Thomas Drucker, Graham Paints & Varnish Co., Inc.; Registration—Thomas Yates, of United Coatings Inc.; Program—Natu Patel, Ace Paint Div.; Federation Booth—Victor Willis, Ace Paint Div.; and Spouses' Program—Audrey LeNoble.

NPCA to Meet Same Week

The National Paint & Coatings Association will hold its annual meeting on October 17-19, at the Palmer House in Chicago. Persons wearing the NPCA registration badge and who sign up at a special FSCT registration desk will be admitted to the Paint Show on Wednesday only, with the compliments of the Federation.

To Conquer New Worlds You Need the Right Exposure



JCT readers *are* the coatings industry: chemists, formulators and technicians who specify the right products needed for today's coatings. And these special issues detail the Federation's Annual Meeting and Paint Industries' Show—*the* premier event in the industry and one in which our readers—the members of the Federation—are most interested.

SEPTEMBER—Featured are the Preliminary Program of Technical Sessions, floor plan of show exhibitors, registration forms, housing forms and hotel information, as well as general show information.

OCTOBER—This special Annual Meeting and Paint Show Issue, which is distributed at the show in addition to our regular circulation, contains Abstracts of Papers to be presented; the Program of Technical Sessions; floor plan of show exhibitors; a list of exhibitors and their booth numbers, classified by product/service; an alphabetical list of exhibitors and their booth numbers; and general show information.

DECEMBER—This Annual Meeting and Paint Show Wrap-up Issue features information on all exhibitors, with emphasis on products and special booth features; photo displays of award-winning booths; as well as a complete review of important Annual Meeting and Paint Show happenings.

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FSCT
66th ANNUAL MEETING
53rd PAINT INDUSTRIES' SHOW
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OCTOBER 19, 20, 21 1988

Attention, Runners! Sign Up Now For Second Annual Paint Show 5000

Runners who are planning to attend the 1988 FSCT Annual Meeting and Paint Industries' Show in Chicago, October 19-21, are invited to enter the Second Annual Paint Show 5000. The five kilometer (3.1 mile) run was inaugurated at the 1987 Paint Show in Dallas. The Paint Show 5000 is sponsored by Troy Chemical Corp. in cooperation with the Federation of Societies for Coatings Technology.

The Paint Show 5000 for 1988 will be run on a course through a lakefront park in downtown Chicago on Thursday, October 20. It will start across from the Buckingham Fountain in Grant Park, about three blocks from the main convention hotel, the Chicago Hilton, at 7:00 a.m.

All runners must register. There is a $5 entry fee. All participants will receive a free t-shirt and a souvenir award. Proceeds from the registration fees will be donated to the Federation Scholarship Fund.

More than 150 runners took part in the inaugural Paint Show 5000 in Dallas. This year's event is expected to attract an even larger number of participants, according to

Mort Spiegel, Director of Sales and Marketing for Troy.

"The event was very well received last year and we anticipate that it will become a permanent part of the Paint Show schedule in coming years," Spiegel said.

Deadline for registration is September 30, 1988. Entry forms will be printed in the Federation registration brochure that is mailed in July. Forms can also be obtained by sending a stamped, self-addressed envelope to Paint Show 5000 Pre-registration, Troy Chemical Corp., One Avenue L, Newark, NJ 07105.

Career Promotion Videotape Produced by Federation

The Federation has announced availability of "The Choice," a videotape production promoting career opportunities in the coatings industry.

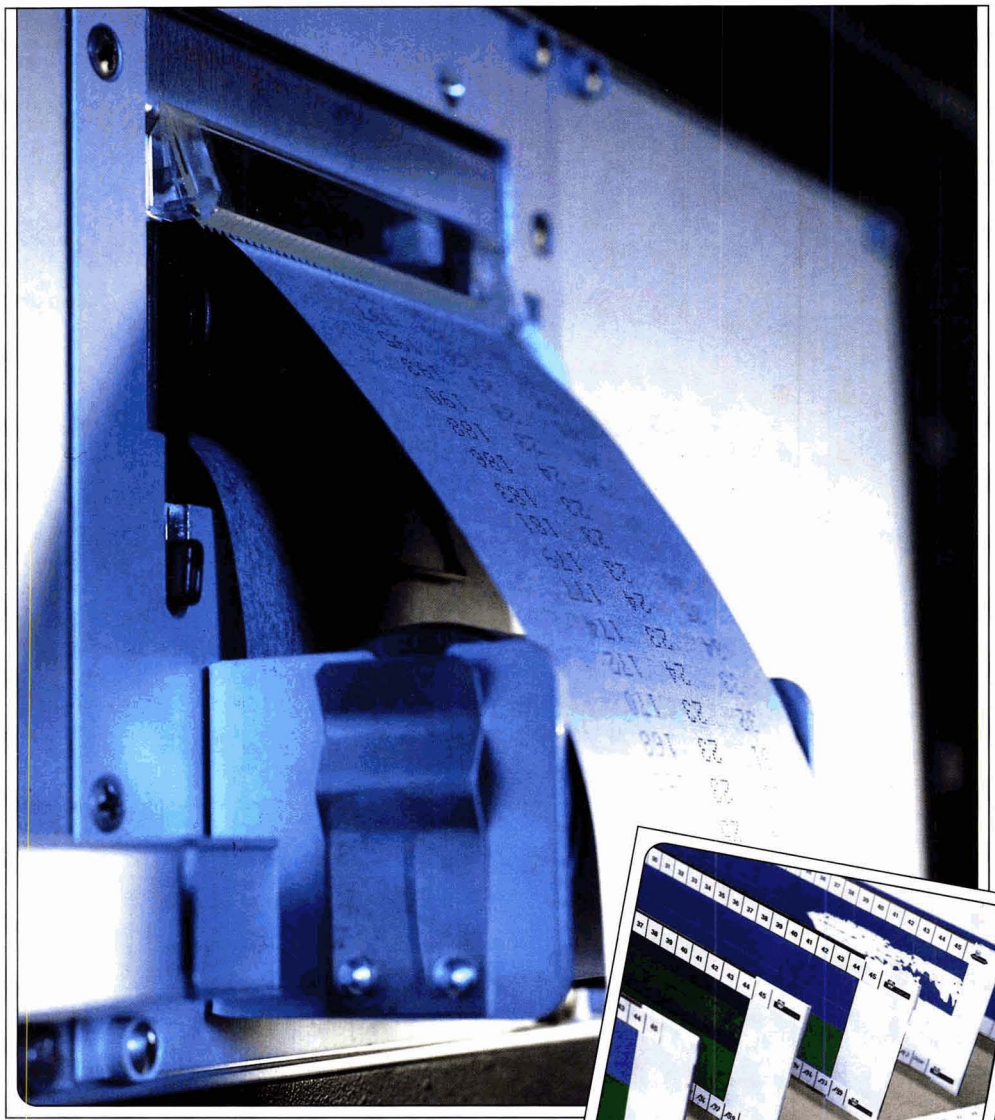
Developed under the auspices of the Educational Committee, the 20-minute professionally produced videotape depicts coatings as a highly technical industry offering many interesting and challenging opportunities, and is designed for presentation to high school students.

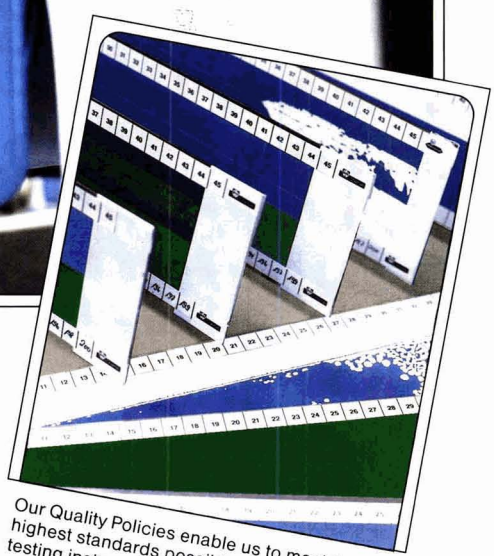
Copies of the videotape have been made available to each Constituent Society for showing at local high schools, Education Nights, Career Day programs, and other educational forums, to assist in their efforts to encourage students to pursue a career in coatings.

Available in VHS or Beta format, "The Choice" may be purchased through the Federation office. Price is $25 per copy.

RESULTS OF THE RUN—The FSCT Scholarship Fund was the winner of the first "Paint Show 5000," held in conjunction with the Paint Show in Dallas. Mort Spiegel, Director of Sales and Marketing for Troy Chemical Corporation, presented the Federation with a check for $500, shown here printed on a souvenir T-shirt. The gift represented the proceeds from the runners' registration fees

Quality you can reckon with





Color strength and consistency, fine dispersion, no floating or flooding – these are the criteria for measuring the quality of a coating system.
Universal mixing systems call for the highest quality if reproducible results are to follow. Wetting and dispersing additives play their part.

Our Quality Policies enable us to meet the highest standards possible. Our modern testing instruments many of which we have developed ourselves, allow us to monitor processes and measure results.

BYK Chemie

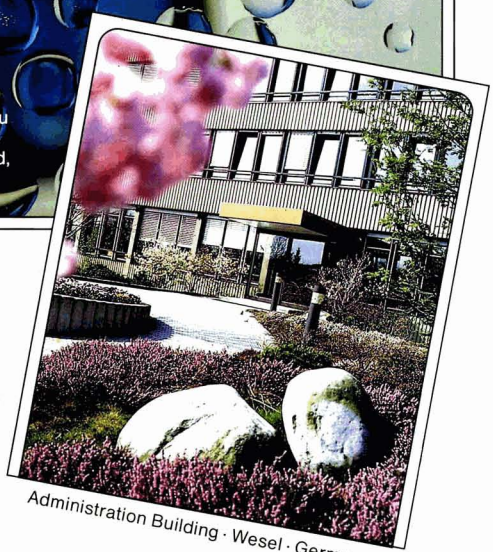
Characteristics of Disperbyk®-160/162/163

Criteria	Disperbyk®-160	Disperbyk®-162	Disperbyk®-163
Molecular weight			
Polarity	polar ←		→ less polar
Solid content	29 %	38 %	45 %
Main areas of usage			
High quality industrial paints	very good	very good	very good
Automotive Original Finish	very good	suitable	suitable
Vehicle Refinish	very good	very good	suitable
Pigment pastes	suitable	suitable	very good

Members of the Disperbyk®-160-family have been patented in several countries. They differentiate in the molecular weight and the polarity. So you have the possibility to choose the most suitable additive for your system.

This summary contains important information. Should you have any questions, don't hesitate to call your local BYK-Chemie Technical Representative or our Wallingford, Connecticut office.

W - HK Düsseldorf 11 991



Administration Building · Wesel · Germany

The new generation of patented* polymeric wetting and dispersing additives for organic and inorganic pigments improve pigment wetting, shorten the dispersion process, prevent reflocculation of pigments and permit the formulation of high-grade pastes. In terms of the type of bonding groups, their position in the molecule and the molecular weight, the Disperbyk®-160 family of additives has been developed according to the latest scientific findings.

*US-Patent 4,647,647 European-Patent EP-A0154678 Japan-Patent 166 319/1985

BYK-Chemie USA · Wallingford · Connecticut

BYK Chemie

Additives + Instruments

Regulatory UPDATE

JUNE 1988

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

Tin Paint Bill Passage Expected — As the *Regulatory Update* goes to print, H.R. 2210, a bill to curb pollution from tributyltin and other organotin based paints will likely be considered on the floor of the House, according to Congressional staff sources. Sources also indicate that House and Senate differences have been resolved making passage likely. The Navy and EPA are expected to recommend the bill to the President.

Organotin based paints are used to prevent barnacles, algae, and other encrusting organisms from attaching to the bottom of vessels. H.R. 2210 would prevent organotin paints on boats 25 meters or less in length, but provides an exemption for aluminum boats and outboard motors. The bill would also establish a release rate of four micrograms per centimeter per day. A ban on sale of organotin paints for larger ships would be in effect until EPA issued final regulations on the use of organotin chemicals. States would be permitted to impose stricter standards.

Contact the Committee on Merchant Marine and Fisheries, 1334 Longworth House Office Building, Washington, D.C. 20515, (202) 225-4047.

Toxicology and Carcinogenesis Study of Boric Acid Released — The National Toxicology Program (NTP) of the Department of Health and Human Services (HHS) has announced the availability of a Technical Report describing the toxicology and carcinogenesis studies of boric acid. Under the conditions of two year feed studies on male and female $B6C3F_1$ mice, there was no evidence of carcinogenicity of boric acid.

Copies of the report "Toxicology and Carcinogenesis Studies of Boric Acid in $B6C3F_1$ Mice (Feed Studies) (TR-324)," are available from the NTP Public Information Office, MD B2-04, P.O. Box 12233, Research Triangle Park, NC 27709, (919) 541-3991. Questions or comments should be directed to Dr. Michael P. Dieter, P.O. Box 12233, Research Triangle Park, NC 27709, (919) 541-3368.

EPA Proposes Underground Injection Control Rule — EPA has issued a proposed rule to implement the prohibitions on the underground injection of selected hazardous wastes mandated in the Hazardous and Solid Waste Amendments of 1984 (HSWA). The proposed rule covers wastes defined by section 3004(d)(2) of the Resource Conservation and Recovery Act (RCRA) — termed "California list" wastes — and solvents and dioxins prohibited under section 3004(g) of RCRA. See 53 Federal Register 14892 (Apr. 26, 1988).

Section 3004(f) of RCRA requires EPA to promulgate rules prohibiting the disposal of solvents, dioxins, and California list wastes unless the disposal is determined to be protective of human health and the environment. If EPA does not determine those instances when disposal would be protective, the injection of those wastes will be prohibited on August 8, 1988.

For certain hazardous wastes, EPA has determined that there is not enough alternate disposal capacity to contain the wastes being generated. Therefore, EPA is proposing a two-year variance from the August 8, 1988 deadline, and proposes banning injection of these wastes on August 8, 1990.

Included in the wastes for which EPA is proposing a 1990 injection ban are:

- K016 — Heavy ends or distillation residues from production of carbon tetrachloride.
- K019 — Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production.
- K030 — Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.
- K104 — Combined wastewater streams generated from nitrobenzene/aniline production.

Driven by a statutory deadline, the one-month comment period expired on May 26, 1988. Contact John Atcheson, Office of Drinking Water, (WH-550), 401 M Street, S.W., Washington, D.C. 20460, (202) 382-5508.

Federal Regulatory Agenda Shows Schedule for New Rules—The federal departments and independent agencies have issued their regulatory agenda. See 53 Federal Register (Apr. 25, 1988). Regulatory agenda provide information on the status of regulations that are under development, revision, and review, i.e., the pre-rule, proposed rule, and final rule stages. Regulatory agenda are revised semi-annually and appear in the Federal Register each April and October.

Persons interested in the schedule of regulations that may apply to the paint and coatings industry should obtain copies of the regulatory agenda of EPA and the Department of Labor [contains that of the Occupational Safety and Health Administration (OSHA)].

For copies of the EPA regulatory agenda, contact Bridgette Dent, Regulation Management Branch, PM-223, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-5475.

For copies of the Department of Labor regulatory agenda, contact Roland G. Droitsch, Deputy Assistant Secretary for Policy, Office of the Assistant Secretary for Policy, Rm. S-2312, Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-9058.

Included in the regulatory agenda are the following items.

EPA to Initiate Rulemaking Requiring Testing

The following list contains chemicals for which EPA will initiate rulemaking to require testing, obtain testing through negotiated consent orders, or publish notice which provides the reasons for not doing so. The date shown for each notice of proposed rulemaking is estimated and is not a commitment to act on that date.

Chemical	Notice of Proposed Rulemaking
Acid blue 40	04/00/89
Acid blue 45	04/00/89
Acrylates	02/00/89
Anthroquinone dyes	12/00/89
C.I. disperse blue 79	12/00/89
Disperse blue 56	04/00/89
Disperse red 60	04/00/89
Ethylbenzene	00/00/00
Ethylene glycol ethers category	00/00/00
Methyl ethyl ketoxime	09/00/88
Nonylphenol	06/00/88
1,1,1-Tricholourethane	01/00/89

See 53 Federal Register 14349 (Apr. 25, 1988).

Contact Gary Timm, Pesticides and Toxic Substances (TS-788), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 475-8130.

Regulatory Investigation of Chlorinated Solvents

EPA, in consultation with the Consumer Product Safety Commission, the Occupational Safety and Health Administration, and the Food and Drug Administration, is developing a strategy for a regulatory investigation of six chlorinated solvents: methylene chloride, perchloroethylene, trichloroethylene, methyl chloroform, carbon tetrachloride, and CFC-113. The investigation will determine whether coordinated regulatory controls are needed to eliminate or reduce exposure to these solvents. A notice of proposed rulemaking is expected in September, 1988. See 53 Federal Register 14352 (Apr. 25, 1988).

Contact Joseph DeSantis, Pesticides and Toxic Substances (TS-794), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-3945.

Occupational Exposure to Methylene Chloride

OSHA has issued a set of guidelines for controlling occupational exposure to methylene chloride and has decided to proceed with rulemaking to develop a new permanent standard. An advance notice of proposed rulemaking was issued in 51 Federal Register 42257 (Nov. 23, 1986). The notice of proposed rulemaking is expected in November, 1988. See 53 Federal Register 14022 (Apr. 25, 1988).

Contact Charles E. Adkins, Director, Health Standards Programs, Occupational Safety and Health Administration, Rm. N3718, FP Bldg., Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-7075.

OSHA Issues Final Ethylene Oxide Exposure Standard — The Occupational Safety and Health Administration (OSHA) has issued a final standard effective June 6, 1988 amending the existing standard that regulates occupational exposure to ethylene oxide (EtO). The new standard adopts an excursion limit for EtO of five parts of EtO per million parts of air (5 ppm) averaged over a sampling period of 15 min. The term "excursion limit" refers to the short term permissible exposure limit and is designed to reduce the significant risk faced by workers at the current eight-hour time-weighted average permissible exposure limit. Where the excursion limit is exceeded, employers are obligated to reduce exposure through implementation of feasible engineering controls and work practices. Employers are also required to establish a compliance program, exposure monitoring, and employee training. See 53 Federal Register 11414 (Apr. 6, 1988).

For further information, contact James F. Foster, Occupational Safety and Health Administration, Office of Public Affairs, Rm. N-3649, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-8151.

EPA Proposes to Delist Acid Blue 9 — EPA has issued a proposed rule to delete C.I. Acid Blue 9, diammonium salt, and C.I. Acid Blue 9, disodium salt, from the list of toxic chemicals subject to release reporting under section 313 of Title III of the Superfund Amendments Reauthorization Act of 1986 (SARA). The EPA received a petition to delist these chemicals and is proposing to grant the petition based on toxicity data on all salts of Acid Blue 9. See 53 Federal Register 12035 (Apr. 12, 1988).

EPA requests comments on all the analyses conducted for the review and on the proposal to delete Acid Blue 9 from the list of toxic chemicals under section 313.

Comments were due in triplicate by June 1, 1988, at Docket Control Number OPTS-400011, Section 313 Petition Coordinator, OTS Docket Clerk, TSCA Public Docket Office, Mail Stop TS-793, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. Contact Renee Rico, Petition Coordinator (WH-562A), Emergency Planning and Community Right-to-Know Hotline, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (800) 535-0202 or, in Washington, D.C. and Alaska, (202) 479-2449.

Reporting Requirements for Continuous Releases of Hazardous Substances — EPA has issued a proposed rule presenting its interpretation of section 103(f)(2) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended.

Section 103(a) of CERCLA requires that releases of hazardous substances equal to or greater than the reportable quantity (RQ) for that substance be reported immediately. Section 103(f)(2) provides relief from that requirement in the case of continuous releases of a stable quantity and rate. Such releases only require notification annually or when there is a statistically significant increase in the quantity released.

Key concepts included in the proposed rule include EPA's definitions of "continuous," "stable in quantity and rate," and "statistically significant increase." See 53 Federal Register 12868 (Apr. 19, 1988).

Comments are due in triplicate by June 20, 1988 at Docket Number 103(f)CR, Superfund Docket Clerk, Emergency Response Division, Rm. LG-100, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. For further information, contact Hubert Walters, Project Officer, Response Standards and Criteria Branch, Emergency Response Division (WH-548B), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20480, or call the RCRA/Superfund Hotline at (800) 424-9346 (in Washington, D.C. call (202) 382-3000).

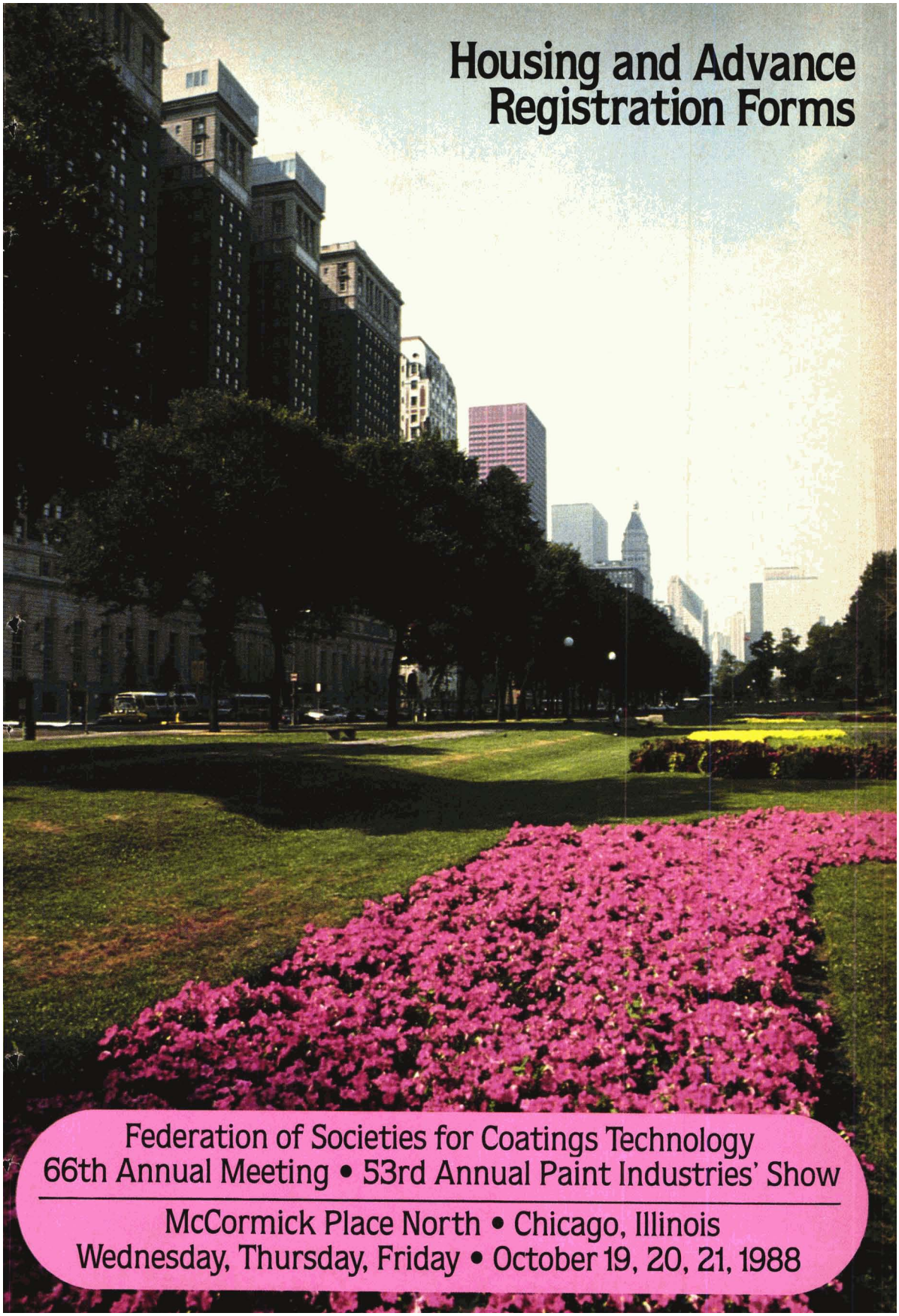
Request for Comments on Chemicals Nominated for Toxicological Evaluation—The Agency for Toxic Substances and Disease Registry (ATSDR) is soliciting public comments on eight chemicals nominated by EPA for toxicology studies under the National Toxicology Program (NTP). The chemicals are: Barium chloride; Xylene; Phenol; Monochlorobenzene; Manganese sulfate; Hexachlorocyclopentadiene; Copper sulfate; and two valences of Selenium, Sodium selenate and Sodium selenite. See 53 Federal Register 10569 (Apr. 1, 1988).

The ATSDR is authorized by the Superfund Amendments and Reauthorization Act (SARA) to obtain toxicological data for assessing potential human health effects. Public participation in the chemical evaluation process is encouraged. In particular, ATSDR is seeking information concerning: modes of production, current production levels, and environmental exposure potential; uses and resulting exposure level; toxicologic testing in the private sector; and results of toxicologic studies of related compounds.

Comments are due by June 30, 1988, at Docket Control Number ATSDR-4, Attn: Dr. Barry L. Johnson, Associate Administrator, Agency for Toxic Substances and Disease Registry, and Chairman, Hazardous Waste Information Evaluation Subcommittee, Building 27 South, Chamblee (F-38), 1600 Clifton Road, N.E., Atlanta, GA 30333, (404) 488-4590.

SUMMARY CALENDAR OF REGULATORY ACTIONS

June, 1988	Notice of proposed rulemaking proposing nonylphenol for toxic substances testing is expected in June according to EPA's regulatory agenda. (See this issue.)
June 1, 1988	Comments due on EPA's proposed delisting of C.I. Acid Blue 9 (both the diammonium and disodium salts) from the SARA release reporting requirements. (See this issue.)
June 20, 1988	Comments due on EPA's determination that the health data base for naphthalene is inadequate to determine carcinogenic potential or warrant regulation under the Clean Air Act. (See May issue.)
June 20, 1988	Comments due on EPA's proposed rule interpreting CERCLA section 103(f)(2) which concerns reporting requirements for continuous releases of hazardous substances. (See this issue.)
June 30, 1988	Comments due on nomination of eight chemicals for toxicology studies by the Agency for Toxic Substances and Disease Registry under the National Toxicology Program. (See this issue.)
July 13, 1988	Preliminary Assessment Information Manufacturer's Report due to EPA for plants where 18 new PAIR substances are manufactured or imported. (See May issue.)

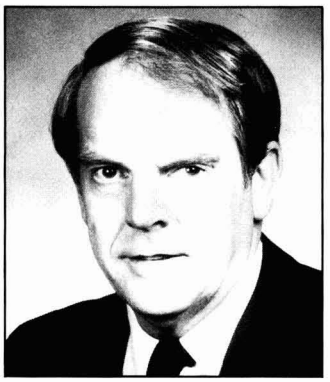


Housing and Advance Registration Forms

Federation of Societies for Coatings Technology
66th Annual Meeting • 53rd Annual Paint Industries' Show

McCormick Place North • Chicago, Illinois
Wednesday, Thursday, Friday • October 19, 20, 21, 1988

66th Annual Meeting
53rd Paint Industries' Show
October 19, 20, 21, 1988
McCormick Place North
Chicago, Illinois



TO OUR MEMBERS AND FRIENDS
OF THE FEDERATION EVERYWHERE:

It is a pleasure for me to invite all those associated with the coatings manufacturing industry to attend the Federation's 66th Annual Meeting and 53rd Paint Industries' Show in the great city of Chicago, October 19-21.

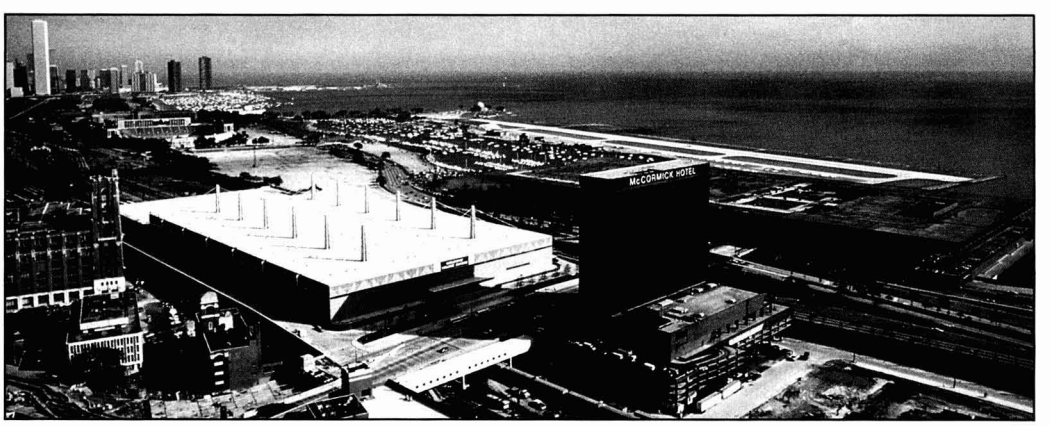
Because these events grow from year to year, for the first time in Chicago they will be held in the new North Hall of McCormick Place. The Paint Show has increased by over 50% since the last time it was held in Chicago, in 1984. An attendance of over 7,000 is also expected.

Running concurrently with the Paint Show will be the technical Program Sessions with the theme—"Performance *and* Compliance: The Challenge Intensifies." Presentations will highlight the new technologies which respond to the dual challenges of producing quality products while meeting increasingly restrictive compliance standards.

Come to Chicago to see the largest and finest exhibit of materials, equipment, and services for paint and coatings manufacturers—and—to attend the excellent program sessions which will help you to better understand and prepare for the future.

Deryk R. Pawsey

President, FSCT



The Paint Show—the largest in Federation history—will be held at the new McCormick Place North (left, center)

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY
1988 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
McCORMICK PLACE NORTH, CHICAGO, ILLINOIS
WEDNESDAY, THURSDAY AND FRIDAY, OCTOBER 19, 20, 21

The combined Annual Meeting and Paint Industries' Show is a major educational activity of the Federation. This international coatings manufacturing industry event consists of three days of technical program sessions and exhibits, running concurrently. Registration is required for admission.

"PERFORMANCE AND COMPLIANCE: THE CHALLENGE INTENSIFIES"

The theme of the 1988 Annual Meeting underscores the impact of regulatory restrictions on the coatings industry, which must respond to the dual challenges of producing quality products while meeting increasingly restrictive compliance standards. Programming will focus on such areas as corrosion protection, aerosol coatings, "high tech" coatings research, and the major regulatory issues affecting coatings formulation and manufacture. Also on the program will be the Mattiello Memorial Lecture, Roon Award Papers, Society Papers, and Seminars. Speakers will come from throughout the world of coatings science and manufacture.

ANOTHER RECORD PAINT SHOW WILL FEATURE LATEST PRODUCTS/SERVICES OF MORE THAN 220 EXHIBITORS

The Paint Industries' Show—the largest and best international exhibit of its kind in the world—will feature attractive exhibitor displays devoted to a wide variety of raw materials, production equipment, containers, laboratory apparatus, testing devices, and services furnished to the coatings manufacturing industry.

The purpose of the Show is to provide attendees with an opportunity to learn of the latest developments in these products and services. Key personnel from the top technical and sales staffs of exhibitors will be on hand. More than 220 exhibitors from the U.S., Canada, Europe, and Japan will utilize over 67,000 net square feet of exhibit space at the Show. Exhibit hours will be 11:00 – 5:30 on Wednesday; 9:00 – 5:30 on Thursday; and 9:00 – 3:00 on Friday.

The exhibitors who have reserved space in the Show are listed on page 7 in this brochure.

HOTELS AND RESERVATIONS: CHICAGO HILTON IS HEADQUARTERS

Eight hotels in Chicago have reserved blocks of rooms for the Annual Meeting and Paint Show. The headquarters hotel will be the newly-renovated, 1600-room Chicago Hilton and Towers.

The other cooperating hotels are: Essex Inn, Congress, Palmer House and Towers, McCormick Center, Hyatt Regency, Best Western Inn of Chicago, and Days Inn-Lake Shore. Please refer to map in this brochure showing location of hotels and schedule of rates.

Rooms are subject to a 12.1% occupancy tax. All hotel reservations will be processed by the FSCT Housing Bureau. Phone reservations will not be accepted. You will receive an acknowledgment of your reservation from the Housing Bureau. *This is not the hotel confirmation*; that will be sent to you directly from the hotel to which you have been assigned.

Additions, changes and cancellations—prior to September 19—must be submitted in writing to FSCT, c/o Chicago Convention & Visitors Bureau, McCormick Place-on-the-Lake, Chicago, IL 60616. After September 19, please direct all inquiries to the hotel, the phone numbers of which are (Area Code 312):

Chicago Hilton	922-4400	McCormick Center	791-1900
Essex Inn	939-2800	Hyatt Regency	565-1234
Congress	427-3800	Best Western	787-3100
Palmer House	726-7500	Days Inn-Lake Shore	943-9200

Reservations for the Palmer House and Towers will be accepted for arrival beginning Wednesday, October 19, only. Any reservations requesting the Palmer House for arrival prior to October 19 will be assigned to another hotel.

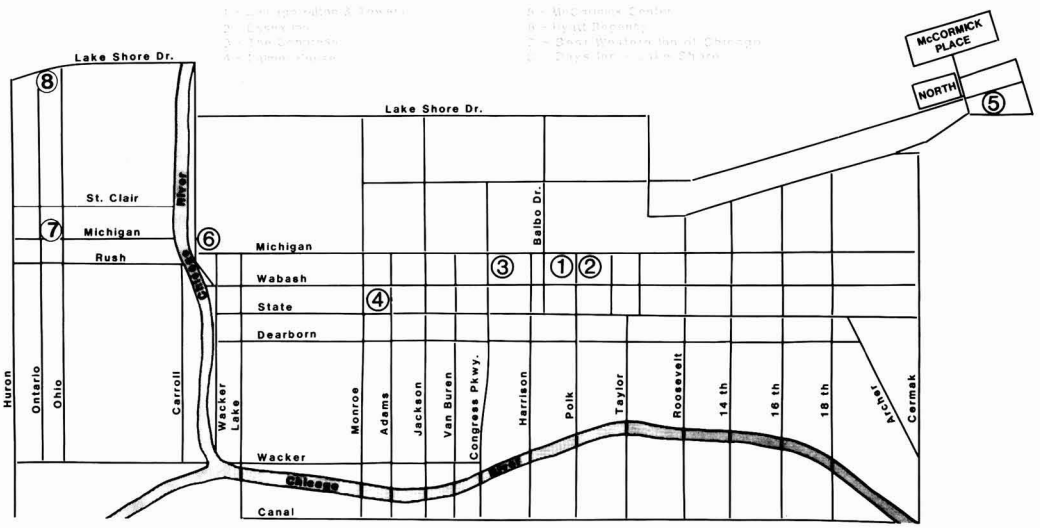
Requests for accommodations at either the Chicago Hilton or McCormick Center will be limited to ten rooms per company. A parlor counts as one room. Many hotels require deposits. Please read your confirmation carefully. If a deposit is required, *mail it directly to the hotel.*

HOTEL ROOM AND SUITE RATES

Map No.	Hotel Code	Hotel	Singles	Doubles/Twins	Suites	
(1)	111	**Chicago Hilton**	110-125-140 155-170	135-150-165 180-195	380-545 510-720	1 BR 2 BR
(1)	119	**Chicago Hilton Towers**	175-190	200-215	390-870	
(2)	106	**Essex Inn**	68-74-78	78-84-88	150-250	
(3)	115	**Congress**	70-80	85-95	150-350 225-425	1 BR 2 BR
(4)	112	**Palmer House & Towers**	100-115 130-145	120-135 150-165	260 & Up 515 & Up	1 BR 2 BR
(5)	110	**McCormick Center**	99-145	119-165	325-950	
(6)	113	**Hyatt Regency**	130	155	325-625 450-850	1 BR 2 BR
(7)	220	**Best Western Inn of Chicago**	85-90	90	205-375	
(8)	213	**Days Inn-Lake Shore**	89	99		

Note: Rates subject to 12.1% tax

Requests for accommodations at the Chicago Hilton and/or the McCormick Center will be limited to 10 rooms per company. A parlor counts as one room. Please read your confirmation from the hotel carefully. If a deposit is required, please mail check directly to the hotel.



FSCT 1988 ANNUAL MEETING AND PAINT INDUSTRIES' SHOW
McCORMICK PLACE, CHICAGO, ILLINOIS
WEDNESDAY, THURSDAY, AND FRIDAY, OCTOBER 19, 20, 21

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

APPLICATION FOR HOTEL ACCOMMODATIONS

Mail To: **FSCT**
c/o Chicago Convention & Visitors Bureau
McCormick Place-on-the-Lake
Chicago, IL 60616

Please indicate below the type of accommodations desired and choice of hotels. (Refer to the hotel map and rates and codes on opposite page). All reservations will be processed by the Chicago Convention and Visitors Housing Bureau. Hotel assignments will be made in accordance with prevailing availability. You will receive an acknowledgment of your reservation from the Housing Bureau. This is not the hotel confirmation. That will come to you directly from the hotel to which you have been assigned. Additions/changes/cancellations—prior to September 19—must be submitted in writing to the Housing Bureau at the above address. After September 19, please direct all inquiries to the hotel (phone numbers in this brochure).

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

CHOICE OF HOTELS	HOTEL CODE
1st	1.
2nd	2.
3rd	3.
4th	4.

NAMES OF ROOM OCCUPANTS AND DATES OF ARRIVAL/DEPARTURE

Type of Room	Name	Dates Arrive	Depart

Please Type Additional Reservations on a Separate Sheet and Attach to This Form

SEND CONFIRMATION FOR ALL RESERVATIONS TO:

Name _____ Telephone _____

Company _____

Address _____

City, State, Zip _____

Country _____

Name of Credit Card and # _____ Exp. Date _____ Signature _____

Note: Requests for accommodations at either the Chicago Hilton or McCormick Center will be limited to 10 rooms per company. A parlor counts as one room.

1988 Paint Industries' Show
Current List of Exhibitors

AccuRate, Inc.
Aceto Corp.
Advanced Coating Technologies, Inc.
Advanced Software Designs
Air Products & Chemicals, Inc.
Alcan-Toyo America, Inc.
Alpine American Corp.
Ambrose Co.
American Cyanamid Co.
Amoco Chemical Co.
Angus Chemical Co.
Applied Color Systems, Inc.
Aqualon Co.
Arco Chemical Co.
Aries Software Corp.
Ashland Chemical Co., IC&S Div.
Atlas Electric Devices Co.

B&P Environmental Resources, Inc.
B.A.G. Corp.
BASF Corp., Chemicals Div.
T.J. Bell, Inc.
Berol Chemicals, Inc.
Blackmer Pump Div., Dover Resources Co.
Bohlin Reologi, Inc.
Brinkmann Instruments
Brookfield Engineering Labs., Inc.
Brookhaven Instruments Corp.
BTL Specialty Resins Corp.
Buckman Laboratories, Inc.
Buhler-Miag, Inc.
Bulk Lift International
Burgess Pigment Co.
Byk-Chemie USA

C.B. Mills
Cabot Corp., Cab-O-Sil Div.
Calgon Corp., Div. of Merck & Co., Inc.
Cardolite Corp.
Cargill, Inc.
CasChem, Inc.
Catalyst Resources, Inc.
CDF Corp.
Chemical & Engineering News
Chemical Week
Chemolimpex, Hungarian Trading Co.
CIBA-GEIGY Corp.
Clawson Tank Co.
Coatings Magazine
Colloids, Inc.
Color Corp. of America
Colorgen, Inc.
Columbian Chemicals Co.
Cook Resins & Additives
Cosan Chemical Corp.
Coulter Electronics, Inc.
CPI Purchasing
Cray Valley Products, Inc.
Crosfield Chemicals, Inc.
Cuno Process Filtration Products
Custom Metalcraft Inc.
Cyprus Industrial Minerals Co.

D/L Laboratories
Daniel Products Co.
Datacolor
DataLogiX Formula Systems, Inc.
Day-Glo Color Corp.
Degussa Corp.
University of Detroit
Dow Chemical USA
Dow Corning Corp.
Draiswerke, Inc.
Drew Industrial
DSA Consulting, Inc.
DSET Laboratories, Inc.
Du Pont Co.

E.C.C. America
Eagle Zinc Co.
Eastern Michigan University
Eastman Chemical Products, Inc.
Ebonex Corp.
Eiger Machinery Inc.
Elcometer, Inc.
Elmar Industries, Inc.
EM Industries
Engelhard Corp.
Epworth Manufacturing Co., Inc.
ERDCO Engineering Corp.
Expancel, Nobel Industries Sweden
Exxon Corp.

Fawcett Co., Inc.
Federation of Societies for Coatings Tech.
Filter Specialists Inc.
Freeman Chemical Corp.
H.B. Fuller Co.

GAF Chemicals Corp.
Paul N. Gardner Co.
Georgia Kaolin Co., Inc.
Goodyear Chemical Div.
W.R. Grace & Co., Davison Chemical Div.

Halox Pigments, Div. Hammond Lead Prods
Harshaw/Filtrol Partnership
Henkel Corp.
Heubach, Inc.
Hilton-Davis Co.
Hi-Tek Polymers Inc.
Hitox Corp. of America
Hockmeyer Equipment Corp.
Hoechst Celanese Corp.
Horiba Instruments, Inc.
J.M. Huber Corp.
Hüls America Inc.
Hunter Associates Lab., Inc.

ICI Americas, Inc.
ICI Resins U.S.
Ideal Manufacturing & Sales Corp.
Illinois Minerals Co.
Indusmin Inc.
Industrial Finishing Magazine
Itasco Industries Div., I.W.I., Inc.
ITT Marlow Pumps

S.C. Johnson & Son, Inc.

Kemira Oy
Kenrich Petrochemicals, Inc.
Kent State University
King Industries, Inc.
Kraft Chemical Co.
KTA-Tator, Inc.

Labelette Co.
Leeds & Northrup
Liquid Controls Corp.
LogiCom, Inc.
The Lubrizol Corp., Diversified Prod. Group

3M
Macbeth Div. of Kollmorgen Corp.
Magnesium Elektron, Inc.
Malvern Instruments Inc.
Manchem, Inc.
Manville Corp.
The McCloskey Corp.
McWhorter, Inc.
The Mearl Corp.
Mettler Instruments
Micro Powders, Inc.
Micrometrics Instrument Corp.
Mid-States Eng. & Mfg. Co., Inc.
Miller Paint Equipment, Inc.
Milton Roy Co.
Mineral Pigments Corp., Davis Colors
MiniFIBERS, Inc.
Minolta Corp.
University of Missouri-Rolla
Mitech Corp.
Mixing Equipment Co.
Mobay Chemical Corp.
Modern Paint & Coatings Magazine
Morehouse Industries, Inc.
Mozel Chemical Products Co.
Myers Engineering

Netzsch Incorporated
Neupak, Inc.
Neville Chemical Co.
NL Chemicals, Inc.
North Dakota State University
NYCO

O'Brien Industrial Equipment
Ontario Research Foundation
ORB Industries, Inc.

P.A. Industries
Pacific Micro Software Engineering
Pacific Scientific Co., Instrument Div.
Packaging Service Co., Inc.
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Pico Chemical Corp.
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PPG Industries, Inc.
Premier Mill Corp.
Progressive Recovery, Inc.

Q-Panel Co.

Raabe Corp.
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Renzmann Inc.
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Rhone-Poulenc Inc.
Rohm and Haas Co.
Rosedale Products, Inc.
Russell Finex, Inc.

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Sanyo-Kokusaku Pulp Co., Ltd.
Schold Machine Co.
Semi-Bulk Systems, Inc.
Serac, Inc.
Shamrock Technologies, Inc.
Shell Chemical Co.
Sherex Polymers, Inc.
Sherwin-Williams Chemicals Co.
Silberline Manufacturing Co., Inc.
Sonoco Fibre Drum, Inc.
South Florida Test Service, Inc.
Spartan Color Corp.
Stone Container Corp., Bag Div.
Sub-Tropical Testing Service
Sun Chemical Corp.
Sylvachem Corp.

Tammsco, Inc./Unimin Corp.
Tego Chemie Service USA
Texaco Chemical Co.
Thiele Engineering Co.
Tokheim Corp., Process Controls Div.
Troy Chemical Corp.

U.S. Silica Co.
Unimin Corp./Tammsco, Inc.
Union Carbide Corp.
Union Process, Inc.
United Catalysts, Inc.
Universal Color Dispersions
Unocal Chemicals Div., Unocal Corp.

R.T. Vanderbilt Co., Inc.
Viking Pump-Houdaille, Inc.
Vorti-Siv Div. of M&M Machine, Inc.

Wacker Silicones Corp.
Warren-Rupp-Houdaille, Inc.
Wilden Pump & Engineering Co.
Witco Corp.

Zeelan Industries, Inc.

1988 ADVANCE REGISTRATION

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

1315 Walnut St., Philadelphia, PA 19107

C U V	Office Use Only
	Date received _____
	Amount $ _____
	Check No. _____

Please fill out this form and mail with a check in the correct amount (made payable to the FSCT) **to the Federation address shown above.** All checks must be payable in U.S. Funds. Any that are not will be returned. DEADLINE DATE FOR ADVANCE REGISTRATION IS SEPTEMBER 19. NONE WILL BE ACCEPTED AFTER THAT DATE.

A $10.00 charge will be made for cancellations received prior to September 19. No refunds will be made after that date.

INDUSTRY REGISTRATION FEES:

A ☐ MEMBER $50.00

Please name the Federation Society in which you are a paid-up member:

_____
Federation Constituent Society

B ☐ NON-MEMBER $65.00

G ☐ SPECIAL FEE FOR RETIRED MEMBERS $25.00

_____
Federation Constituent Society

INFORMATION FOR REGISTRATION BADGE

NICKNAME

FIRST NAME LAST NAME

BUSINESS AFFILIATION

STREET

CITY STATE *(U.S. only)*

MAILING ZONE COUNTRY (OTHER THAN U.S.)

BUSINESS CLASSIFICATION DATA FOR THE ABOVE REGISTRANT:

YOUR COMPANY (CHECK ONE BLOCK)

AA ☐ Manufacturers of Paints, Varnishes, Lacquers, Printing Inks, Sealants

BB ☐ Manufacturers of Raw Materials

CC ☐ Manufacturers of Equipment and Containers

DD ☐ Sales Agent for Raw Materials and Equipment

EE ☐ Government Agency

FF ☐ Research Testing Consulting

GG ☐ Educational Institution Library

HH ☐ Paint Consumer

JJ ☐ Other

YOUR POSITION (CHECK ONE BLOCK)

KK ☐ Management/ Administration

LL ☐ Manufacturing and Engineering

MM ☐ Quality Control

NN ☐ Research and Development

PP ☐ Technical Sales Service

QQ ☐ Sales and Marketing

RR ☐ Consultant

SS ☐ Educator/Student/ Librarian

TT ☐ Other

SPOUSES REGISTRATION AND INFORMATION FOR REGISTRATION BADGE

D ☐ SPOUSE $35.00

NICKNAME

NAME

ADDRESS

CITY STATE

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SPECIAL FEE FOR THE SPOUSES OF RETIRED MEMBERS ONLY:

H ☐ $25.00

TICKETS FOR FEDERATION LUNCHEON, FRIDAY, OCTOBER 21 (@ $20.00)

Z ☐ NUMBER REQUIRED: _____
$20.00 EACH.

A CHECK IN THE AMOUNT OF:

$ _____

IS ENCLOSED

SPECIAL FARES AVAILABLE FROM UNITED AND DELTA AIRLINES

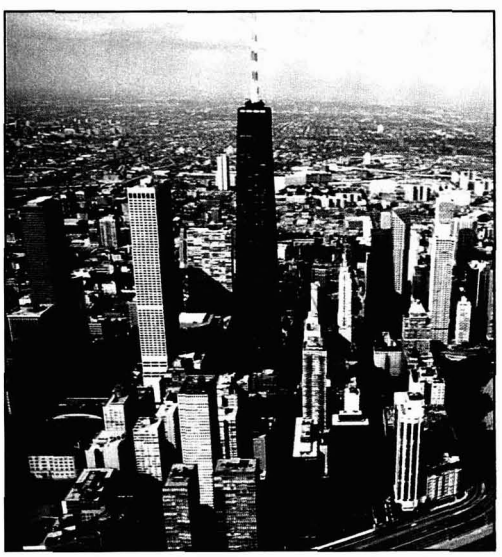
United Airlines and Delta Air Lines, in cooperation with the FSCT, are offering a special discount fare which affords passengers a 40% minimum savings off their round trip, undiscounted day coach fares for travel to the FSCT Annual Meeting and Paint Industries' Show on the airlines' domestic systems. The discount from Canada is 35%.

United Airlines Reservations

To take advantage of this discount, you must: (1) Travel between October 16-24, 1988; (2) Phone 1-800-521-4041 for reservations. Immediately reference the FSCT File Number: **8002D**. The special fares are available only through this number.

Delta Air Lines Reservations

To take advantage of this discount, you must: (1) Travel between October 14-23, 1988; (2) Purchase tickets at least seven days in advance; (3) Phone 1-800-241-6760 for reservations. Immediately reference the FSCT File Number: **U0235**. The special fares are available only through this number. For Delta Frequent Flyers, triple mileage is available if tickets are purchased with an American Express card.



The Sears Tower, the tallest building in the U.S., dominates the magnificent Chicago skyline

Discounts on either airline are good for both direct and connecting flights to Chicago. If you use travel agents, have them place your reservation through the toll-free number to obtain the same fare advantages. Both United and Delta have a variety of other promotion fares, some of which may represent even greater savings. When you phone for reservations, ask for the best discount applicable to your itinerary.

FEDERATION BOARD OF DIRECTORS TO MEET ON TUESDAY AT THE HILTON

The Board of Directors of the Federation will meet on Tuesday, October 18, at 9:00 a.m. in the Chicago Hilton Hotel.

SHUTTLE BUS SERVICE BETWEEN HALL F TO McCORMICK

Special daytime shuttle bus service will be provided between the North Hall of McCormick Place and the *cooperating hotels.*

ANNUAL FEDERATION LUNCHEON WILL BE HELD ON FRIDAY

The annual Federation Luncheon will be held on Friday, October 21, at the McCormick Center Hotel.

SPOUSES ACTIVITIES TO INCLUDE TOUR OF UNIVERSITY OF CHICAGO AND MUSEUM OF SCIENCE & INDUSTRY

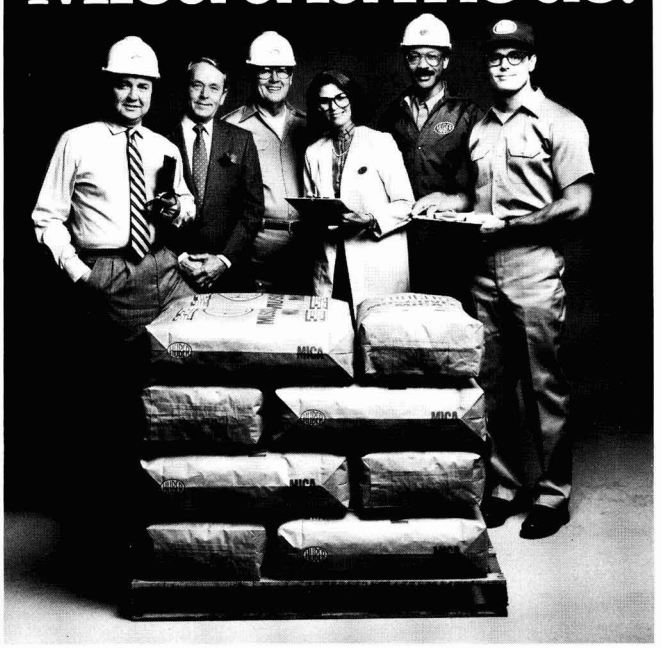
The Spouses Program of Activities will begin on Wednesday, October 19, with a get-acquainted wine and cheese social in the Williford Room of the Chicago Hilton. On Thursday, the spouses will tour the University of Chicago with a visit to the Museum of Science and Industry. The group will be treated to a private organ recital at the University's Rockefeller Chapel. Luncheon will be served at the Ambassador West Hotel's elegant Guildhall.

NPCA TO MEET SAME WEEK AT PALMER HOUSE

The National Paint and Coatings Association will hold its annual meeting on October 17-19, 1988, at the Palmer House and Towers. Persons wearing NPCA badges (who sign up at a special registration desk) will be admitted to the Paint Show on Wednesday only, with the compliments of the Federation.

Mica a la carte.

Mica a la mode.



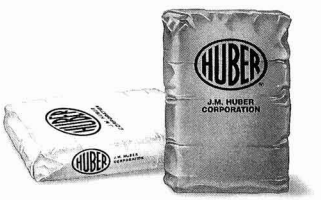
With Huber mica products, you get a lot more than quality mica. You get added value in the form of people and services—at no extra cost.

How does Huber mica stack up to the others? Huber delivers a high aspect ratio, highly delaminated, wet ground white muscovite mica. To live up to those standards, we built the newest, most modern mica plant in the world.

But what makes our mica unique is the "a la mode." The total range of services and resources that ensure top performance for your products.

Like our polymer lab and compounding facility in Texas where we test your compounds to determine which formulation works best for you. And our tech support team that can become an extension of your staff.

Next time, order your mica a la mode. Order from Huber. For product details, contact your Huber sales representative, or call 912/745-4751.



Our Quality Runs Deep.℠

Color and Appearance Interlaboratory Testing Program Strives to Improve Reliability of Measurements

The Collaborative Testing Program for Color and Appearance, 1988-89, operated and maintained by Collaborative Testing Services, Inc., Herndon, VA, provides participating laboratories a means of comparing, periodically, the level and uniformity of their testing with that of other laboratories. The program is aimed toward improvement in the reliability of color and appearance measurements.

The interchange of components and products that must match in color and appearance is of interest to producers of such products as paint, plastics, paper, textiles, food, and cosmetics, as well as to the users of these products, which includes the automotive and appliance industries, government, and the consumer.

The program is geared toward checking both instrument calibration and operator techniques, comparing the level and precision of participants' test results, regular examination of instrument calibration, refining test accuracy, improving uniformity of supply, and providing documentation of testing capabilities.

The Interlaboratory Testing Program offers four testing cycles a year and a choice of four different conditions of measurements. In addition, a large data base of over 200 participants currently enrolled in the program will insure the validity of instrument testing.

The program furnishes test samples and results and a summary report for each method showing the data from all participants. Test samples and schedules include: test specimens at two levels of gloss during each of the four time samples; color and color difference of paint chips; a spectrophotometric analysis of paint chips (requires participation in the color and color difference test); and color and color difference of primarily near-white papers.

Registration for the 1988-89 program runs from July 1, 1988 through June 30, 1989. Enrollment may take place at any time during the year with the fee prorated for the balance for the testing year.

The Collaborative Testing Program is operated and maintained by CTS. Technical guidance and advice is provided by representatives from various instrument manufacturers. CTS also offers collaborative and interlaboratory testing programs in cooperation with various associations for a wide variety of industries.

For additional information, write Collaborative Testing Services, Inc., P.O. Box 1049, Herndon, VA 22070.

Henkel to Build Tech Center in Ambler, PA; Morristown, NJ, Based Unit to Relocate

Henkel Corp., Gulph Mills, PA, the U.S. subsidiary of the Henkel Group, West Germany, will build a $7 million technical center at its operations facility in Ambler, PA. Construction of the 36,000-sq ft facility is expected to be completed and the building occupied during the first quarter of 1989.

The new laboratory will be staffed with approximately 80 professionals and technicians who will conduct medium- to long-range research and development in support of Henkel's U.S.-based metal treatment, high performance polymers, paper, and coating chemicals businesses.

The new plant will be under the direction of Executive Vice-President of Technology Frank Precopio.

In other related business, Henkel will consolidate the marketing, administration, and technical activities of its Morristown, NJ-based Process Chemicals Unit with the Organic Products business already located at the 40-acre Ambler site. An existing building on the Ambler property will be renovated to accommodate the workforce expansion there.

The move will unify operations of the Organic Products business. Approximately 100 employees will be transferred in phases from Morristown to Ambler in the next 10 months.

In addition, the Paper and Chemicals Group of the Process Chemicals Unit will relocate its administrative, marketing, and technical service operations from Morristown to Charlotte, NC. This group, comprised of approximately 20 employees, will move into existing office and laboratory space at a Henkel production facility.

By mid-summer, manufacturing operations currently conducted at Ambler for Parker + Amchem metal treatment products will be transferred to other company production facilities in Warren, MI and Burlington, IA.

ACS Seeks Nominees for 1989 Roy W. Tess Award

The American Chemical Society's Division of Polymeric Materials: Science and Engineering (PMSE) is seeking nominations for the "Roy W. Tess Award in Coatings." This award, for $1,000, will be presented at the 198th meeting of the ACS, September 10-15, 1989, in Miami Beach, FL.

The Tess Award, which recognizes outstanding individual achievements and noteworthy contributions to coatings science, technology, and engineering, is chaired by George R. Pilcher. Members of the Nominating Committee are: Richard J. Himics, of Daniel Products Co.; Taki J. Anagnostou, of Eastern Michigan University; Charles E. Hoyle, of University of Southern Mississippi; Percy E. Pierce, of PPG Industries, Inc.; and F. Louis Floyd, of The Glidden Company.

Nominations are welcomed from all sections of industry and academia, and should be forwarded to the Chairman at Hanna Chemical Coatings Corp., P.O. Box 147, Columbus, OH 43216-0147. Upon receipt of names, the Chairman will submit a documentation form requesting information on the nominee relevant to patents, publications, etc. All nominations for the 1989 Tess Award should be submitted prior to September 1, 1988. Nominations received after that date will be considered for the succeeding year's award.

Cabot Corp. Expansion Announced

The CAB-O-SIL Division of Cabot Corporation recently announced its intention to increase capacity of its line of fumed silica at its plant in Tuscola, IL. The expansion will involve a 25% increase in hydrophilic fumed silica capacity. In addition, the company plans to construct a new unit to manufacture hydrophobic fumed silica grades.

What would you call a dispersant that can be effectively used at 1/3 to 1/2 the level of products now in use?

We call it K-SPERSE™

Introducing K-SPERSE™ — the new standard of cost performance in dispersing agents... exclusively from King Industries.

K-SPERSE™ delivers excellent dispersion rates, uniformly greater viscosity reduction and a lot more — for less.

You can expect MORE in:

MATERIAL SAVINGS — Maintain needed properties using 1/2 to 2/3 less dispersant. K-SPERSE™ works from 0.2% to 2.0% total pigment weight or 0.2% to 0.8% total formula weight.

VERSATILITY — K-SPERSE™ works for organic and inorganic pigments in non-aqueous and solvent free compositions.

STABILITY — K-SPERSE™ produces a uniform pigment dispersion and prevents reagglomeration during letdown.

LOW VISCOSITY/HIGH GLOSS — K-SPERSE's superior deflocculating action gives you the desired low viscosity for application flexibility, good hiding power, better resistance properties and a glossy finish.

COMPATIBILITY — K-SPERSE™ has proven effective in alkyd, epoxy, chlorinated rubber, bitumen, polyurethane, acrylic and polyester systems.

New K-SPERSE™ Dispersant Agent, when you want more — for a lot less!

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INNOVATIVE PRODUCTS FROM INVENTIVE PEOPLE

ICI/Monsanto Patent Litigation Now Settled; Agricultural Herbicide to Be Sold in U.S. in 1991

ICI, Wilmington, DE, and Monsanto Co., St. Louis, MO, have announced a settlement of patent litigation which acknowledges the validity of Monsanto's patents on the herbicide glyphosate and provides ICI Agrochemicals with certain international licenses for the manufacture and sale of Touchdown® herbicide under those patents. Monsanto will be the supplier of the intermediate n-phosphonomethylglycine used to make Touchdown.

The settlement ends litigation begun in 1983 between Monsanto and Stauffer Chemical Co., which was acquired by ICI in July 1987.

The Federal District Court in St. Louis has entered a final judgement which decrees that Monsanto's U.S. patents involved in the suit are valid, enforceable, and infringed by Stauffer's Touchdown herbicide.

Under the terms of the agreement, ICI is licensed to manufacture and sell Touchdown for agricultural use in the U.S. as of April 1, 1991. The agreement also provides for worldwide testing and development and for entry prior to patent expiry in a few other selected countries where there is potential for large market expansion. The terms of the agreement also enable ICI to manufacture Touchdown immediately in the U.S. for export to countries in which glyphosate patents have expired.

Monsanto's U.S. patent protection covering glyphosate herbicides expires in the year 2,000.

Monsanto also will have rights to acquire options for joint exclusive U.S. distribution with ICI of certain potential new corn herbicides of ICI.

Hanson Industries Sells Latin American Holdings

On April 5, Hanson Industries, New York, NY, the U.S. arm of Hanson PLC, announced the sale of certain companies comprising their Latin American operations to H.B. Fuller Co., St. Paul, MN, for $15.3 million.

The sale of Hanson's holdings include 100% of the Glidden Paint operations in Panama, 60% in Costa Rica, and 63.3% in Ecuador. Hanson acquired its interests in Glidden Paint in Latin America as part of its 1986 acquisition of SCM Corporation. Hanson Industries still retains paint operations in Mexico.

Hanson PLC is a British-American industrial management corporation.

Ashland Chemical Acquires Water Treatment Business

Ashland Chemical Co., Columbus, OH, has contracted the water treatment business of Chemical Testing Corp., Stamford, CT, a supplier of specialty chemicals and consulting services for industrial and commercial water treatment.

The business will be incorporated into Ashland's Drew Industrial Division. Drew Industrial is a supplier of specialty chemicals and consulting services for the treatment of boiler and cooling water, fuel, and waste streams. It also supplies process chemicals and technical services to the pulp and paper and mining industries and additives to manufacturers of paint and latex.

Ashland Chemical is a producer and distributor of chemicals, specialty chemicals, and plastics for industry.

Degussa AG/Bhartia Group Form Joint Silicas Venture

Degussa AG, Frankfurt am Main, West Germany, in conjunction with the Indian Bhartia Group, has established a joint venture in India for the manufacture of 7,000 tons of spray-dried precipitated silicas per year.

Both partners will take out a 40% holding in the joint-venture subsidiary, which will operate under license from Degussa as Insilco. The remaining 20% of the shares will be made available on the Indian capital market.

The Insilco production plant is to be set up in Gajraula, in the state of Uttar Pradesh, India. The necessary approval has been issued by the government of India and production is scheduled to begin in early 1991.

New MetChem Division Formed by Betz Industries; Emphasis on Surface Preparation and Finishing

Betz Industrial, Trevose, PA, has announced the formation of MetChem—a new division charged with servicing exclusively the automotive, steel, and manufacturing industries.

MetChem will provide a full range of products and services for water, energy, and process systems. Major emphasis will be placed on surface preparation and finishing operations.

The new division will provide total systems management and provide programs for boiler, cooling, waste treatment, surface preparation, paint spray booths, and environmental compliance testing. MetChem will use existing research and development efforts of Betz Labs in the areas related to boiler, cooling, and water and waste. However, the new division will have its own research and development facilities for surface preparation and paint spray booth program development.

In addition, the facility will have a fully automated multistage phosphating line, coil and container lines, and wet and dry paint spray booths.

Managing the new division will be: Vice-President and General Manager—Leonard R. Wall; Assistant Vice-President (Engineering and Product Management)—Carmen V. Sarno; and Sales Manager (Field Management)—M. Raymond Matuza.

Environmental Program Launched by Hercules

Hercules Incorporated, Wilmington, DE, recently launched the worldwide environmental awareness program "We Care." A unique, new Hercules environmental flag was unveiled during the festivities.

The We Care activity focuses on a "renewed commitment to environmental protection," according to David S. Hollingsworth, Chairman and Chief Executive Officer of Hercules. Their efforts involve thorough and continuous evaluation of all manufacturing operations for environmental accomplishments.

The environmental awareness program will be inaugurated at all Hercules locations around the world. Flags with the appropriate language of each country have been designed.

Volstatic Group of Companies Acquired by Subsidiary Firm

Volstatic, Inc., Florence, KY, purchased its parent company Volstatic International, Ltd., on March 18. Included in the sale is the subsidiary company Volstatic, Ltd., London, England.

The modernization of facilities in the United Kingdom and expansion of the U.S. organization to include a West Coast office and demonstration facility are among growth plans currently underway.

The London-based Volstatic, Ltd., remains a British company under British day-to-day management, while Volstatic, Inc., remains an American company.

The Volstatic group of companies designs and manufactures electrostatic powder coating application equipment.

PICTORIAL STANDARDS OF COATINGS DEFECTS

Revised and updated edition of this manual (previously titled "Exposure Standards Manual") has been compiled in conjunction with the American Society for Testing and Materials, and includes definition, description, and photographic standards for each of the following defects: Adhesion; Blistering; Chalking; Checking; Cracking; Erosion; Filiform Corrosion; Flaking; Mildew; Print; Rust; Traffic Paint Abrasion and Chipping.

Also included is reference information on supplementary standards, along with sample record sheets for compiling exposure data.

Bound in handsome 10" × 11½" × 1½" three-ring, vinyl-covered binder which readily accommodates additional material as it is developed.

Complete manual...$90 (includes shipping charges)*
Individual Standards...$3 each, plus $3 for each photograph.
Record Sheets (pad of 100 sheets)...$3.50

Please make all checks payable in U.S. funds.
Pennsylvania residents add 6% sales tax.

Send orders to: Federation of Societies for Coatings Technology
1315 Walnut St., Suite 832, Philadelphia, PA 19107

Federation of Societies for Coatings Technology

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 7,000 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 the submission not only of regular research papers, but also *Open Forum* comments on subjects of relevant interest, and *Letters to the Editor.* All manuscripts will be assumed to be original work and to have been unpublished elsewhere; not under consideration for such publication; not copyrighted; and to have been submitted for appropriate clearance by the organization with which the author is affiliated if such clearance is necessary. 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 or regional meetings or symposia of the Constituent Societies. ***Papers in which proprietary products or processes are promoted for commercial purposes are specifically non-acceptable for publication.***

SUBMISSION OF MANUSCRIPTS . . .

. . . for the Journal

Technical Papers: Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, PA 19107.

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 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.

Papers originally composed for oral presentation may have to be revised or rewritten by the author to conform to the style suitable for written publication.

Open Forum: Three complete copies should be sent to the Open Forum Editor, at the address listed above.

The same general rules as given for technical papers should be followed in the preparation of an Open Forum manuscript. However, the subject may be informally approached. Topics may be nontechnical in nature, dealing with any aspect of the coatings industry.

Letter 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 above.

. . . for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to the Chairman of the 1988 Roon Awards Committee, Gary Gardner, Tnemec Co., Inc., P.O. Box 1749, Kansas City, MO 64141. (For complete details, see "Roon Awards" section of the JOURNAL for January 1988.)

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).

Manuscripts should be typed with double spacing on one side of 8½ × 11 inch (22 × 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 × 7 inch (13 × 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

The headings and sub-headings in this Guide illustrate their use to divide the text into sections to improve readability for comprehension, and to break up typographical monotony; they may be used as a model for preparation of the text of a manuscript for publication. The text should *not* be presented as an alphanumeric outline.

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 non-photographic blue-lined 8½ × 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 for typesetting.

Graphs should not be used if they merely duplicate the data given in tables, or vice versa.

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 × 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.

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(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).

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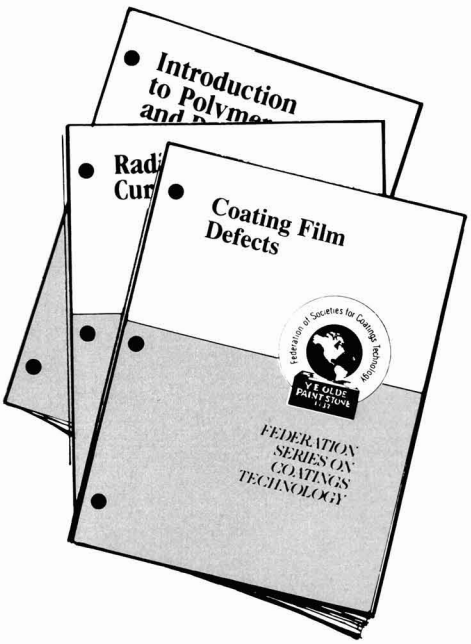

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Isoparaffins Impart Beneficial Properties To Coatings

S.J. Storfer, J.T. DiPiazza, and R.E. Moran
Exxon Corporation*

Synthetically produced isoparaffins possess lower surface tensions than most other solvents. Employment of these isoparaffinic solvents in solvent blends and in paint formulations reduces their surface tensions, which enhances their ability to wet substrates.

In water-borne coatings, foam generation is reduced when isoparaffins are used at low concentrations, alone or together with conventional antifoam agents, with no sacrifice in odor or performance. Higher-boiling isoparaffins offer the added benefit of extending wet-edge time for these water-borne coatings.

INTRODUCTION

Because surface tension affects coatings performance, appearance, and value, an understanding of its role in coatings behavior is necessary if one is to fully utilize this property in formulating coatings. In addition to affecting the ability of a coating to wet and adhere to a substrate, surface tension and/or surface tension gradients are reported to influence flowout, leveling, and sprayability of coatings.

This paper reviews the relationship between surface tension of solvents and the ability of coatings formulated with them to wet substrates. Also described is a synergism found in reducing surface tension of coatings when isoparaffins are employed. Finally, examples are given of how the properties of water immiscibility and low surface tension, which are found in isoparaffins, help to reduce foaming of aqueous coatings.

Presented at the Water-Borne and Higher-Solids Coatings Symposium, in New Orleans, LA, on February 26, 1987.

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RELATION BETWEEN SURFACE TENSION OF NEAT SOLVENTS AND COATINGS

Perhaps the most generally recognized phenomenon related to surface tension is the ability of a liquid to wet a substrate. The beading of various liquids on a surface forms the basis of assigning to that surface a characteristic parameter, called the critical surface tension γ_C. To determine γ_C, one measures the contact angles (Θ) of liquids with various surface tensions on the surface to be measured, and extrapolates a plot of the cosines of these angles vs the respective surface tensions to Cos Θ = 1 (*Figure* 1). This is the value at which a liquid would spontaneously spread if applied to that surface as a droplet. According to Zisman,[1] any liquid with a surface tension lower than γ_C should wet that surface.

The belief that adhesion is promoted by good contact between coating and substrate pervades the literature,[2]

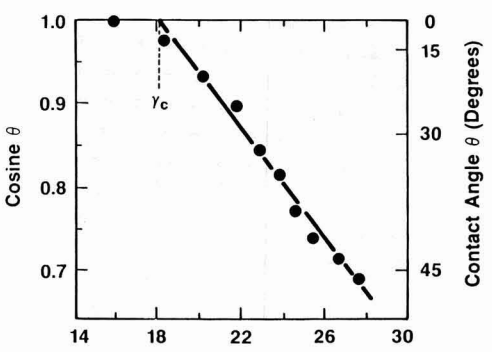

Figure 1—Determination of critical surface tension

Table 1—Surface Tensions of Solvents[a]

Solvent Type	Surface Tension dynes/cm, 20°C
Aliphatic hydrocarbons	18-28
Esters	21.2-28.5
Alcohols	21.4-35.1
Ketones	22.5-26.6
Glycol ethers	26.6-34.8
Aromatic hydrocarbons	28-30
Glycol ether esters	28.2-31.7
Water	72.7

(a) From ref. (4).

Table 2—Critical Surface Tensions of Polymers[a]

Polymer	dynes/cm
Poly n-butyl methacrylate	32
Polyvinyl acetate	36
Polyvinyl chloride	39
Melamine resin	39
Polymethyl methacrylate	41
Polyethylene terephthalate	43
Epoxy resin	47
Urea-formaldehyde resin	61

(a) From ref. (4).

and applies to inks as well as coatings. For example, Dooley's work with printing inks[3] concludes that: (a) Adhesion of an applied liquid to a solid surface is best obtained when the critical surface tension of the surface is equal to or higher than that of the liquid; and (b) Improvement of adhesion can be obtained by reducing the surface tension of the liquid applied.

Sprinkle[4] notes that all the ingredients in a coating contribute to its surface tension. With the exception of water, most solvents have lower surface tensions than the resins employed in surface coatings. For solvents, these values range from 18 dynes/cm for aliphatic hydrocarbons to 35 dynes/cm for some glycol ethers (*Table* 1). Paint polymers generally have critical surface tensions ranging from 32 dynes/cm for some acrylic resins to 61 dynes/cm for urea-formaldehyde resins (*Table* 2).

Measurement of Surface Tension

Three methods for measuring surface tension were considered for this study: Du Nuoy ring; Wilhelmy plate; and capillary tube. Of the three, the Wilhelmy plate proved to be the best choice for our purposes; it is accurate, reproducible, and most suitable for measuring the surface tensions of paints.

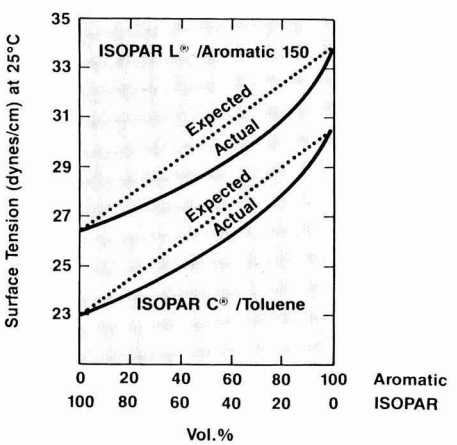

Figure 2—Surface tensions of isoparaffinic and aromatic hydrocarbon blends

The Wilhelmy plate method is similar in principle to the more widely known Du Nuoy ring method. Both techniques require that the force necessary to withdraw a chemically inert platinum body from a liquid is precisely measured. In the Du Nuoy method, a platinum ring, horizontally suspended, is immersed into the liquid, and the force necessary to pull the wetted ring from the liquid is measured. With the Wilhelmy plate method, the bottom horizontal edge of a vertically suspended rectangular platinum plate of known dimensions is brought into contact with the liquid, and the force necessary to pull the plate from the liquid is measured.[6] Both procedures are precise when homogeneous liquids are employed, but the Wilhelmy plate method proves more reproducible with paints which are both heterogeneous and contain solvents with varying volatilities. A Kruess Digital Tensiometer K 10, equipped with a Wilhelmy plate, was employed for all the surface tension measurements described herein.

Surface Tensions of Solvent Blends

In many cases, surface tensions of solvent blends may be calculated by simple interpolation of the values of each component. Occasionally, synergism occurs, where the resulting surface tension is significantly lower than expected. For example, blends of isoparaffinic solvents with aromatic solvents (*Figure* 2) show a reduction of intermediate surface tensions. An even more dramatic reduction in surface tension is obtained with blends of an isoparaffin plus n-butyl alcohol (*Figure* 3).

The improved wetting capabilities of solvents with lower surface tensions can be demonstrated via a simple test. If drops of different solvents are placed next to each other on a substrate with a critical surface tension lower than either solvent, the solvent with the lower surface

Table 3—Surface Tension of a Pigmented Acrylic/Melamine Coating Solution at 2.8 lbs Solvent/USG Coating[a]

Solvent	Surface Tension, dynes/cm Coating	Solvent
Isobutyl isobutyrate	26.5	23.2
Methyl amyl ketone	29.5	26.1
Xylene	31.5	28.0
Ethoxyethyl acetate	32.0	28.2

(a) From ref. (4).

Table 4—Effect of Solvent on Surface Tensions of Polymer Solutions

Resin Type	Solvent Type	Solvent	Surface Tension, dynes/cm		
			Wt %	Solution	Solvent[a]
Long oil alkyd[b]	Isoparaffinic hydrocarbon	Isopar® G[c]	60	23.6	22.3
	Naphthenic hydrocarbon	Exxsol® D40[d]	60	26.4	24.7
	Aromatic hydrocarbon	Aromatic® 100[e]	60	31.2	28.8
Melamine[f]	Aliphatic ester	Exxate® 600[g]	60	29.4	25.7
	Aliphatic ketone	Methyl amyl ketone	60	29.5	26.0
	Glycol ether acetate	Methoxypropyl acetate	60	32.0	27.7
	Aromatic hydrocarbon	Aromatic 100	60	32.0	28.8
Acrylic lacquer[h]	Aliphatic ester	Exxate 600	50	24.4	25.7
	Aliphatic ketone	Methyl amyl ketone	50	26.6	26.0
	Glycol ether acetate	Methoxypropyl acetate	50	27.8	27.7
	Aromatic hydrocarbon	Aromatic 100	50	27.1	28.8
Polyurethane[i]	Aliphatic ester	Exxate 600	60	28.9	25.7
	Aliphatic ketone	Methyl amyl ketone	60	30.0	26.0
	Glycol ether acetate	Methoxypropyl acetate	60	31.7	27.7
	Alicyclic ketone	Cycohexanone	60	38.5	34.2

(a) Additional information on the surface tension of hydrocarbon solvents is found in *Table* 11.
(b) Synresate 1700, a registered tradename of DSM Resins, the Netherlands.
(c) Isopar is a registered tradename of Exxon Corp.
(d) Exxsol is a registered tradename of Exxon Corp.
(e) Aromatic is a product of Exxon Corp.
(f) Cymel 303, a registered tradename of American Cyanamid Co.
(g) Exxate is a registered tradename of Exxon Corp.
(h) Acryloid B44, a registered tradename of Rohm and Haas Co.
(i) Desmodur N-100, a registered tradename of Mobay Chemical Co.

tension will literally push the other away. Isoparaffins have been found to perform excellently in this test.

Surface Tensions of Solvents Vs Polymer Solutions

As the formulator increases the resin concentration in a higher-solids coating, the influence of the higher surface tensions of resins becomes apparent as the solution surface tension increases. Many problems encountered are surface-tension related, such as poor wetting, cratering, and "picture framing." Sprinkle finds a direct relationship between the surface tension of the solvents used in a coating and the resulting surface tension of the coating (*Table* 3). On the basis of this, he recommends that, by selecting solvents with lower surface tension, one may obtain a coating with a corresponding lower value.

We have observed a similar relationship between surface tensions of neat solvents and of their polymer solutions (*Table* 4). A reduction also was obtained when an experimental high solids paint formulated with an isoparaffin (Isopar G) was compared with a paint made with an aromatic solvent of similar volatility (Aromatic 100). As seen in *Table* 5, the observed reduction in surface tension is more than twice as great as would have been expected by simple interpolation of data. To illustrate, the surface tension of Isopar G is 6.5 dynes/cm less than that for Aromatic 100. Linear interpolation suggests that the surface tension of the coating formulated with Isopar G would be about 0.7 dynes/cm less than that made with Aromatic 100; in fact, it is 1.7 dynes/cm lower.

Table 5—Reduction in Surface Tension with Isoparaffinic Solvents

Sample	A	B
Composition		
Acrylic resin	27.1 wt %	27.1 wt %
Cymel 303	10.6	10.6
TiO_2	25.6	25.6
Additives	1.2	1.2
Total solids	64.5	64.5
Exxate 600	20.6	20.6
n-butyl alcohol	4.3	4.3
Isopar G	10.6	—
Aromatic 100	—	10.6
Surface tension, dynes/cm		
Composite solution	24.8	26.5
Isopar G (100% solvent)	22.3	—
Aromatic 100 (100% solvent)	—	28.8

Table 6—Effectiveness of Isopar M as a Defoaming Agent

Sample	Density, g/mL		Density Reduction, Percent
	Original	After Agitation	
Commercial semi-gloss paint	1.2806	1.0836	15.4
Plus 1% Isopar M	1.2439	1.2190	2.0
Plus 1% water	1.2465	1.1599	6.9

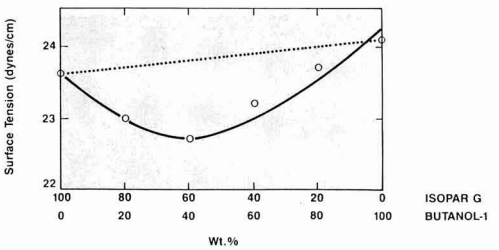

Figure 3—Surface tensions of isoparaffin/butanol-1 blends

Table 8—Comparison of Isoparaffins with Other Solvents As an Antifoaming Agent

Sample	C′	D′	D″	D‴
Paint	Semi-Gloss			
Additives, wt %				
Propylene glycol	5.96	2.98	2.98	2.98
Silicone antifoam	0.51	0.26	0.26	0.26
Isopar M	—	3.23	—	—
Mineral spirits	—	—	3.23	—
Deodorized kerosene	—	—	—	3.23
Density, lb/USG				
Before shaking	10.31	10.35	10.34	10.33
After shaking	10.22	10.29	10.19	10.22
% Change in density	0.87	0.58	1.45	1.06

EFFECT OF ISOPARAFFINS ON ANTIFOAMING BEHAVIOR AND WET-EDGE CONTROL

Two challenges that face formulators of water-borne coatings are the minimization of foaming and the control of evaporation rate to retain good wet-edge properties. The surfactants employed in many water-borne paints cause them to foam readily, and the high volatility of water, compared with solvents used in solvent-borne architectural paints, can allow brush and roller marks to remain if good wet-edge control is not maintained.

According to Laere,[5] foaming is a function of several parameters, including surface tension. He further suggests that many water-immiscible liquids will act to control foam in aqueous systems, and attributes it to the following mechanism (*Figure* 4):

(1) A droplet of immiscible liquid must be admitted to the surface of the foamable system;

(2) The droplet must spread spontaneously across the aqueous film. As the immiscible liquid spreads, it imparts a shearing force to the film and causes subsequent thinning of the film;

(3) The thin surface ultimately becomes incapable of supporting an extended liquid foam, and rupture occurs. Silicone fluids are frequently used, although mineral oils also may be employed. However, silicones tend to be costly, and may impart undesirable surface properties to the applied coating, whereas hydrocarbons, such as isoparaffins, benefit from lower cost and evaporate from the paint without deleterious side effects.

An important application property of gloss and semi-gloss latex paints affecting their formulations is the need for wet-edge time. To lap into a previously painted area without leaving the surface distorted with brush or roller marks, the paints must stay wetter longer than flat latex wall paints, sufficiently so that there will be adequate reflow into the lapped areas. This is accomplished, in most cases, by using relatively high levels of a glycol or glycol ether in the formulation.[7] Many references can be cited which describe the use of water-miscible glycols or glycol ethers to extend wet-edge time, but the authors could find no references which either discussed or precluded the use of water-immiscible solvents for this purpose.

Since isoparaffinic solvents are endowed with low surface tension values, we devised a series of experiments to measure their performance as defoamers. In addition, to test the benefits of water-immiscible liquids to control wet-edge time, we restricted the selection of isoparaffins to those with relatively low volatility. In the first series of tests, we examined the effect of the addition of high-boiling isoparaffinic solvents on the properties of commercial paints. These results were sufficiently attractive to encourage us to obtain flat, semi-gloss, and high-gloss base stocks from paint manufacturers, in which antifoam agents and wet-edge improvers were omitted, so that we

Table 7—Isoparaffins as an Antifoaming Agent and Wet-Edge Improver

Sample	A	B	C	D	E	F
Paint	Flat		Semi-Gloss		High Gloss	
Additives, wt%						
Ethylene glycol	2.1	1.05	—	—	—	—
Propylene glycol	—	—	5.96	2.98	—	—
Methoxyethoxyethanol	—	—	—	—	4.5	2.25
Silicone antifoam	0.35	0.18	0.51	0.26	0.48	0.24
Isopar M	—	1.22	—	3.23	—	2.49
Density, lb/USG						
Before shaking	11.03	10.92	10.50	10.39	10.04	9.96
After shaking	10.98	10.89	10.33	10.29	9.56	9.74
% Change in density	0.45	0.27	1.62	0.96	4.8	2.2
Wet-edge, sec	—	—	360	420	420	450

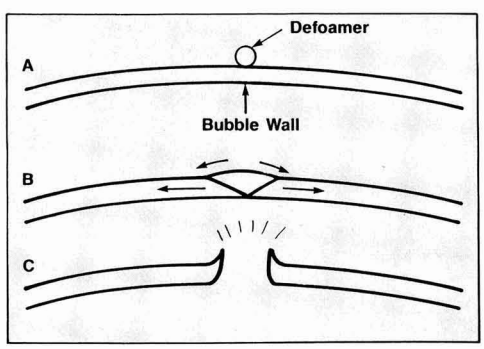

Figure 4—Mechanism of defoaming action

Table 9—Cost of Conventional Antifoam and Wet-Edge Additives vs Partial Replacement with Isoparaffins

Paint		Semi-Gloss	
Sample		C	D
Density, lb/USG		10.0	10.0
Additives	**Cost, $/lb**	**Quantity, lb/USG**	
Propylene glycol	0.40	0.596	0.298
Silicone antifoam	2.00	0.051	0.026
Isopar M	0.284	—	0.323
		Cost, $/USG	
		0.340	0.263
		Savings, $/USG	
		—	0.077

might control the total antifoam and wet-edge package. In the final phase of this program, we evaluated the effects of reformulation on the properties of the applied high-gloss paints.

Phase I. Addition of Isoparaffins To Commercial Paints

High-boiling isoparaffins were found to provide significant improvement to architectural latex paints, with respect both to defoaming and extended wet-edge control. In these tests, we purchased several commercial semi-gloss enamels from a paint store and added to each 1 vol % of Isopar M (bp = 207-254°C) or (as a control) water. Each sample was agitated for 30 min and allowed to stand for 30 min after shaking. The densities of the paints, before and after shaking, were measured, and the percent density reduction was calculated (*Table* 6). Similar tests were run, in which the vol % foam was measured as a function of time (*Figure* 5). For these experiments, 100 mL of paint were shaken in a graduated cylinder, and the volume of foam was measured as a function of time. In all cases, the addition of water *or* isoparaffin reduced the tendency of the paint to foam, compared with the untreated sample, but Isopar M was found to be more effective in reducing foaming.

In an effort to correlate wet-edge with solvent volatility, we developed a method to determine the relative

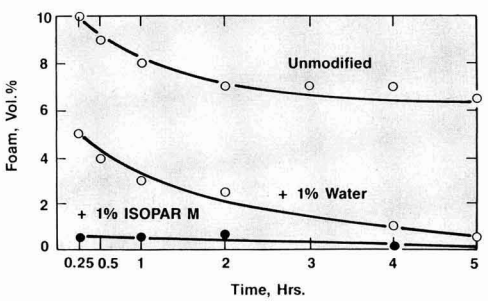

Figure 5—Foaming characteristics of agitated semi-gloss latex paint

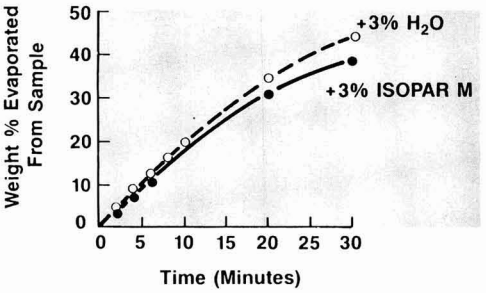

Figure 6—Effect of high boiling isoparaffins on evaporation of volatiles from a semi-gloss latex paint

Table 10—Properties of Paints Formulated with Isopar M

Sample	E	F
Paint	**High Gloss**	
Additives, wt%		
Methoxyethoxyethanol	4.5	2.25
Silicone antifoam	0.48	0.24
Isopar M	—	2.49
Viscosity stability		
Initial, KU	98	106
2 Weeks @ 125°F	100	116
Freeze-thaw, 5X	100	110
Set-to-touch, min		
77°F, 50% RH	15	20
Ease of Application		
Brush	Exc.	Exc.
Roller	Exc.	Exc.
Leveling	Exc.	Exc.
Gloss, 60°	76	74
Opacity	96.2	96.2
Whiteness	90.2	90.1
Blocking	Trace	v.Sl.
Water spotting	None	Trace

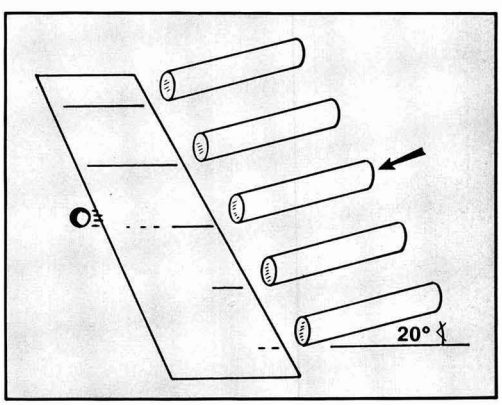

Figure 7—Schematic illustration of rolling-ball wet-edge tester

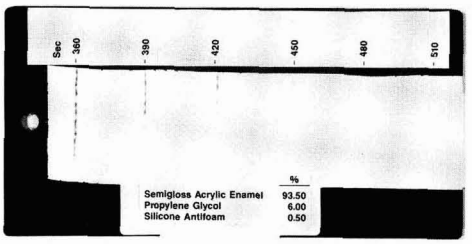

Figure 8—Wet-edge measurement of semi-gloss acrylic enamel standard

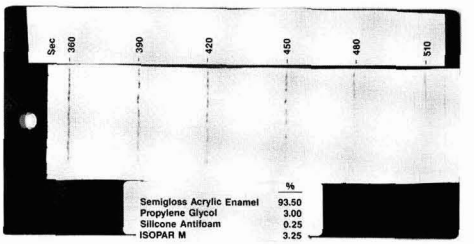

Figure 9—Wet-edge measurement of semi-gloss acrylic enamel with Isopar M

evaporation rates of volatiles from applied films. This was accomplished by applying a 3-mil draw-down, and measuring the loss of solvent (primarily water) on an analytical balance as a function of time. The addition of relatively low concentrations of isoparaffins resulted in considerable reduction of the evaporation rate. As seen in *Figure* 6, addition of 3% Isopar M to a commercial paint increased the time for evaporation of the volatiles by about 20%. This effect is not due to the lower volatility of Isopar M, alone. We believe that the isoparaffinic solvent may form a thin film on the surface of the applied paint, which retards the evaporation of the water and thus extends its wet-edge time.

Phase II. Partial Replacement Of Conventional Additives

A second procedure was also devised to measure wet-edge. This involved rolling a one-half inch diameter stainless steel ball across a 3-mil wet draw-down at 30-sec intervals. *Figure* 7 illustrates the equipment, which consists of a battery of 6-in. long tubes set at a 20° angle (to assure that the steel balls roll across the panels in a uniform manner). Since no attempt was made to control relative humidity or temperature (both of which can affect wet-edge time), we minimized the impact of these factors by running comparative evaluations at the same time.

For this program, we obtained three water-borne architectural paints directly from paint manufacturers, to which were added no commercial (silicone) antifoam agents or wet-edge improvers (ethylene glycol for the flat paint, propylene glycol for the semi-gloss, and diethylene glycol mononethyl ether for the high-gloss paints). Optimum results were obtained with a partial replacement of the commercial additives with Isopar M (*Table* 7). (Total replacement of the commercial additives was impractical because some glycol is required to maintain freeze-thaw stability of these paints.)

The controls employed contained the concentration of antifoam and glycol that was recommended by the paint manufacturers (columns A, C, and E in *Table* 7). To test the effect of using isoparaffins in these formulations, we reduced the recommended concentrations of glycol and silicone by 50%, and added an equal weight of Isopar M (columns B, D, and F in *Table* 7).

In all cases, foaming was reduced by 40-50%, as measured by the density reduction of the paints after shaking. In addition, wet-edge was extended by 30-60 sec, using the rolling ball test we devised. *Figures* 8 and 9 are photographs of the panels employed with the semi-gloss paints. No attempt was made to correlate the results of this rolling ball test with the ability of an applied paint to accept a second-coat touchup. We do believe, however, that this test directionally indicates the benefits achieved with low concentrations of isoparaffins in architectural paints.

Additional foam tests were run to compare isoparaffins with other hydrocarbon solvents of comparable molecular weight, such as mineral spirits and deodorized kerosene. As seen in *Table* 8, less foaming occurred with Isopar M, and we attribute this to its lower surface tension.

In addition to offering performance benefits, the partial replacement of conventional additives with isoparaffinic solvents also offers economic benefits. As seen in *Table* 9, replacement offers the formulator an estimated savings of 7.7 cents/gal based upon the formulations employed. (Additional savings that would be realized because of the lower density of isoparaffins vs propylene glycol and silicone oil were not calculated. At equal weights, isoparaffinic solvent contains more gallons per hundred pounds than do the additives it replaces. This, in turn, modestly increases the number of gallons that will be realized by the formulator.)

Table 11—Surface Tensions of Hydrocarbons

Type	Hydrocarbon	Surface Tension dynes/cm
Aromatic	o-Xylene	30.04[a]
Aromatic	m-Xylene	28.66[a]
Aromatic	p-Xylene	28.31[a]
Aromatic	Ethylbenzene	29.05[a]
Aromatic	Aromatic 100	29.0[b]
Aromatic	Aromatic 150	30.0[b]
Naphthenic	Exxsol D40	24.6[b]
n-Paraffin	n-Octane	21.61[a]
n-Paraffin	Norpar® 12 (10-13C)	24.8[b]
Isoparaffin	2,2,4-Trimethylpentane	18.77[a]
Isoparaffin	Isopar G	23.5[b]
Isoparaffin	Isopar L	25.9[b]
Isoparaffin	Isopar M	26.6[b]

(a) Source: Design Institute for Physical Property Data (conducted at 20°C).
(b) Source: Exxon Co., U.S.A. (conducted at 25°C).
Norpar is a registered tradename of Exxon Corp.

Phase III. Evaluation of Paints Made With Isoparaffins

Finally, paints formulated with standard antifoam and wet-edge improvement agents were compared with those made with isoparaffins to assure that no deterioration in properties occurred as a result of this reformulation. The results in *Table* 10 show little-to-no effect on the properties of the applied paints as a result of incorporating isoparaffinic solvents.

SUMMARY

The ability of a paint to wet a substrate can be improved by using solvents with lower surface tensions (*Table* 11).

Isoparaffinic solvents may be employed as antifoaming agents at lower cost than conventional glycols and silicone additives, without sacrificing the performance properties of the coating.

Isoparaffinic solvents can be used to extend the wet-edge time of water-borne coatings and to inhibit foaming.

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Introduction of a Novel, Nonmetallic Fungicide for the Coatings Industry

Dennis L. Dalton
Cosan Chemical Corporation*

Paint films are subject to fungal attack, which leads to cosmetic disfigurement, deterioration of the paint itself, and possible loss of adhesion. Fungicides are incorporated into coatings to prevent these deleterious effects and to prolong the life and usefulness of the paint. Of the organic fungicides used today, the leading products have come from the agricultural chemical market and were not designed for use in coatings. They present a variety of negative attributes and exhibit side-effects in the coating formulation. Consequently, coating manufacturers have had either to formulate around these shortcomings or offer an exterior coating with less than optimum characteristics. At the present time, coatings manufacturers are still looking for an improved paint mildewcide.

After many years of development work, a new fungicide based on novel chemistry specifically designed for use in coatings to protect against mildew defacement has been introduced. This paper reveals the chemistry of this new compound, the developmental history, and the superior performance characteristics through the presentation of both laboratory and field evaluation data. Comparisons with fungicides currently on the market are shown. The form in which the compound will be commercially available is reviewed, as well as its favorable toxicity profile.

INTRODUCTION

The susceptibility of organic surface coatings to attack and deterioration by microorganisms is well known. Under humid conditions, coatings are subject to fungal development, which leads to loss of aesthetic value and deterioration of film properties, such as elasticity, water resistance, adhesion, and general film integrity. To prevent premature failure due to microbiological attack, the coatings must be protected through the incorporation of a suitable fungicide. Such a fungicide should ideally meet several requirements besides have biocidal activity. These requirements include:

(1) low mammalian and nontarget organism toxicity;

(2) persistence in the film after exposure to weathering (nonleaching and nonvolatile);

(3) resistance to ultraviolet (UV) light exposure (nonchalking and nonyellowing);

(4) resistance to inactivation through hydrolysis, pH reactivity, and physical adsorption;

(5) compatibility with paint formulation ingredients; and

(6) no effect on physical characteristics of the coating, such as viscosity, color, odor, corrosiveness, etc.

Most of the paint film fungicides that are commercially available were not designed specifically for use in coatings. The leading products in use today, in fact, originated from the agricultural chemical market. Hence, these products do not meet all the requirements previously listed. Coatings manufacturers have had to formulate around these shortcomings and offer exterior coatings that are lacking in some performance areas. In 1978, an ambitious research program was launched in search of a coatings fungicide that would meet these various toxicity and performance criteria, and overcome the shortcomings of the products currently on the market. After years of research and development work involving the synthesis and screening of thousands of compounds, one chemical emerged that met the rigid specifications set at the outset

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Table 1—Common Deficiencies of Commercial Mildewcides

Effect	Cause
Loss of fungal resistance after storage of the paint	Loss of fungicide through hydrolytic decomposition, physical adsorption, or chemical reaction
Undesired color development	Reaction of the fungicide with other paint constituents (i.e., driers, bactericide, etc.)
Premature loss of fungal resistance in areas directly exposed to rain	Loss of fungicide through solubilization (leaching)
Poor fungal resistance in geographical regions with high acid rain levels	Loss of fungicide through solubilization in acidic medium
Premature loss of fungal resistance in areas directly exposed to sunlight	Loss of fungicide through photodegradation, volatilization, or thermal decomposition
Yellowing upon exposure to sunlight	Photooxidation of the fungicide
Chalking and poor tint retention	Photooxidation of the fungicide
High toxicity or handling hazards	Chemical nature of the fungicide

of the project. This compound is N-(4-bromo-2-methylphenyl)-2-chloroacetamide (BMPCA).

This paper introduces this new fungicide to the coatings industry. The developmental history of this new compound is briefly reviewed and its performance characteristics discussed through the presentation of both laboratory and field evaluation data. A toxicity summary is also provided.

DEVELOPMENTAL HISTORY

Historically, compounds such as organomercurials, trialkyltin compounds, and barium compounds have been used in coatings as mildewcides or fungistats. Due to perceived problems of acute toxicity and waste discharge, as well as other environmental considerations, some companies have increasingly chosen to limit their use of these products. This created a need in the industry for a nonmetallic fungicide which does not have these perceived drawbacks. As a result, a handful of nonmetallic fungicides such as Chlorothalonil and Folpet have gained fairly wide acceptance as replacements for the metallic fungicides.

Many of these mildewcides were originally developed for uses other than coatings, primarily agricultural use, and therefore, present a variety of negative attributes when used in coatings. Thus, those formulators who have exchanged metallic compounds for nonmetallics have also exchanged one set of limitations for another in making the change. One such limitation is photooxidation, which is often a required property of agricultural chemical treatments. In coatings, this ultraviolet light decomposition of fungicides can promote discoloration, chalking, erosion, loss of adhesion, and loss of activity.

Another limitation of some nonmetallic fungicides is instability in aqueous systems. These products undergo hydrolytic decomposition in water and water-based products; this limits their use to solvent-based coatings. Still, other nonmetallics undergo reactions with common paint components, such as ammonia, which lead to inactivation of the fungicide and require the addition of stabilizers to prevent this inactivation.

Toxicity also remains a problem for some of the nonmetallic fungicides. Rather than high acute toxicity, however, which is mainly associated with the metallics, some of the nonmetallic fungicides can exhibit adverse long-term toxicity characteristics, such as mutagenicity, carcinogenicity, teratogenicity, or other toxicological drawbacks that make handling or use hazardous.

A listing of the limitations of commercially available fungicides used in coatings is shown in *Table* 1.

The need for a fungicide that is specifically geared toward the coatings industry prompted the initiation of this research project.

The probability of a successful candidate resulting from an extensive research program is 10,000 to 1. In other words, if 10,000 compounds are synthesized over a period of months or years, it is probable that only one compound could be commercially developed. Besides the toxicological and performance standards that have been set as specifications for such a candidate, other factors need to be considered in deciding whether to continue or discontinue the development of a new fungicide. Some of these are: increasingly stringent government requirements for EPA registration; plant waste disposal and environmental impact considerations; rising costs of plant construction, raw materials, and energy; and changing market potentials and competitive situations.

The preliminary phase of the project involved a general study of many classes of compounds and functional groups to determine in which of these areas further detailed research work should be carried out. The mode of action and the toxicology of an antimicrobial compound depends primarily on the active group or groups that make up the molecule. This first phase of the project led to the decision to concentrate on the acetamide class of bioactive compounds. This decision was made because acetamides have known biocidal activity. In addition, the acetamides as a group have good chemical stability, particularly in the 7-9 pH range. Furthermore, amides do not generally contribute color, which, of course, is extremely important in coatings applications.

During the next stage of the project, thousands of compounds belonging to this class of chemicals were synthesized. All of these chemicals were then screened for effectiveness against a selected group of microorganisms known to colonize paint films under varying exposure conditions. The biological assay tests used for screening were minimum inhibitory concentration (MIC) tests. These types of tests strictly determine biological activity, independent of other factors such as compatibility in coatings, resistance to weathering, etc. One of the MIC procedures used is described in the section, Materials and Methods.

Nine candidate compounds emerged out of this effort as having good biological activity against a broad spectrum of paint-colonizing microorganisms. They were then subjected to a battery of secondary screening tests, in-

cluding laboratory and field performance evaluations in coatings, and preliminary toxicological assays.

After completion of this extensive evaluation program, analysis of all of the data revealed that two of these compounds had excellent biocidal activity in both the laboratory tests and the extended outdoor exposures. One of the compounds, however, showed a far superior toxicological profile, and therefore, this chemical was chosen as the final candidate. This chemical is N-(4-bromo-2-methylphenyl)-2-chloroacetamide (BMPCA).

The final stage of our project comprised a cooperative research effort with several leading U.S. coatings manufacturers. Agreements were signed with these companies whereby the coatings manufacturers would incorporate BMPCA into their formulations in replacement of the fungicide normally used. Coded paint samples (unidentified) were then provided to an independent exterior test facility in Florida. Coatings were tested via test fence exposure. Results of this work are given later in this paper.

MATERIALS AND METHODS

Materials

In the comparative laboratory and exterior test fence evaluations, several commercial fungicides, both metallic and nonmetallic, were used for comparative purposes. These materials are listed in *Table* 2, along with the recommended use levels.

All of the laboratory and field tests involved the use of two basic emulsion paint formulations. One was a vinyl acrylic flat outdoor house paint formulation shown in *Table* 3 and the second was an acrylic flat house paint formulation which is shown in *Table* 4. These are the basic coatings without fungicide.

Methods

MIC TEST: As a preliminary study of biocidal activity, the compounds were tested in a malt extract broth medium against the following organisms: *Alternaria solani, Aspergillus niger, Aureobasidium pullulans, Chaetomium globosum, Neurospora species,* and *Penicilium species.*

In this procedure, a stock solution of the compound under test is prepared, as well as a series of culture tubes containing equal amounts of malt extract broth. An appropriate quantity of the compound stock solution is added to a first tube to achieve a concentration of 1,000 ppm. After proper mixing, an equal amount is transferred from tube one into tube two and mixed. This results in a concentration of 500 ppm in tube two. This process of serial dilutions is continued until the lowest concentration to be tested is achieved.

After preparation of all the tubes, they are each inoculated by pipetting an appropriate volume of a spore suspension of the test organism into each tube and shaking. The tubes are incubated for seven days at 25°C. Following incubation, the tubes are visually rated for growth (+) or no growth (0). The presence of turbidity in the broth is indicative of growth. (If the broth immediately

Table 2—Fungicides Used in Comparative Evaluations

Fungicide	Generic Chemical Name	Tradename[a]	Recommended Use Levels
Tetrachloroiso-phthalonitrile	Chlorothalonil	Nopcocide® N-96	0.4-1.0%
3-Iodo-2-propynyl butyl carbamate	IPBC	Polyphase® AFI	0.3-1.0%
2-N-Octyl-4-Iso-thiazolin-3-one	Isothiazolin	Skane® M-8	0.08-0.3%
Phenylmercuric acetate	PMA	Cosan® PMA 100	0.08-0.25%

(a) Throughout this text these generic chemical designations are used to refer to the fungicide listed under the "Tradename" column.
Nopocide is a registered tradename of the Henkel Corp.
Polyphase is a registered tradename of the Troy Chemical Co.
Skane is a registered tradename of the Rohm and Haas Co.
Cosan is a registered tradename of the Cosan Chemical Corp.

Table 3—Vinyl Acrylic House Paint Formulation

Ingredients	Pounds Per 100 Gal
Pigment Grind	
Water	367.4
Hydroxyethyl cellulose QP-15000	5.0
Dispersant	4.6
Potassium tripolyphosphate (KTPP)	1.0
2-Amino-2methyl-1propanol	1.0
Surfactant	2.2
Ethylene glycol	18.6
Antifoam	0.9
Titanium dioxide	200.0
Clay	150.0
Calcium carbonate	175.0
Let Down	
Vinyl acrylic emulsion	271.5
Coalescing aid	7.9
Antifoam	1.8
	1,206.9

Table 4—Acrylic House Paint Formulation

Ingredients	Pounds Per 100 Gal
Pigment Grind	
Water	200.0
Ethylene glycol	20.0
Cellulosic thickener	3.0
Dispersant	6.0
Surfactant	2.0
Defoamer	1.0
Titanium dioxide	250.0
Magnesium silicate	150.0
Let Down	
Water	31.3
Coalescing agent	8.0
Defoamer	1.0
Acrylic emulsion	468.0
	1,140.3

Table 5—Minimum Inhibitory Concentrations for BMPCA Against Various Common Fungal Species

Fungal Species	Fungicide Level (PPM)[a] 1000	500	250	125	63	31	16	MIC (PPM)
Alternaria solani	0	0	0	0	0	0	+	31
Aspergillus niger	0	0	0	0	0	0	+	31
Aureobasidium pullulans	0	0	0	0	0	+	+	63
Chaetomium globosum	0	0	0	0	0	0	+	31
Neurospora species	0	0	0	0	+	+	+	125
Fenicilium species	0	0	0	0	0	+	+	63

(a) Key: + = growth; 0 = no growth.

becomes cloudy however, due to the nature of the test material itself, then the various broth samples need to be streaked onto mycophil or malt agar plates.) The development of growth on the plates should be noted after the appropriate period of incubation.

FILTER-PAPER METHOD: To test a candidate compound's ability to prevent mildew growth on an actual paint film, coatings are prepared containing the candidate compound at various concentrations. These are brush-coated and self-primed onto both sides of a 1¼-in. filter paper square. Twenty four hours of drying time is allowed between coats and before the test commences. The samples are surface sterilized in boiling water, and the squares are placed on a malt agar medium and inoculated with the spores of *Aureobasidium pullulans*. This is the most common fungal species to attack outdoor paint films in the United States.

The plates are incubated for four weeks and observations are recorded weekly. If fungal growth occurs on the surface of the painted filter-paper square, the degree of growth is expressed as the percentage of the paint film surface that is covered by mildew growth.

The results are compared with a control system containing no fungicide, as well as a positive control containing a fungicide with known fungal inhibiting characteristics.

This procedure is a useful screening tool to show the ability of a biocide to control fungal growth on a paint film. It has little value, however, in predicting to what degree mildew growth will be inhibited under conditions of normal outdoor use.

ZABEL TEST: This procedure was developed under sponsorship of the Paint Research Institute Mildew Consortium Steering Committee. The method is designed to be a more realistic procedure for determining resistance to *Aureobasidium* growth on paint films and wood surfaces than is the filter-paper test.

In this test method, flat strips of Southern Yellow Pine, 7.5 cm wide × 0.5 cm thick, are heat sterilized for 20 min at 125°C. The wood is stored at room temperature for 24 hr and is then painted by brush-coating one coat of paint containing the candidate compound, at the concentration under test, on the upper half of the surface. After the paint has fully cured for 48 hr, the sample is surface sterilized. A series of 16 oz French square bottles with screw cap are filled with 20 g of vermiculite and 100 mL of nutrient medium. A painted strip is then inserted vertically into each bottle into the vermiculite until the bottom of the painted zone is 0.5 cm above the vermiculite surface. A spore suspension of *Aureobasidium pullulans* is then pipetted onto the top of the painted wood strip and distributed so that it runs uniformly down the painted surface into the vermiculite reservoir. The jar is then incubated at 28°C for 60 days.

The samples are observed weekly for fungal development. *Aureobasidium* growth should occur on the unpainted surface (blue stain) which functions as a control to ensure that it is a viable test. The samples are rated based on the percentage of mildew growth occurring on the painted surface. The test is run until failure of a negative control without fungicide or until meaningful differences between test compounds are obtained.

ENVIRONMENTAL CHAMBER TEST: As specified by ASTM, the environmental chamber test is designed to measure the resistance of a paint film to mold growth under moist, humid conditions. The chamber consists of a cabinet having a water reservoir on the bottom capable of being heated to a constant temperature. A tray is placed

Table 6—Minimum Inhibitory Concentrations for Chlorothalonil Against Various Common Fungal Species

Fungal Species	Fungicide Level (PPM)[a] 1000	500	250	125	63	31	16	MIC (PPM)
Alternaria solani	0	0	0	0	0	0	+	31
Aspergillus niger	0	0	0	0	0	0	+	31
Aureobasidium pullulans	0	0	0	0	0	0	+	31
Chaetomium globosum	0	0	0	0	0	0	+	31
Neurospora species	0	0	0	+	+	+	+	250
Penicilium species	0	0	0	0	0	+	+	63

(a) Key: + = growth; 0 = no growth.

Table 7—Mildew Resistance of Vinyl Acrylic Latex Paints (Filter-Paper Test Method)

Fungicide	Percentage of Paint Film Surface Covered by Mildew Growth (%) 1 Week	2 Weeks	3 Weeks	4 Weeks
None	100	100	100	100
0.7% BMPCA	25	25	50	50
0.8% BMPCA	0	0	0	0
0.9% BMPCA	0	0	0	0
1.0% BMPCA	0	0	0	0
0.7% Chlorothalonil	25	25	50	50
0.8% Chlorothalonil	25	50	50	75
0.9% Chlorothalonil	0	0	0	0
1.0% Chlorothalonil	0	0	0	0
0.07% IPBC	0[a]	0[a]	0[a]	0[a]
0.8% IPBC	0[a]	0[a]	0[a]	0[a]
0.9% IPBC	0[a]	0[a]	0[a]	0[a]
1.0% IPBC	0[a]	0[a]	0[a]	0[a]
0.7% Isothiazolin	25	25	25	50
0.15% Isothiazolin	50	50	50	75
0.2% Isothiazolin	75	75	75	75
0.25% Isothiazolin	75	75	75	100

(a) Zone of inhibition present around filter paper.

above the reservoir with a permeable screen bottom that contains potting soil. The soil is inoculated with a mixture of fungi that commonly attack paint films. A relative humidity of 95-98% and a temperature of 32.5°C are maintained.

Ponderosa Pine is normally used as the test substrate. The coatings containing the candidate compounds at various concentrations are brush applied onto the pine panels. After allowing one week of drying time, the test specimens are suspended above the soil tray.

Test samples are normally exposed for 4-5 weeks. The coatings that are not properly protected against fungal growth will normally undergo severe fungal disfigurement after this period of time. Samples are rated for surface mold growth on a scale of 10-0, with 10 being no growth and zero being completely covered.

Although this is a more severe and realistic test than some of the simpler laboratory screening tests such as the filter-paper technique, it does not simulate actual outdoor exposure conditions. One of the major limitations of this procedure is that it lacks outdoor UV light which may inactivate certain preservatives. Therefore, a compound may appear effective based on this test, but may be readily decomposed as a result of outdoor UV light, leaving the coating unprotected.

TEST FENCE EXPOSURE: The exposure of coatings containing the candidate compounds on an exterior test fence is the most realistic and most reliable accelerated method to evaluate paint-film fungicides. In this method, wooden panels are coated with the paint containing the fungicide under test, and are then exposed outdoors on a test rack. In this way the panels are exposed to rain, heat, cold, sunlight, etc.

Different fungicides are usually compared on one panel in coatings applied side-by-side to eliminate variability from one board to the next. In addition, two or three replicates are exposed to confirm reproducibility of results. Southern Yellow Pine is a common test substrate.

The panels are exposed vertically facing north and south. The coatings under test are rated regularly for mildew growth on a scale from 10-0, with 10 being no growth and zero being complete coverage. They may also be rated for other factors such as chalk resistance, tint retention, yellowing, and general durability, which may be a function of the fungicide used in the coating.

This type of exposure is considered by many paint technologists to be reasonably reliable since it represents exterior exposure with inoculation by naturally occurring fungal organisms under natural weathering conditions.

ULTRAVIOLET LIGHT EXPOSURE: This procedure parallels the method of Gabriele and Iannucci which was used in their study of UV light induced photooxidation of mildewcides and fungicides.[1] In this case, an acrylic emulsion (Rhoplex® AC388) containing 1% of each fungicide was prepared. These mixtures were subsequently applied onto white draw-down sheets at a film thickness of 3 mils. After allowing 48 hr of drying time, the acrylic films were exposed to a black light source at a distance of 22 cm. The films were exposed for a period of 30 hr and then visually inspected for signs of photooxidation.

Rhoplex is a registered tradename of the Rohm and Haas Co.

Table 8—Mildew Resistance of Vinyl Acrylic Latex Paints Containing IPBC Using the Filter Paper Test Method (Retest)

	Percentage of Paint Film Surface Covered by Mildew Growth (%)			
Fungicide	1 Week	2 Weeks	3 Weeks	4 Weeks
0.7% IPBC	100	100	100	100
0.8% IPBC	75	75	75	75
0.9% IPBC	0[a]	0[a]	0	0
1.0% IPBC	0[a]	0[a]	0[a]	0[a]

(a) Zone of inhibition present around filter paper.

RESULTS

Laboratory Evaluations

MIC TEST SERIES: The minimum inhibitory concentration for BMPCA was determined against various common fungal species that are known to grow on paint films. The results of this work are shown in *Table* 5. For comparative reasons, the minimum inhibitory concentration for Chlorothalonil, a widely used nonmetallic fungicide, was also determined against the same microorganisms. The results of this series are shown in *Table* 6.

This preliminary screening evaluation showed that BMPCA is effective against a broad spectrum of paint

Table 9—Mildew Resistance of Vinyl Acrylic Latex Paints (Zabel Test Method)

	Percentage of Paint Film Surface Covered by Mildew Growth (%)			
Fungicide	1 Week	2 Weeks	3 Weeks	4 Weeks
None	50	75	75	80
0.4% BMPCA	0	0	0	0
0.6% BMPCA	0	2	2	2
0.8% BMPCA	0	0	0	0
0.4% Chlorothalonil	0	0	0	0
0.6% Chlorothalonil	0	0	2	4
0.8% Chlorothalonil	0	2	2	2
0.4% IPBC	0	5	17	22
0.6% IPBC	0	0	0	0
0.8% IPBC	0	0	0	0
0.08% Isothiazolin	2	5	8	10
0.16% Isothiazolin	2	2	5	10
0.25% Isothiazolin	0	0	0	0
0.04% Isothiazolin + 0.8% zinc oxide	0	17	31	40
0.08% Isothiazolin + 0.8% zinc oxide	0	3	6	7
0.16% Isothiazolin + 0.8% zinc oxide	0	0	2	2
0.8% zinc oxide	10	28	42	65
2.1% zinc oxide	13	35	39	44
4.2% zinc oxide	13	25	34	44
0.08% PMA	0	0	0	0
0.16% PMA	0	0	0	0
0.25% PMA	0	0	0	0

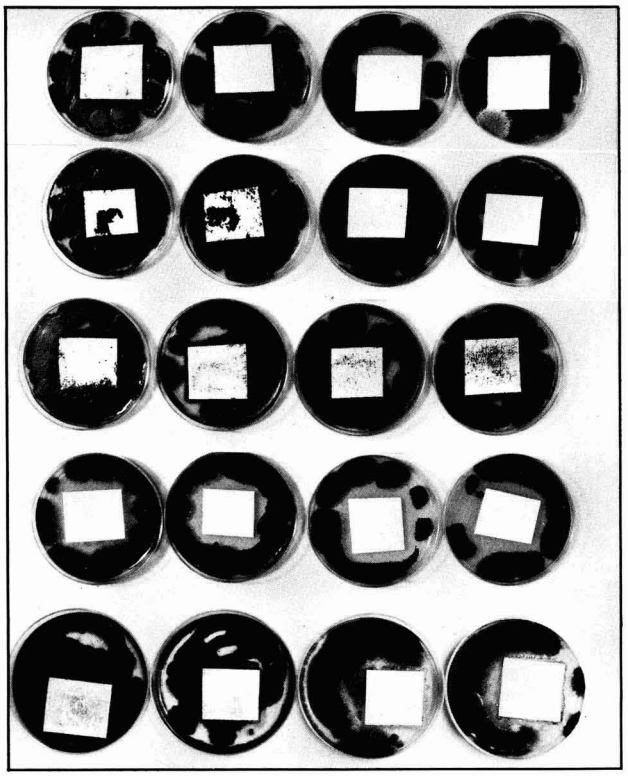

Figure 1—Mildew resistance evaluation using the filter-paper technique (l-r, top-bottom): 0.7, 0.8, 0.9, and 1.0% BMPCA; 0.7, 0.8, 0.9, and 1.0% Chlorothalonil; 0.1, 0.15, 0.2, and 0.25% Isothiazolin; 0.7, 0.8, 0.9, and 1.0% IPBC; and 0.7, 0.8, 0.9, and 1.0% IPBC following retest of IPBC coatings after transfer to new petri dishes

fungi at low levels, in the 31-125 ppm range. BMPCA thus appeared to have a spectrum of activity very similar to that of Chlorothalonil which is similarly effective at relatively low levels in the 31-250 ppm range.

FILTER-PAPER TEST SERIES: A series of filter-paper tests were run using the vinyl acrylic latex paint formulation shown in *Table* 3.

The vinyl acrylic system without fungicide was used as a negative control. BMPCA was evaluated in this vinyl acrylic system at levels ranging from 0.7-1% on total formula weight. The commercial nonmetallic fungicides Chlorothalonil, IPBC, and Isothiazolin were evaluated as positive controls.

The results of this evaluation are shown in *Table* 7. The results show that the control paint without fungicide failed completely as it was entirely covered with mold growth even after the first week of exposure.

The BMPCA compound completely inhibited mold growth starting at a level of 0.8%. The Chlorothalonil was fairly similar in performance and completely inhibited growth at a level of 0.9%. The IPBC control material inhibited fungal growth at all levels tested. It should be pointed out, however, that only the IPBC test plates showed a so called "zone of inhibition." This is an area surrounding the filter-paper square with no fungal growth occurring. This may indicate that the fungicide is water soluble and may be leaching from the paint film into the agar medium, where it establishes a barrier of toxicant which prevents fungus from growing up to and on top of the coated filter paper. This may indicate that the fungicide would leave the paint film too rapidly under actual exposure conditions due to water solubilization and leaching, thus leaving the paint film unprotected. To test this hypothesis, the IBPC filter-paper squares were removed from the petri dishes at the conclusion of the four week test and placed into new agar dishes, which were then reinoculated with *Aureobasidium pullulans*. Not surprisingly, the two lower IPBC concentrations were now unable to prevent mildew growth on the paint film. This would indicate that the fungicide had leached out of the paint film during the course of the normal test, leaving

Table 10—Mildew Resistance of Vinyl Acrylic Latex Paints (Environmental Chamber Test Method)

Fungicide	Mildew Resistance Rating[a] 4 Weeks	6 Weeks	12 Weeks
None	3	1	1
0.5% BMPCA	10	10	10
0.75% BMPCA	10	10	10
0.5% Chlorothalonil	10	9	8
0.75% Chlorothalonil	10	10	10

(a) Key: 10 = no mildew growth; 0 = completely covered by mildew.

the film unprotected against further fungal contamination. The results of the retesting of the IPBC filter-paper squares are shown in *Table* 8.

The vinyl acrylic latex paints containing the Isothiazolin control material failed to inhibit mildew growth at all of the concentrations tested. These exposures are shown in *Figure* 1.

ZABEL TEST SERIES: This was a third method used to assess the biocidal activity of BMPCA in comparison with other fungicides. The same vinyl acrylic latex system was used as in the filter-paper technique. The results of this evaluation are shown in *Table* 9.

The control paint without fungicide was nearly completely covered with mildew growth after four weeks of testing. The BMPCA paints showed either growth or traces of fungal growth in the 0.4-0.8% concentration range. The Chlorothalonil and phenylmercuric acetate showed essentially the same magnitude of inhibition. The IPBC and Isothiazolin materials, however, allowed more than traces of growth to occur at the lower levels. Zinc oxide failed at all of the levels tested.

ENVIRONMENTAL CHAMBER SERIES: BMPCA was evaluated in the environmental chamber in both the vinyl acrylic latex formulation and the acrylic system. A negative control without fungicide was included, as well as Chlorothalonil as positive control. The results are shown in *Tables* 10 and 11.

In this evaluation, the paints without fungicide failed after the standard four week test period. Both the BMPCA and Chlorothalonil paints completely inhibited mildew growth after this period.

The test was continued beyond the standard four weeks to a total exposure period of 12 weeks, representing a very severe evaluation. After 12 weeks, the BMPCA material still inhibited mildew growth entirely in the vinyl acrylic system and allowed only trace growth at the lowest level in the acrylic system.

Table 12 shows the results of proprietary latex paints that were also tested using the environmental chamber procedures. In this evaluation, the BMPCA was equivalent in performance to the mercury-based control fungicide.

Table 11—Mildew Resistance of Vinyl Acrylic Latex Paints (Environmental Chamber Test Method)

Fungicide	Mildew Resistance Rating[a] 4 Weeks	6 Weeks	12 Weeks
None	3	1	1
0.5% BMPCA	10	10	9
0.75% BMPCA	10	10	10
0.5% Chlorothalonil	10	10	9
0.75% Chlorothalonil	10	10	10

(a) Key: 10 = no mildew growth; 0 = completely covered by mildew.

Table 12—Mildew Resistance of Proprietary Alkyd Modified Acrylic Latex Paints (Company A) Using Environmental Chamber Test

Fungicide	Mildew Resistance Rating[a] (6 Weeks)
None	5
0.1% PMA 100	10
0.9% BMPCA	10

(a) Key: 10 = no mildew growth; 0 = completely covered by mildew.

Table 13—Mildew Resistance of Proprietary Paint Formulations (North Vertical Test Fence Exposures in Largo, FL)

Paint Company	Type of System	Length of Exposure (Months)	Fungicide	Mildew Resistance Rating[a]
A	Alkyd mod. acrylic	19	None	4
			0.1% PMA 100	8
			0.9% BMPCA	10
B	Acrylic	8	None	1
			Positive control	3
			0.4% BMPCA	3
			0.6% BMPCA	5
			0.8% BMPCA	7
C	Latex	27	Positive control	4
			0.4% BMPCA	6
			0.6% BMPCA	8
			0.8% BMPCA	8
			1.0% BMPCA	9
D	Latex	9	None	2
			Mercury control	2
			0.4% BMPCA	6
			0.6% BMPCA	9
			0.7% BMPCA	9
E	PVAC	11[b]	None	7
			0.3% Chlorothalonil	9
			0.2% BMPCA	9
			0.4% BMPCA	10
			0.9% BMPCA	10
F	Oil	15	None	0
			Positive control	7
			0.5% BMPCA	8
G	Latex	39	None	0
			Positive control (Isothiazolin + zinc oxide)	4
			0.6% BMPCA + zinc oxide	6
			0.9% BMPCA + zinc oxide	8

(a) Key: 10 = no mildew growth; 0 = completely covered by mildew.
(b) Exposed in Houston, TX.

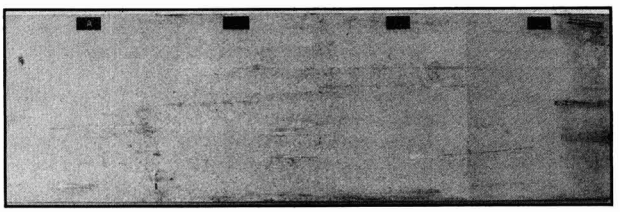

Figure 2—UV resistance evaluation using South Vertical Test Fence Exposure of acrylic latex paints for 45 months in Largo, FL. A = 0.2% Isothiazolin and 2.0% zinc oxide; B = 0.8% IPBC; C = 0.6% Chlorothalonil; and D = 0.7% BMPCA

ULTRAVIOLET LIGHT EXPOSURE SERIES: The UV light exposure method described earlier was used to evaluate BMPCA, Chlorothalonil, IPBC, and Isothiazolin for yellowing, which is believed to be a visible sign of photooxidation. After completion of the exposure, the acrylic film containing BMPCA and the film without fungicide both remained clear and colorless. The Isothiazolin film showed moderate yellowing, while the Chlorothalonil and IPBC films had yellowed severely.

This work showed that under laboratory conditions, BMPCA, when exposed to UV light, did not yellow.

Further data supporting BMPCA's resistance to photooxidation is given in the Exterior Exposure Results section.

Exterior Exposure Results

In order to test BMPCA in actual commercial formulations, rather than idealized raw material suppliers formulations, joint research agreements were made with a number of leading U.S. paint manufacturers.

Table 13 shows the mildew ratings for the evaluations that have already been completed and thus for which the paints have already been identified by the coatings manufacturers.

In some cases, the positive control fungicide was not disclosed. For the purposes of this evaluation, however, knowledge of the positive control is not essential since the objective was to determine relative performance of BMPCA in relationship to fungicides currently used by the industry.

In evaluating these results, the mildew resistance of BMPCA should be compared only with the positive and negative controls within the same group of coatings. This is because mildewcide performance is also dependant on the particular paint formulation used. This is why we see some paints fail more quickly than others, although the same level of fungicide was used in these paints.

Based on these exterior exposure studies, it can be concluded that BMPCA performs equal to or better than the fungicides currently used by the paint industry.

It should also be noted that the stability of all of these coatings was tested by the manufacturers, using heat-aging as well as shelf studies. None of these paints, nor any of the many paints which are still under evaluation, demonstrated any instability or incompatibility problems, such as gelling, changes in viscosity, changes in color, odor development, etc.

A series of phthalo blue tinted acrylic latex paints was also prepared and exposed in order to study photooxidation phenomena. *Table* 14 shows the tint retention ratings for the phthalo blue test paints containing BMPCA as well as three positive control fungicides. After 28 months of vertical exposure facing south, the BMPCA coating was showing perfect color retention, indicating a lack of chalking, fading, or any other signs of photooxidation. The Chlorothalonil paint had developed a heavy chalkface, thereby causing a lighter, faded appearance. The other two control materials were also showing loss of tint retention, but to a lesser extent after this length of exposure.

Table 15 shows the tint retention ratings for the same blue acrylic systems tested on another panel, after 45 months of exposure facing south. The BMPCA coating is still exhibiting good tint retention whereas all of the control materials are now nearly completely failing due to chalking and fading. Photographs of this panel are shown in *Figure* 2.

Table 14—UV Light Resistance of Phthalo Blue Acrylic Latex Paints (Florida Test Fence Exposure)

Fungicide	Tint Retention Rating[a] South Vertical (28 months)
0.7% BMPCA	10
0.6% Chlorothalonil	5
0.8% IPBC	8
0.2% Isothiazolin + 2.0% zinc oxide	7

(a) Key: 10 = best; 0 = worst.

Table 15—UV Light Resistance of Phthalo Blue Acrylic Latex Paints (Florida Test Fence Exposure)

Fungicide	Tint Retention Rating[a] South Vertical (45 months)
0.7% BMPCA	7
0.6% Chlorothalonil	2
0.8% IPBC	2
0.2% Isothiazolin + 2.0% zinc oxide	2

(a) Key: 10 = best; 0 = worst.

Table 16—Toxicological Summary for BMPCA

Toxicity Test	
Oral LD_{50} (rats)	4,044 mg/kg
Dermal LD_{50} (rabbits)	>21,000 mg/kg
Inhalation LC_{50} (rats)	>10 mg/L
Eye irritation (rabbits)	slight to moderate irritant
Skin sensitization	nonsensitizer

These extended outdoor exposure studies confirm the accelerated lab test findings: BMPCA has excellent resistance to photooxidation as compared to existing nonmetallic fungicides. Therefore, coatings formulated with BMPCA exhibit superior color retention and lack of yellowing.

Toxicology

Extensive toxicity testing has been carried out with BMPCA, including acute toxicity tests, teratogenicity, mutagenicity, cytogenicity, and wild life toxicity. Analysis of all this data indicates that BMPCA possesses a favorable toxicological profile in comparison with other fungicides used by the industry.

Table 16 provides an abbreviated toxicological summary for BMPCA, and *Figure* 3 shows the relative toxicity of BMPCA in comparison with several known reference materials.

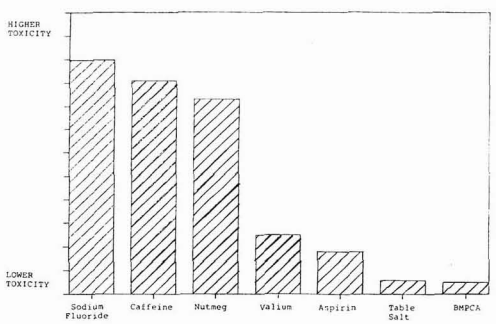

Figure 3—Comparison of acute oral toxicity values of BMPCA vs several common food additives and drugs as known reference materials

DISCUSSION

Both the laboratory and extended field studies demonstrate that the newly developed compound BMPCA exhibits equal or superior antifungal activity as compared to nonmetallic fungicides that are currently on the market.

It was also demonstrated by both the accelerated laboratory studies as well as the test fence exposures, that BMPCA exhibits excellent resistance to photooxidation. Therefore, BMPCA shows superior tint retention in tinted paints, and a lack of yellowing or discoloration in whites and clears.

Stability tests have shown BMPCA to have excellent compatibility in a variety of commercial coatings formulations. The chemical is resistant to hydrolysis in aqueous systems, and therefore, can be used in both water and solvent-based coatings. No interactions were observed with any paint formulation components. The compound did not contribute any odor to the coatings nor any color or other physical changes.

It was also demonstrated that BMPCA has a very favorable toxicological profile and offers no unusual hazards during handling of the material.

This novel compound, BMPCA, will be made commercially available as a 40% active liquid product.

ACKNOWLEDGMENT

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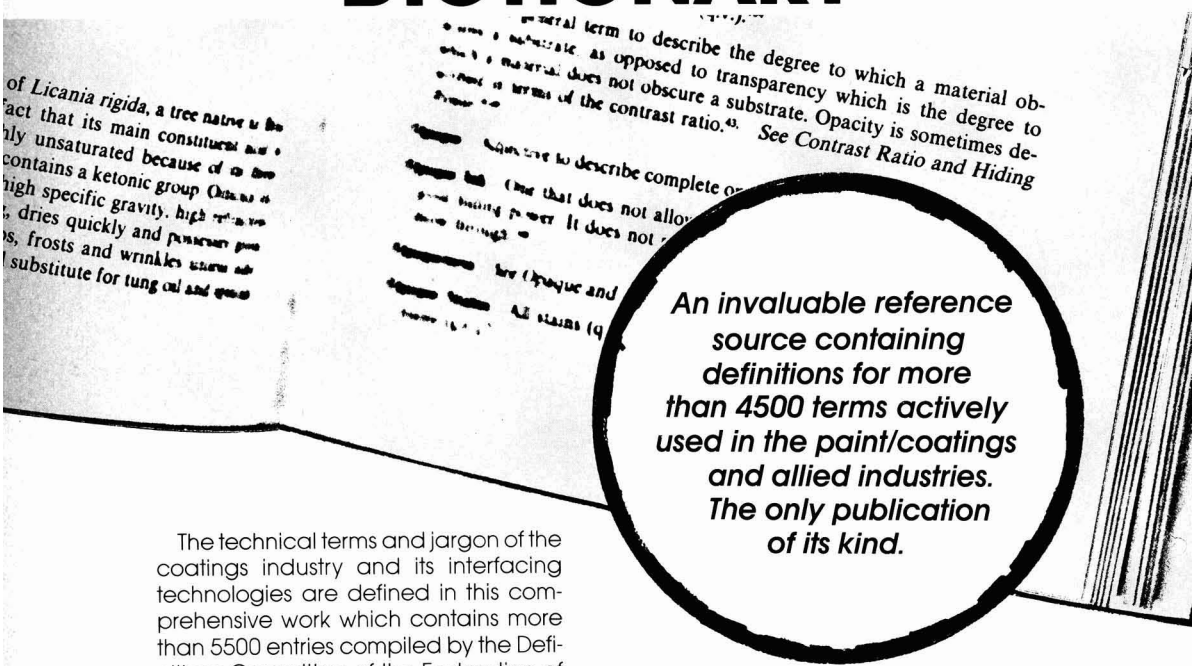

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Applications of DMA and TGA to Quality And Process Control in the Manufacture Of Magnetic Coatings

R.B. Prime, J.M. Burns, M.L. Karmin, C.H. Moy, and H-B. Tu
IBM General Products Division*

The manufacture of high technology products requires rigid controls at all steps of the process. This paper describes the application of dynamic mechanical analysis (DMA) and thermogravimetric analysis (TGA) to the manufacture of magnetic media. Applications include the incoming inspection of a phenolic resole resin, and process controls of the coating preparation and cure steps. DMA and TGA are shown to be effective in measuring the lot-to-lot variation of the phenolic resin. Process control of the coating ink includes measurement of pigment volume concentration (PVC) and percent solids by TGA, and the glass transition after controlled cure by DMA. Application of DMA to monitor the manufacturing cure process is also described.

INTRODUCTION

This paper describes the application of dynamic mechanical analysis (DMA) and thermogravimetric analysis (TGA) to the manufacture of particulate magnetic media used in direct access storage device (DASD) technology.[1] The production of a final disk product involves several process steps, including coating preparation (formulation, milling, and letdown), spin coating application onto an aluminum substrate, and cure (predominantly a time-at-temperature phenomenon). Control at these early process steps ensures proper downstream processing and attainment of the required coating properties. The resulting coating, if properly prepared and processed, is a highly crosslinked, infinite network exhibiting good magnetic properties and good durability.

The curing of thermosets and their characterization by thermoanalytical techniques have been described in detail.[2-5] Differential scanning calorimetry (DSC) is the most widely used of the thermal analysis techniques for characterizing thermosets and their cure. DSC measures heat flow into the sample for endothermic processes (e.g., increasing heat capacity, melting, and volatilization) and out of the sample for exothermic processes (cure and crystallization). Due to the presence of solvents, including a high boiling solvent, and partially volatile resins, endothermic processes compete with the exothermic cure reactions resulting in ambiguous DSC information. For these reasons, DSC was not used in these studies.

DMA, on the other hand, is ideally suited for studying the cure of such systems.[6] Coatings must be supported for DMA, e.g., on a glass braid for torsional braid analysis (TBA)[4-6] or on a wire mesh for analysis on the DuPont DMA.[7] Quantitative measurement of the elastic moduli, e.g., G′ and G″, is possible with the latter technique.[7] Supported samples are subjected to a small sinusoidal strain while time, temperature, and atmosphere are varied in a controlled manner. Actual cure conditions may be simulated and the several contributions to cure (solvent evaporation, reaction and crosslinking, phase separation, degradation, etc.) measured as they occur. DMA may be used in either the scanning or isothermal modes. In the scanning mode, it can detect the glass transition temperature (T_g) of phase separated material as well as the matrix itself, at any stage from completely unreacted to fully cured. Since DMA responds predominantly to the elastic

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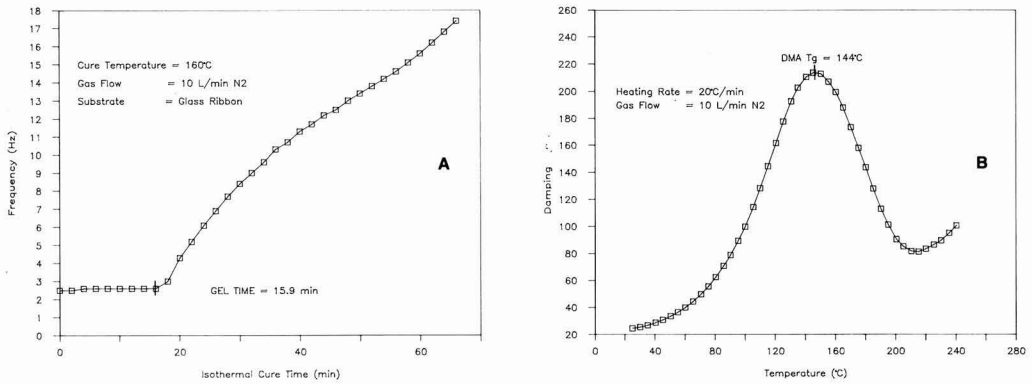


Figure 1—DMA of phenolic resin lot B. (A) Isothermal cure in N_2 at 160°C to measure gel time. (B) Subsequent scan in N_2 at 20°C/min from 25 to 240°C to measure T_g

properties of a material, in the isothermal mode it will be more sensitive to the later portions of cure, e.g., beyond the gel point or after significant solvent evaporation.

TGA provides a very sensitive measure of sample weight under controlled time, temperature, and atmosphere conditions. TGA is well suited for studying solvent evaporation, which for mixed solvent systems can be very complex. It also yields quantitative information on weight loss processes which directly accompany cure, e.g., the evolution of solvents, condensation reaction products, volatile resin components, or even degradation products. TGA, being able to quantitatively distinguish between solvents, resins, and inorganic filler, is also an effective measure of coating composition. For example, TGA can easily and accurately measure percent solids and pigment volume concentration (PVC), as described in this paper.

A typical coating ink used for the manufacture of rigid disk magnetic media is the subject of this paper. In simple terms, this coating ink may be viewed as a mixture of thermosetting resins, a thermoplastic additive, solvents, and iron oxide. The cure behavior of a similar magnetic recording ink has been studied in detail by TGA and DMA.[8] During cure, the thermoplastic additive phase separates, as evidenced by a secondary damping peak near its T_g. This behavior is similar to that observed for rubber-modified epoxies.[9] Above 200°C, oxidative reactions promoted by iron oxide make a major contribution to the crosslink density. Characteristic parameters for this coating are $T_{g\infty,N_2} \simeq 95°C$ and $T_{g\infty,air} \simeq 270°C$, the glass transition temperatures for coating cured to completion in nitrogen and air, respectively. Isothermal TGA in air and nitrogen showed evidence for oxygen uptake and an oxidative weight loss under nominal curing conditions. The curing of this coating thus involved phase separation of the thermoplastic additive, chemical and oxidative crosslinking, and chemical and oxidative weight loss. Iron oxide, oxygen content of the purge gas, and flow rate of the purge gas were observed to affect cure behavior.

EXPERIMENTAL

Phenolic Resin

The phenolic resin examined in this study is Methylon® 75108. This is predominantly a mixture of mono-, di, and tri-methylol allyl phenyl ethers and their oligomers and by-products.[10,11] A variable amount of residual inorganic base (0.2-2% by weight), remaining from the synthesis, is also present.[10]

Coating Ink

A typical magnetic coating ink was examined. It consisted of a DGEBPA-type epoxy/phenolic resole crosslinkable binder, a thermoplastic additive, iron oxide magnetic particles, and solvents.

Dynamic Mechanical Analysis (DMA)

Analyses were performed on either a DuPont 981 or a DuPont 982 Dynamic Mechanical Analyzer in the horizontal clamping mode. The DMA was programmed with a DuPont 1090 Thermal Analyzer. A 6.5 mm spacing between the passive and driven arms, and 0.1 mm oscillation amplitude were fixed in these studies. Samples were cut to 16-20 mm lengths before being mounted in the DMA. The DMA T_g was taken as the maxima in the damping peak associated with the α-transition; it was reported to the nearest °C as the average of two measurements which differ by no more than 6°C.

PHENOLIC RESIN: The neat resin was coated onto DuPont fiber glass DMA substrates that were first heated to 600°C in air and held for one hour to remove any sizing. Coating was accomplished by immersing the substrate in the liquid resin followed by passing it through a 0.5 mm Teflon® slit to remove excess resin. The uncured sample was immediately loaded into the 981 DMA and,

Methylon is a registered tradename of General Electric Co.
Teflon is a registered tradename of E.I. du Pont de Nemours & Co., Inc.

after a 5 min nitrogen purge, was heated as rapidly as possible to 160 ± 1°C and held for a total run time of 67 min. The nitrogen purge rate was 10l/min. The gel time was taken as the onset of the frequency increase, as illustrated in *Figure* 1A. This is equivalent to the onset of elasticity, a classical definition of gelation. The sample was then cooled quickly to ambient temperature and analyzed dynamically at 20°C/min under nitrogen. As before, the DMA T_g was taken as the temperature at the maximum in the damping curve (see *Figure* 1B).

COATING INK: The ink was coated onto stainless steel wire mesh ribbons (84 × 84 wires/in., wire diameter = 0.0035 in., Tetko, Inc.) and allowed to dry in a hood for at least 24 hr. All samples were cured in a circulating air oven for ~2 hr at temperatures close to 230°C. Two ovens were utilized. One was a well controlled laboratory oven used to measure ink batch-to-batch variation at constant cure. Coated mesh ribbons (3-8 in. in length) cured in this oven were suspended from an oven rack by clips (No. 20 binder clips) so that the mesh ribbons were in the center of the oven. The other was a typical manufacturing oven, where mesh samples were cured along with actual coated disks by mounting ~2 in.-long samples in the special disk fixture shown in *Figure* 2. By utilizing a constant coating ink, the oven batch-to-batch variation was determined. Samples were scanned in the 982 DMA at 10°C/min under 0.4l/min nitrogen flow. As before, DMA T_g was taken as the maximum in the damping curve associated with the glass transition.

Thermogravimetric Analysis (TGA)

Combined dynamic/isothermal TGA was measured on phenolic resin and coating ink samples. Measurements were performed on a Perkin-Elmer TGS-2 Thermogravimetric Analyzer which was programmed with an Omnitherm 35053 Three Module Controller/Data System. Air and nitrogen purge gases were utilized depending on the application. A constant purge rate of 100 ± 5 cc/min was used; at that flow rate a 5 min purge at the beginning of an experiment, or when switching gases, was shown to be sufficient to fill the balance and furnace tube with the respective atmosphere. Special aluminum sample pans, identical in size to the platinum pans supplied by Perkin-Elmer, were used so that they could be discarded after each run.*

PHENOLIC RESIN: Lot-to-lot variation was characterized by combined programmed heating/isothermal TGA in nitrogen/air environments. A sample size of 4.5 ± 0.5 mg was used. Samples were heated in nitrogen at 20°C/min from 25° to 240°C and held for 20 min to allow the resin to cure. The purge gas was then switched to air while the temperature remained at 240° for an additional 10 min to allow the balance and furnace tube to completely fill with air. The sample was then heated to 630°C at 20°C/min to accomplish oxidative decomposition. The temperature maxima of the second decomposition weight loss (char temperature, see *Figure* 3) was found to best characterize

*Part No. X9901, available from Omnitherm Corp., Arlington Heights, IL.

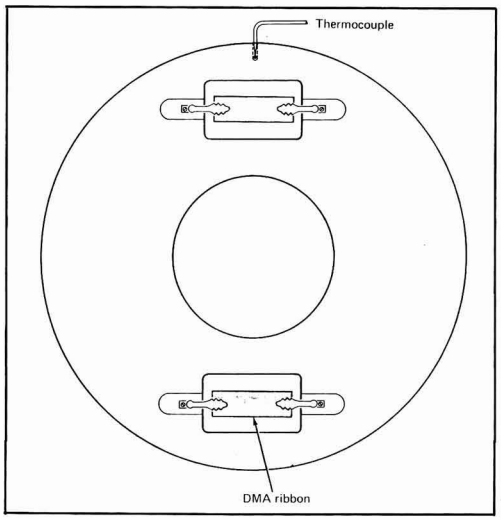


Figure 2—Special thermocoupled disk for curing coating on stainless steel mesh for subsequent DMA analysis. Samples can be cured together with actual disks in the manufacturing process, and DMA T_g can be compared with time/temperature profiles

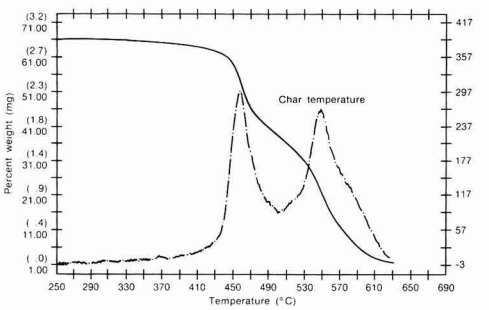


Figure 3—TGA of phenolic lot B after nitrogen cure showing char temperature

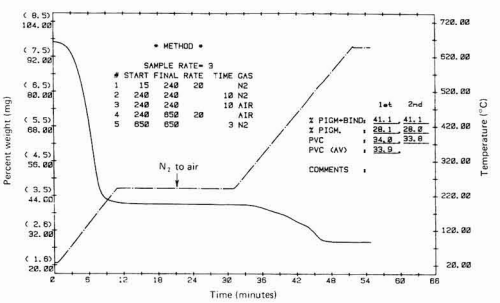
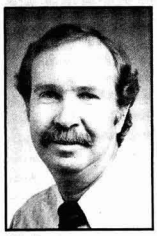


Figure 4—TGA method for measuring percent solids and PVC of magnetic coating ink



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the lot-to-lot variation by TGA. To accurately measure the char temperature necessitated high temperature calibration, which was accomplished with Nickel, Nicoseal, and Perkalloy magnetic standards using the standard Perkin-Elmer procedure.

COATING INK: Percent solids and PVC are measured on a routine basis. Very precise measurement of the magnetic oxide amount is required to control the magnetic performance of the disk. *Figure* 4 illustrates the TGA technique; note that Method #1 is preceded by an approximately 5 min purge in nitrogen. Sample size (including solvents) is controlled at 8.25 ± 0.25 mg, which is important for the precision required of this measurement. To avoid significant solvent loss, it is necessary to weigh the sample in ≤20 sec; this is important only for the measurement of percent solids. As shown in *Figure* 4, the first step in this analysis is solvent removal and cure in an inert atmosphere at 240 ± 1°C. As with the sample size, rigid control of this temperature is necessary to obtain the needed precision, and frequent temperature calibration is performed with nickel (GM-761, available from National Bureau of Standards). The weight percent after cure is taken as the percent solids. Equation (1) gives the definition and calculation of percent solids. Following cure, the balance is allowed to fill with air, which is necessary for complete pyrolysis of the organic binder. Pyrolysis is accomplished by heating to 650°C* which leaves only the inorganic oxide(s) or pigment. The weight percent of the pigment and weight percent of the cured coating, e.g., pigment plus binder, are used to calculate PVC. The definition of PVC, which can be found in any appropriate text [ref. (12), for example] and its calculation from the TGA experiment are given in equation (2). The calculation is illustrated in *Figure* 4.

$$\% \text{ Solids} = \frac{\text{weight \% after cure}}{\text{initial sample weight \%}} = \frac{P + B}{I} \quad (1)$$

$$\text{TGA PVC} = \frac{V_{pigment}}{V_{pigment} + V_{binder}} = \frac{P}{4.188\,(P + B) - 3.188P} \quad (2)$$

where I = initial sample weight percent (i.e., 100%), P + B = pigment + binder (weight percent after nitrogen cure), and P = pigment (weight percent after binder decomposition at 630°C). Appropriate densities are: $\rho_{pigment}$ = 4.69 g/cc and ρ_{binder} = 1.12 g/cc.

RESULTS AND DISCUSSION

Phenolic Resin Lot-to-Lot Variation

Table 1 shows the thermal analysis results of six lots of phenolic resin. Measurement errors ($\pm 3\sigma$) are: 1.2% for TGA weight loss, 11°C for char temperature, 2.7 min for gel time, and 11°C for T_g.

Char temperature, gel time, and T_g were found to correlate with each other (*Table* 1) and to characterize the known lot-to-lot variability. The majority of this variability has been attributed to residual base remaining from the

*To eliminate the possibility of melting the aluminum pan, the upper temperature has been reduced to 630°C.

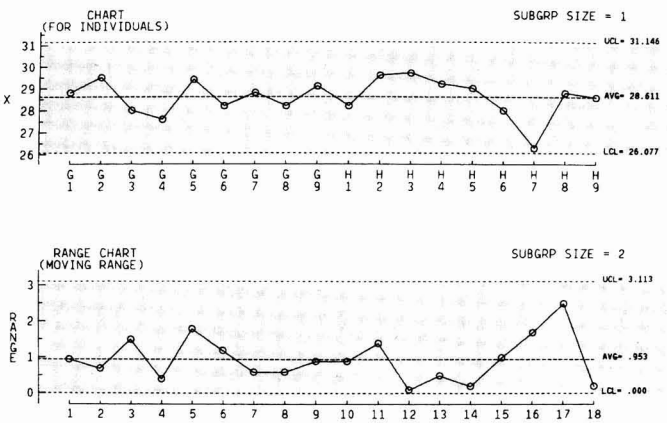

Figure 5—Process control chart for PVC, inks same as in *Figure* 6. Ordinate is PVC; abscissa is coating ink batch number, but also distinguishes between batches made from phenolic lots G and H. PVC is within the control limits and is not affected by variations in phenolic lot

resin synthesis.[10] Bases are known to catalyze methylol condensation[13]; thus, resin lots with a greater amount of residual base will have a shorter gel time and higher T_g (e.g., compare lots A and B with lot F). It is speculated that residual base also catalyzes char decomposition, causing the same lots to have lower char temperatures. Using the range in experimentally observed values ratioed to the measurement error as an indicator of measurement sensitivity, all three measurements were found to be equally capable of distinguishing lot-to-lot variability.

Coating Batch-to-Batch Variation

Variability will exist between coating batches due to variability in raw materials, and to variability in composition and processing. TGA was used to examine compositional differences between coating batches, while DMA was used to investigate differences in cure. It was found that variability in both raw materials and composition was responsible for most of the observed differences in cure response.

COMPOSITION: Measurement error ($\pm 3\sigma$) for percent solids is 0.7%, and for PVC it is 0.3%. Variation in percent solids was found to be ~4 times larger than the measurement error, but within statistically determined process control limits. A process control chart for PVC is shown in *Figure* 5, demonstrating that PVC is in control most of the time, but with occasional batches that are close to or outside the control limits. When PVC is outside of the control limits, it is usually due to weighing errors during coating preparation or removal of inadequately dispersed iron oxide by filtration.

Table 1—TGA and DMA Characterization of Phenolic Resin Lots

Phenolic (Lot No.)	TGA Weight Loss (40 min/240°C/N_2)	Char Temp (°C)	Gel Time (min)	T_g (°C)
A	33.2	561	17.4	144
B	34.0	561	15.9	144
C	32.8	570	18.0	132
D	35.9	573	21.2	116
E	34.2	583	21.3	118
F	36.8	601	26.1	94

CURE: Measurement error ($\pm 3\sigma$) for DMA T_g was found to be 5.6°C. As illustrated in *Figure* 6, most of the variability in cure response can be attributed to the phenolic resin lot-to-lot variability and to PVC batch-to-batch variability. The correlation coefficient between PVC and DMA T_g of 0.86-0.87 is reasonable for such coatings where variability in other raw materials and the processing itself also contribute to the cure response of the coating.

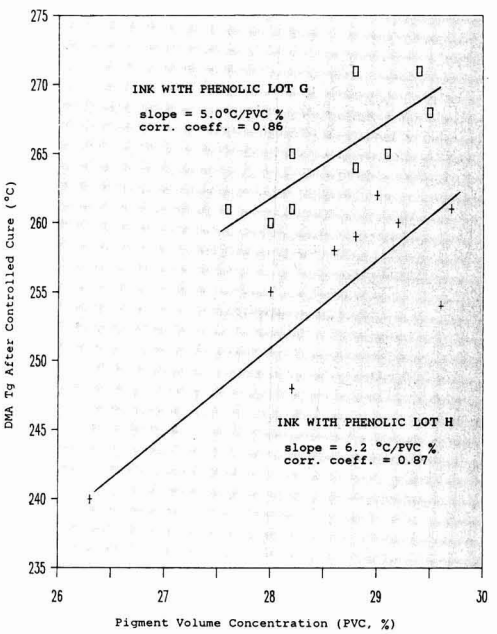

Figure 6—Correlation between PVC and DMA T_g, showing that most of the variation in T_g may be attributed to variation in PVC and the lot of phenolic resin

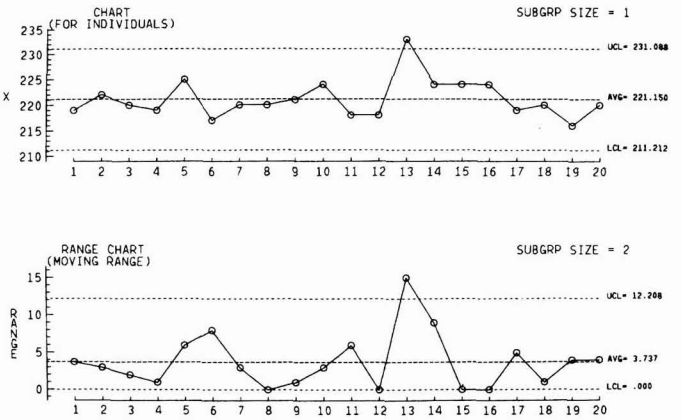

Figure 7—Process control chart for DMA cure monitor. Ordinate is DMA T_g (°C) and abscissa is oven batch number. Value outside of control limit was attributed to incorrect oven set-point

Cure Process Variation

The same DMA measurement error, 5.6°C, applies to this measurement. Variation in a typical manufacturing cure process is determined from the variability in the DMA T_g of stainless steel mesh ribbons coated with a single reference coating ink batch and placed in the same location within the oven. Variations in the time-temperature profiles associated with cure, air flow rate, and percent oxygen will all result in variations in cure.[8] *Figure* 7 is a process control chart showing the cure process to be within statistically determined control limits with one exception. This was attributed to a high oven setting. From previously established correlations between T_g and Equivalent Isothermal Temperatures (EIT), it was deduced that the oven setting was ~ 3°C higher for this cure batch. EIT is an average cure temperature calculated from actual time-temperature profiles using the activation energy for cure.[14]

SUMMARY

Thermoanalytical techniques utilizing dynamic mechanical analysis and thermogravimetric analysis were developed to help control the production of rigid disk magnetic media. By monitoring an incoming raw material, the coating preparation process, and the cure process, a more precise control of the final product properties, and therefore its performance and reliability, has been achieved. These types of monitoring tools also allow early detection of problems, and thus, an early elimination of inferior material and parts from the process, resulting in a net cost reduction of the product.

ACKNOWLEDGMENT

The authors would like to acknowledge Michael Oxsen for his contribution to the development of several of these techniques.

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An Example of Spherical Agglomeration Of Pigment in Latex Paint

Ronald E. Smith
PPG Industries, Inc.*

Spherical agglomeration, as defined by the mineral refining industry, can result from adsorption of a surfactant and a hydrocarbon solvent onto solid particles dispersed in an aqueous medium. Bridging of the particles by the hydrocarbon leads to separation as unique, large, spherical agglomerates. Such behavior was observed in a water-based latex paint where preferential agglomeration of a particular pigment, yellow iron oxide, caused an undesirable loss of tinting strength with increased shaking time. The pigment agglomerates were studied after separation by dilution and decanting. The problem was avoided by making the pigment less hydrophobic.

INTRODUCTION

Flocculation or agglomeration of dispersed pigment can result from several causes.[1] Almost always, these terms imply that pigment particles are attracted by van der Waals or other forces of attraction. However, situations exist in which the particles are not dispersed, yet particle-particle attraction is not an important factor. We encountered such a situation with a yellow colorant, or concentrated pigment dispersion, designed to tint either water-based latex paints or solvent-based alkyd paints. In a certain white latex paint base, there was a loss of tinting strength with longer shaking times after mixing the colorant and paint base.

Further work showed the cause of the problem to be preferential agglomeration of the yellow pigment caused by a hydrocarbon solvent present in the paint as a defoamer. This phenomenon has been termed "spherical agglomeration" in the field of mineral refining, but it is generally unfamiliar to the coatings industry.

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In this paper, the nature of such agglomeration is described, along with methods for its detection and ways to avoid the problem.

SPHERICAL AGGLOMERATION

The particular type of agglomeration termed spherical agglomeration has received greatest attention in the field of mineral refining.[2-8] In one common application, a surfactant (or "collector") is added to an aqueous mineral slurry to adsorb onto particles of the mineral to be extracted, thus making them hydrophobic. Then, a hydrocarbon (or "bridging liquid") is added, resulting in the formation of large spherical agglomerates that are easily separated from the aqueous phase. The generally-accepted mechanism is that, in this example, the hydrocarbon liquid wets the particles that were made hydrophobic by the surfactant. The particles then collide and are held together by bridges of hydrocarbon as a result of interfacial (oil-water) tension (*Figure* 1). The reverse process has also been used, where water is added to a suspension of hydrophilic particles in a nonwater-miscible liquid.

Puddington and Sparks[2] described several industrial applications of spherical agglomeration. In addition to mineral beneficiation, as previously described, they also reported processes where the desired end products are small spheres, such as tips for ball-point pens. Another purpose is to treat waste effluent by the addition and subsequent agglomeration of particulate solids either to remove the solids or, in an aqueous system, to remove small amounts of oil.

Whether or not spherical agglomeration takes place depends on several factors: the properties and concentration of the bridging liquid, the size and surface characteristics of the particles, and the degree of agitation. When agglomerating hydrophobic particles in water, the viscosity of the bridging liquid is an important property; higher viscosities, up to a point, result in stronger, larger ag-

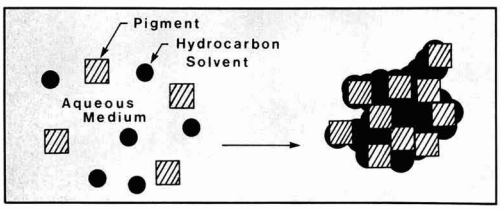

Figure 1—Schematic illustration of spherical agglomeration

glomerates. The concentration of bridging liquid is also critical because low concentrations will merely produce a loose floc, while an excess of bridging liquid will result in a paste rather than discrete agglomerates.

The surface properties of the particles are usually determined by the amount and type of added surfactant, which must be such as to produce a contact angle of more than 90° between the particle surface and the two liquid phases. By adjusting the type of surfactant, and conditions such as pH, it is possible to selectively treat one type of particle of a mixture.

The diameter of the agglomerates typically increases with the degree and duration of agitation over periods from several minutes to hours, since a certain amount of momentum is needed in particle-particle collisions to overcome the energy barrier between particles coated with the bridging liquid.

It also should be noted that the phenomenon of "shear flocculation," as described by Warren,[9,10] is similar; however, no immiscible liquid is required. Here, particles made lyophobic by adsorption of surfactant are stable at low shear rates but flocculated by higher shear rates.

PAINT COLOR DEVELOPMENT

The colorant in which we observed spherical agglomeration was based on yellow iron oxide pigment. It performed well in alkyd paints, but in a certain white latex paint base, the color strength of the paint that had been shaken for 15 min after tinting was noticeably less than paint that had been shaken for shorter times, e.g., 5 min. That is, paint shaken for a longer time exhibited a more red, less lemon-yellow shade. Microscopic examination of the wet, tinted paint showed that a portion of the yellow pigment had concentrated into large agglomerates.

The large size of the agglomerates and high density of the pigment made it easy to separate the agglomerates from the rest of the paint. The procedure was to dilute a portion of tinted paint with about 15 parts of distilled water, mix thoroughly, allow to stand for several minutes, then carefully siphon off the upper half of the dispersion. The bottom half was then diluted with an equal volume of distilled water and the process was repeated. After several such washings, a clean concentrate of yellow agglomerate in water was obtained. A similar washing of the pure colorant did not yield any agglomerates, demonstrating that agglomeration resulted from mixing the colorant and paint base.

When viewed under the microscope (*Figure* 2), the appearance of the washed yellow agglomerates was unusual. They were not at all like undispersed pigment aggregates which are compact and angular, or like flocculated pigment that forms an extensive floc that can usually be redispersed by shearing. Each of the yellow agglomerates was approximately spherical, and plastic—they could be deformed by pressure on the cover slip. The aggregates did not readily coalesce, and resembled droplets of oil containing a large amount of yellow pigment. Extraction of the agglomerates with tetrahydrofuran, followed by analysis using infrared spectroscopy, showed a high concentration of an aliphatic hydrocarbon. However, when transferred into Dowanol® PM, a solvent that is miscible with both water and hydrocarbons, the agglomerates did not readily redisperse. Therefore, they were not simply pigment-enriched droplets of hydrocarbon solvent.

A series of tests was performed to verify the effect of the hydrocarbon solvent in the base paint formulation. The paint was simplified in a series of steps in which certain ingredients were omitted, such as the white pigments, thickeners, the polymer latex, etc. Eventually a point was reached where the same unique agglomeration resulted from addition of the colorant to a mixture of water, surfactants, and hydrocarbon solvent. When this test was repeated without the hydrocarbon, there was no agglomeration.

Spherical agglomeration is strongly suggested by the dependance on hydrocarbon solvent and by the physical nature of the agglomerates—large, strong, insoluble and, of course, spherical. There is also the dependance on agitation time, since in our tests the color differences only appeared after shaking for moderate to long times. Finally, the selective separation of one pigment from a mixture is characteristic of spherical agglomeration.

AVOIDING COLOR-DEVELOPMENT PROBLEM

The colorant contained a complex mixture of surfactants to achieve compatibility with both latex and alkyd paints. Since the problem of color variation resulted from the yellow iron oxide being relatively hydrophobic in the presence of the surfactant, we tried various approaches that might change the degree of surfactant adsorption. For example, raising the pH of the paint avoided the flocculation problem while lowering the pH made it worse. This was not a practical solution, however. Another approach was to heat-age the colorant at 140°F, and this also decreased flocculation. Presumably, changing the pH or heat-aging changed the distribution of the surfactant adsorbed on the pigment surface.

One surfactant used in the colorant had a low Hydrophilic-Lipophilic Balance (HLB) value, meaning that it preferred a hydrocarbon environment to water. The concentration of this surfactant could have been lowered to improve compatibility with latex paints, but this would

Dowanol is a registered tradename of the Dow Chemical Co.

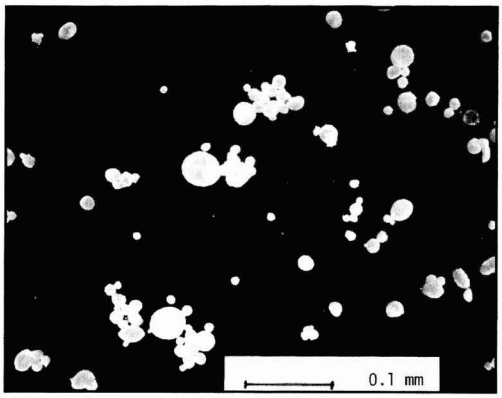

Figure 2—Yellow pigment flocculates after washing and separating as described in the text. Photographed using darkfield illumination at 200X

have decreased compatibility in alkyd paints. An alternative approach was to change the order of mixing of the colorant so that the low-HLB surfactant was added last. This was intended to ensure that the pigment was preferentially wetted with the surfactants that were more hydrophilic. This approach did indeed result in a colorant that did not exhibit spherical agglomeration in the latex paint base.

CONCLUSIONS

Spherical agglomeration of pigment can occur in coatings if an immiscible second liquid phase is present, and if a particular pigment is lyophobic with respect to the continuous phase. The undesirable consequence which we observed was color variation with respect to mixing time, but other potential problems include changes in rheology, settling properties, cure, dry rate, and appearance. Previous studies of spherical agglomeration show that this type of agglomeration can occur in both aqueous and nonaqueous systems. The unique pigment agglomerates resulting from this phenomena can be concentrated by successive dilution and decanting and can be observed with an optical microscope.

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BALTIMORE ..... MAR.

"Coatings Failures"

The meeting's speaker was Kenneth B. Tator, of KTA-Tator, Inc., who spoke on "COATINGS FAILURES—CASE HISTORIES, CAUSES AND CONCLUSIONS."

During the discussion, which was enhanced with the use of a slide presentation, Mr. Tator emphasized surface preparation. He stated that proper surface preparation helps avoid bonding problems. In addition, surface temperature should be at least 5° above dew point to steer clear of moisture problems. Mr. Tator furnished mill scale failure examples to reinforce his point. The speaker discussed common sense solutions, and the effect of preparation procedures on primer and finish coats.

DONALD HILLIARD, *Secretary*

CDIC ..... MAR.

"Improving Opacity and Flow Properties"

William M. Hollifield, of Perry & Derrick Co., Inc., reported for the Nomination Committee and recommended the following officers for 1988-89: President—Carolyn L. Tully; Vice-President—N. Jay Huber, Jr.; Secretary—W.E. "Buddy" Whitlock; and Treasurer—James E. Flanagan.

Hugh Lowery, of Perry & Derrick Co., Inc., reiterated the proposed By-Laws change and advised the membership of the need to reinstate a Student/Educator status back into the organization. Mr. Lowery said the Student/Educator Membership was inadvertantly dismissed and currently CDIC is the only Society without the Student/Educator member.

The evening's technical speaker was Gary R. Jordan, of Hoechst Celanese Corp. Mr. Jordan's topic was "IMPROVING OPACITY AND FLOW PROPERTIES WITH ORGANIC PIGMENTS."

According to the speaker, deep yellows, oranges, and red shades traditionally have been the most difficult colors to reproduce in paints using organic pigments. Mr. Jordan stated that progress has been made in this area by using high opacity pigments. The speaker used current situations to illustrate his premise.

The meeting's educational speaker was James E. Frasier, Director, of Great Oaks Center for Employment Resources.

N. JAY HUBER, JR., *Secretary*

CLEVELAND ..... MAR.

"Paint Strippers"

Society Honorary Member Michael Malaga was elected a Federation Honorary Member by the voting members present at the meeting.

The "Duties of the Society Representative" resolution was passed and carried by Society members.

Paul Kuwik, of Eastern Michigan University, spoke on EMU's polymers and coatings programs.

Detroit Society member Taki Anagnostou, of Eastern Michigan University, was the technical speaker. Dr. Anagnostou discussed "PAINT STRIPPERS—METHYLENE CHLORIDE CASUALTY OR NEW OPPORTUNITY?"

The speaker discussed the developmental systems for removing paint coatings, including those with methylene chloride in the formulation.

According to Dr. Anagnostou, the industry's outlook on methylene chloride, a very important raw material in the coating's industry, has been dramatically reversed. At one time, methylene chloride was considered one of the safest and most environmentally acceptable organic solvents, when used correctly.

The speaker pointed out that the Consumer Product Safety Commission ruled on July 31, 1987, that there must be display labels on consumer products containing methylene chloride. In 1985, the EPA made restrictive rules on methylene chloride. The FDA presently proposes banning the use of methylene chloride in cosmetic products and OSHA has restrictive rules regarding methylene chloride for the workplace.

Dr. Anagnostou said the importance of methylene chloride in the coatings industry is significant. He pointed out that in 1985, 551 million pounds of methylene chloride were used, with 27% utilized in stripping components.

The reason for methylene chloride's importance in the industry, according to the speaker, is its aggressiveness in terms of attacking various types of coating film. When removing coating materials from wood, methylene chloride does not harm the wood or raise the grain. It has no flash point or upper/lower explosive limits in the air. In addition, methylene chloride is an effective vapor pressure depressant for use in aerosol sprays.

In conclusion, Dr. Anagnostou pointed out the difficult task in choosing a paint stripper. Date and results can be misleading if conclusions are based on only one type of coating. He stated the necessity of viewing each coating that needs to be removed and not at one general stripper that will do the job on every coating.

ILONA NEMES-NEMETH, *Secretary*

GOLDEN GATE ..... MAR.

"Using the Personal Computer"

A moment of silence was observed for Bob Holt, of Sherwin-Williams Co., who died recently.

The evening's speaker was Los Angeles Society member Christy A. Hudson, of Pacific Micro Software. The title of her talk was "PRODUCTION MANAGEMENT, FORMULA ANALYSIS AND COMPLIANCE USING THE PERSONAL COMPUTER."

Ms. Hudson discussed how the paint manufacturer can benefit by automating work with the personal computer. Using slides, she described a software program and demonstrated how production management, formula analysis, and compliance information can be entered into the computer and problems solved. The speaker covered the various types of reports that can be generated from the software program and how they can be used. According to Ms. Hudson, software can be developed to provide calculated data for any manufacturers' needs.

GORDON N. PIOCH, *Secretary*

NEW ENGLAND ..... JAN.

"Hazardous Waste Regulations"

Lee Breckenridge, Assistant Attorney General of the Commonwealth of Massa-

LOS ANGELES SOCIETY member Christy A. Hudson (left), of Pacific Micro Software, was the technical speaker at the Golden Gate Society March meeting. Seated with her is Golden Gate Vice-President Timothy Donlin, of Pacific Coast Chemical Co.

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Snyder's Willow Grove, Linthicum, MD). DONALD HILLIARD, Unocal, 1500 Carbon Ave., Baltimore, MD 21226. VIRGINIA SECTION (Fourth Wednesday—Ramada Inn-East, Williamsburg, VA).

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.A.A. WALLINGTON, Macpherson Drynamels Ltd., Westgate, Aldridge, West Midlands WS9 8YH England.

CDIC (Second Monday—Sept., Jan., Apr., June in Columbus; Oct., Dec., Mar., May in Cincinnati; and Nov., Feb. in Dayton). N. JAY HUBER, JR., Paint America Co., 1501 Webster St., Dayton, OH 45404.

CHICAGO (First Monday—meetings alternate between Como Inn in Chicago, IL and Sharko's West in Villa Park, IL). KEVIN P. MURRAY, DeSoto, Inc., 1700 S. Mt. Prospect Rd., Des Plaines, IL 60018.

CLEVELAND (Third Tuesday—meeting sites vary). ILONA NEMES-NEMETH, Sherwin-Williams Co., Cleveland Technical Center, 601 Canal Rd., Cleveland, OH 44113.

DALLAS (Thursday following second Wednesday—Harvey Hotel, North Dallas, TX). STEVE STEPHENS, Ribelin Sales, Inc., P.O. Box 461673, 3857 Miller Park Dr., Garland, TX 75046.

DETROIT (Second Tuesday—Ukrainian Cultural Center, Warren, MI). LIANA CALLAS ROBERTS, A.T. Callas Co., 1985 W. Big Beaver, Suite 308, Troy, MI 48043.

GOLDEN GATE (Monday before third Wednesday—Alternate between Francesco's in Oakland, CA and Holiday Inn in S. San Francisco). GORDON PIOCH, Triangle Coatings, Inc., 1930 Fairway Dr., San Leandro, CA 94577.

HOUSTON (Second Wednesday—Look's Sir-Loin Inn, Houston, TX). SANDRA SWIFT, Cron Chemical Corp., P.O. Box 14042, Houston, TX 77221.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). NICK DISPENSA, Davis Paint Co., P.O. Box 7589, N. Kansas City, MO 64116.

LOS ANGELES (Second Wednesday—Steven's Steak House, Commerce, CA). JAMES F. CALKIN, E.T. Horn Co., 16141 Herron Ave., La Mirada, CA 90638.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). RAYMOND L. MUDD, Porter Paint Co., Coatings Div., P.O. Box 1439, 400 S. 13th St., Louisville, KY 40201-0439.

MEXICO (Fourth Thursday—meeting sites vary). ARTURO ITA, Pinturas Aurolin, S.A. De C.V., Poniente 150 No. 750, Nueva Industrial Vallejo, 02300 Mexico, D.F.

MONTREAL (First Wednesday—Bill Wong's Restaurant, Montreal). ROBERT BENOIT, NL Chemicals Canada Inc., 4 Place Ville-Marie, Ste. 500, Montreal, Que., Canada H3B 4M5.

NEW ENGLAND (Third Thursday—LeChateau Restaurant, Waltham, MA). JOSEPH T. SCHRODY, Unocal Chemicals Div., 90 Cumberland Rd., Leominster, MA 01453.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). ARTHUR A. TRACTON, Hempel Coatings, Inc., Foot of Curie Ave., Wallington, NJ 07057.

NORTHWESTERN (Tuesday after first Monday—Jax Cafe, Minneapolis, MN). MARK W. UGLEM, Hirschfield's Paint Mfg., Inc., 4450 Lyndale Ave., N., Minneapolis, MN 55412. WINNIPEG SECTION (Third Tuesday—Marigold Restaurant, Winnipeg). NEIL WEBB, Phillips Paint Products Ltd., 95 Paquin Rd., Winnipeg, MB, Canada R2J 3V9.

PACIFIC NORTHWEST (PORTLAND SECTION—Tuesday following second Wednesday; SEATTLE SECTION—the day after Portland; BRITISH COLUMBIA SECTION—the day after Seattle). EMIL IRAOLA, Olympic Home Care Products Co., 1141 N.W. 50th, Seattle, WA 98107.

PHILADELPHIA (Second Thursday—Williamson's, GSB Bldg., Philadelphia, PA). ORVILLE E. BROWN, M.A. Bruder & Sons Inc., 52nd & Grays Ave., Philadelphia, PA 19143.

PIEDMONT (Third Wednesday—Americana Inn, Greensboro, NC). FOREST G. FLEMING, Reliance Universal, Inc., P.O. Box 2124, High Point, NC 27261.

PITTSBURGH (Second Monday—Montemurro's, Sharpsburg, PA). JAMES LORE, Watson Standard Co., P.O. Box 11250, Pittsburgh, PA 15238.

ROCKY MOUNTAIN (Monday following first Wednesday—Holiday Inn North, Denver, CO). PAUL D. SILVA, Kwal Paints, Inc., 3900 Joliet St., P.O. Box 39485, Denver CO 80239.

ST. LOUIS (Third Tuesday—Salad Bowl, St. Louis, MO). HOWARD JEROME, Mozel Equipment Co., 4003 Park Ave., St. Louis, MO 63110.

SOUTHERN (GULF COAST SECTION—Third Thursday; CENTRAL FLORIDA SECTION—Third Thursday after first Monday; ATLANTA SECTION—Third Thursday; MEMPHIS SECTION—bi-monthly on Second Tuesday; MIAMI SECTION—Tuesday prior to Central Florida Section). JAMES R. SALISBURY, Union Carbide Corp., 2043 Steel Dr., Tucker, GA 30084-5894.

TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). ROY A. DONNELLY, St. Lawrence Chemical Co. Ltd., 321 Humberline Dr., Rexdale, Ont., Canada M9W 5T6.

WESTERN NEW YORK (Third Tuesday—meeting sites vary). MARKO K. MARKOFF, 182 Farmingdale Rd., Cheektowaga, NY 14225.

chusetts for Environmental Affairs, discussed "HAZARDOUS WASTE REGULATIONS AND THEIR ENFORCEMENT."

Ms. Breckenridge indicated that a great many changes involving prosecution of hazardous waste violators have taken place since she became involved on the state federal level some 10 years ago. She stated that criminal prosecution is replacing civil litigation as a means of controlling hazardous waste.

JOSEPH T. SCHRODY, *Secretary*

NEW YORK..... MAR.

"High Solids Urethane Coatings"

Membership Chairman Arthur I. Nortman, of Nortman Associates, Inc., said a Memorial Plaque will be sent to the family of Philip Maslow.

Fred Daniel, of Daniel Products Co., was presented a Service Award Plaque and elected a Society Honorary Member.

Mike Granito, of Metropolitan New York Paint and Coatings Association, described the legal actions taken by the MNYPCA in New York City to resolve an EPA action restricting paint raw materials. Mr. Granito also reported that the state of New York was having a series of hearings on VOC changes.

The speaker for the evening was Bernard Taub, of NL Chemicals, who spoke on "HIGH SOLIDS URETHANE COATINGS."

Dr. Taub discussed high-solids urethanes with low VOC, and where they are used and their advantages. The speaker elaborated on aromatic urethanes, polyols, and solvents, and aliphatic urethanes, adducts, and resins.

ARTHUR A. TRACTON, *Secretary*

PACIFIC NORTHWEST—PORTLAND SECTION ..... MAR.

"Formula Analysis Using The Personal Computer"

Keith S. Guisinger, of Chemcentral/Portland, gave a detailed report of the requirements of the SARA Title III program and what will have to be done to comply with the plan.

The meeting's guest speaker was Los Angeles Society member Christy A. Hudson, of Pacific Micro Software. Ms. Hudson presented a talk on "PRODUCTION MANAGEMENT, FORMULA ANALYSIS AND COMPLIANCE USING THE PERSONAL COMPUTER."

STEVE REARDEN, *Secretary*

PACIFIC NORTHWEST—SEATTLE SECTION ..... MAR.

"Compliance Using the Personal Computer"

Christy A. Hudson, of Pacific Micro Software, and a member of the Los Angeles Society, was the meeting's speaker. She discussed "PRODUCTION MANAGEMENT, FORMULA ANALYSIS AND COMPLIANCE USING THE PERSONAL COMPUTER."

Ms. Hudson described a software package which contains several disks, or modules, which allows for purchasing, production, and product development people to work with speed, accuracy, and comfort. The software runs on IBM or compatible personal computers. The software package recently has been enhanced with VOC calculation and accounting interface.

JOHN F. BARTLETT, *Secretary*

PACIFIC NORTHWEST—VANCOUVER SECTION ... MAR.

"Production Management Using The Personal Computer"

Los Angeles Society member Christy A. Hudson, of Pacific Micro Software, talked on "PRODUCTION MANAGEMENT, FORMULA ANALYSIS AND COMPLIANCE USING THE PERSONAL COMPUTER."

Ms. Hudson's presentation focused on a new, upgraded computer software package.

JOHN BERGHUIS, *Secretary*

PHILADELPHIA..... MAR.

"Coatings for Plastic Substrates"

A moment of silence was observed for Society Honorary Member H.M. Van Horn, of Van Horn, Metz & Co., Inc., who died recently.

Northwestern Society member Richard Johnson, of Cargill, Inc., was the meeting's technical speaker. He presented "COATINGS FOR PLASTIC SUBSTRATES II."

Mr. Johnson discussed the various types of plastics including thermoplastics, thermosets, and elastomers. He stated that temperature plays a major factor in the coating of plastics, e.g., plastics will deform at high temperatures.

The speaker used a chart to illustrate various plastics and how heat distortion temperatures varied dramatically from a low of 60°C for polystyrene to a high of 150°C for polysulfone.

Mr. Johnson indicated that the substrate in plastics varies across the molded parts due to release of internal and external mold release agents, which affects adhesion and finish properties.

A discussion of adhesion to plastics and the effects of surface energy, weak boundry layers on the top of the plastics, surface typography, and functional groups on the surface of the plastics followed. The speaker also talked on surface free energy vs surface tension, and the effect of each on adhesion.

Mr. Johnson indicated that solvents may be used to improve adhesion, but stressed that solvents can cause embrittlement and stress cracking.

Since the skin of the plastics also can affect the properties, use of the functional groups in the plastics should match those of the functional groups in the coatings to maximize adhesion.

In conclusion, Mr. Johnson showed slides which depicted new ideas in plastic coatings, such as pre-mold, powder coatings of SMC, in-mold coatings for thermoplastics with HPI, in-mold coatings for thermosets, and Michigan Draft Rule 632 and its effect on coatings.

LAWRENCE J. KELLY
Secretary Protempore

Elections

BALTIMORE

Active

KANSAL, SHRI B.—McCormick Paint Co., Rockville, MD.
NEEDLE, BART—Sherwin-Williams Co., Pikesville, MD.

Associate

GARDNER, HENRY A.—Pacific Scientific, Silver Springs, MD.
JELSTROM, G. PETER—George A. Milton Can Co., Elizabeth, NJ.
TURMAN, FRANK H.—Duron Inc., Beltsville, MD.

CDIC

Associate

GRUBER, DANIEL W.—CL Zimmerman Co., Cincinnati, OH.
MACHEK, ALAN L.—Dow Corning Corp., Cincinnati.

CHICAGO

Active

ADAMS, RICHARD C.—Amoco Chemicals Corp., Naperville, IL.
BAUGHMAN, BARRY—Koch Materials Co., Chicago, IL.
BROWN, KENNETH J. SR.—The C.P. Hall Co., Chicago.
DEWULF, JERRY J.—Gaco Western Inc., Waukesha, WI.
DEYOUNG, DUANE D.—Rust-Oleum Corp., Evanston, IL.
FORD, KATHLEEN A.—Valspar Corp., Wheeling, IL.
FUERTE, ISMAEL C.—United Coatings Inc., Chicago.
HANSEN, JEFFREY M.—River Valley Coatings, Aurora, IL.
RAMSAY, ROBERT D.—Sun Chemical, Northlake, IL.
ROBINS, HOWARD M.—Fel-Pro Inc., Skokie, IL.
SHIELDS, GLEN D.—S.C. Johnson & Son Inc., Racine, WI.
SHOEMAKER, STEPHEN H.—Amoco Chemical Co., Naperville.
SIMPSON, SUSAN A.—Amoco Chemical Co., Naperville.
WOLFE, GORDON S.—S.C. Johnson & Son Inc., Racine.
YAP, MICHAEL—Koch Materials Co., Chicago.

Associate

CHIU, JEFFREY S.—Kraft Chemical Co., Melrose Park, IL.
DONAHUE, JOSEPH J.—NL Chemicals, Downers Grove, IL.
O'BRIEN, TIMOTHY H.—Milton Roy Co., Palatine, IL.

CLEVELAND

Active

AUSTIN, BRENDA L.—Glidden Co., Strongsville, OH.
BALL, ALBERT G.—PPG Industries, Cleveland, OH.
CHOSA, MICHAEL S.D.—Akron Paint & Varnish, Akron, OH.
COLLINS, PETER S.—Glidden Co., Strongsville.
COTTRELL, HARRIET—Kalcor Coatings, Willoughby, OH.
DIBIASE, STEPHEN A.—The Lubrizol Corp., Wickliffe, OH.
DILLON, H.S.—Dorn Color Card, Inc., Cleveland.
JANOW, SHARIE A.—Sherwin-Williams, Parma, OH.
KONDILAS, JOHN T.—Dylon Industries, Berea, OH.
MATKO, STEVEN P.—SCD Div., Etna Products Inc., Chagrin Falls, OH.
OLIGHER, KAREN L.—PPG Industries, Strongsville.
TAYLOR, LAURENT—Glidden Co., Strongsville.
VICHA, SUSAN K.—PPG Industries, Strongsville.
WRIGHT, JAMES L.—Wooster Products Inc., Wooster, OH.
ZAMBORY, JOHN G.—Glidden Co., Strongsville.

Associate

AUNGST, JAMES H.—Dover Chemical Corp., Dover, OH.
BROTHERS, ROLAND N.—Sentco Paint Mfg., Youngstown, OH.
NEUMAN, EMIL C.—Neuman Assoc., Inc., Chagrin Falls, OH.
PANOZZO, ANDREW J.—Obron Corp., Painesville, OH.
RICHARDS, EDWARD P.—Lubrizol Corp., Wickliffe, OH.
SALTZMAN, BARRY M.—Lubrizol Corp., Wickliffe.
TRIPP, ISAAC JR.—SCD Div., Etna Products Inc., Chagrin Falls.
URBIHA, SCOTT A.—Dow Chemical USA, Strongsville, OH.
YOSH, JAMES P. JR.—Henkel Corp., Aurora, OH.

DETROIT

Active

QUIROLO, MICHAEL L.—Ford Motor Co., Dearborn, MI.
TILL, BEVERLY A.—Bee Chemical Co., Belleville, MI.

Associate

NICHOLS, FREDERICK D.—Globe Trading Co., Redford, MI.

KANSAS CITY

Active

CROOK, BILL T.—Midwest Coatings, Inc., North Kansas City, MO.
MANGO, HUGO R.—Douglas Paint Co., Kansas City, MO.
MEAD, TIMOTHY A.—Tnemec Company Inc., North Kansas City.

Retired

FRANCIS, GEORGE A.—Raytown, MO.

NEW YORK

Active

DAVE, DILIP I.—Pyramid Paint Products, Brooklyn, NY.
KOUASSI, EDJA—Paragon Paint & Varnish, New York, NY.
WERTHER, DAVID H.—Maas and Waldstein, Newark, NJ.

Associate

DUNDORF, ANDREW J.—American Cyanamid Co., Bridgewater, NJ.
NARGIELLO, MARIA R.—Degussa Corp., Allendale, NJ.
PESETSKY, CRAIG J.—Hercules Incorporated, Wilmington, DE.

NORTHWESTERN

Active

SCHRYER, MELINDA M.—Rexnord Chemical Products Inc., Minneapolis, MN.
SIMMONDS, RICHARD A.—Sierra Corp., Minnetonka, MN.

Associate

ALSETH, JAMES W.—Byk-Chemie, Milwaukee, WI.
LARSON, GAYLE J.—Unocal Chemicals Div., St. Paul, MN.

LEE, M. RICHARD—Central Can Co., Chicago, IL.
LEHR, BILL—Finishing Systems Consultants, Inc., Prior Lake, MN.

Educator/Student

DUCKART, LINDA J.—North Dakota State University, Fargo, ND.
HOLMGREN, JON R.—North Dakota State University, Fargo.

PHILADELPHIA

Active

CHU, I. CHENG—Du Pont Co., Philadelphia, PA.
DI GIACOMO, GABRIELE—The Gilbert Spruance Co., Philadelphia.
GARLAND, BLAIR D.—Norwood Industries Inc., Malvern, PA.
GOLDBERG, DANIEL—Palmer International, Worcester, PA.
GRAHAM, C. ROBERT—Lancaster Laboratories Inc., Lancaster, PA.
HAWTHORNE, GLEN R.—NL Chemicals, Hightstown, NJ.
HOLMES, CHRISTOPHER J.—Superior Varnish, Pennsauken, NJ.
KEHUSMAA, JEFFREY J.—Pflaumer Bros., Inc., Norristown, PA.
KER, DOUGLAS T.—C.J. Osborn, Merchantville, NJ.
MEHTA, NATE R.—C.J. Osborn, Merchantville.
PAK, NAYKEANG—M.A. Bruder & Sons Inc., Philadelphia.
RIVERS, CAROL A.—NL Chemicals, Hightstown.
SCOTT, MAURA K.—M.A. Bruder & Sons Inc., Philadelphia.
THOMAS, ROBERT D.—M.A. Bruder & Sons Inc., Philadelphia.
WU, HAROLD H.—Hüls America Inc., Piscataway, NJ.
ZAVISZA, DANIEL M.—Hercules Incorporated, Wilmington, DE.

Associate

AZARCHI, STUART A.—Performance Industries Inc., Trenton, NJ.
BRESKMAN, ELLIS L.—Sentry Paint Technology, Malvern, PA.
DUNDORF, ANDREW J.—American Cyanamid Co., Bridgewater, NJ.
FARMER, RANDALL—J.M. Huber Corp., Havre De Grace, MD.
GILL, THOMAS MARTIN—Silberline Mfg. Co., Inc., Tamaqua, PA.
GRINDLINGER, BENJAMIN—Performance Industries Inc., Trenton.
JEBSEN, BJORN—NL Chemicals, Hightstown, NJ.
LIEBERT, GREGORY R.—Netzsch Inc., Exton, PA.
NCNAIR, HARLEY R.—Pflaumer Bros. Inc., Norristown, PA.
MURPHY, GEORGE J.—Netzsch Inc., Exton.
NATALINI, JAMES D.—NL Chemicals, Hightstown.
STANLEY, MARGARET—J. Urban Co., Inc., Philadelphia, PA.
SUBACH, DANIEL J.—NL Chemicals, Hightstown.
TRATTA, THOMAS N.—NL Chemicals, Hightstown.
WASHBURNE, ROBERT N.—Rohm and Haas Co., Philadelphia.

TORONTO

Active

DUMOULIN, PETER-JOHN G.—BAPCO, Concord, Ont.
PILAROSCIA, FRANK—Sico Inc., Rexdale, Ont.
SAKHER, JOSEPH M.—Sternson Ltd., Brantford, Ont.

Associate

BHESANIA, MIKE K.—Canada Colors & Chemicals Ltd., Don Mills, Ont.
DIXON, OLIVER F.—Degussa Canada Ltd., Burlington, Ont.
EMERSON, DAVID—Canada Colors & Chemicals Ltd., Don Mills.
LEARN, ROGER A.—Dominion Colour Co. Ltd., Toronto, Ont.
MAY, GARY—Canada Colors & Chemicals Ltd., Don Mills.
MCALLISTER, HUGH—Canada Colors & Chemicals Ltd., Don Mills.
PATERNOSTRO, MARIO—Gray Products, Toronto.

WESTERN NEW YORK

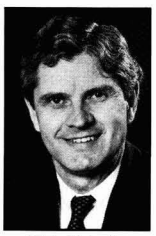
Active

DODD, THOMAS W.—Essex Specialty Products, Jamestown, NY.
LINDELL, MARNE A.—Essex Specialty Products, Jamestown.
LYON, PATRICIA L.—Essex Specialty Products, Jamestown.

People

Daniel Products Co., Jersey City, NJ, has announced the appointment of **Michael C. Frantz** to the newly created position of Director, Advertising and Sales Promotion. Mr. Frantz will be responsible for such diverse activities as organization and coordination of trade show exhibits, preparation and production of product data sheets, catalogues, color cards, direct mail, and print advertising. He is a member of the New York Society.


M.C. Frantz


D.C. Abbott


T.J. Krieg


I. Harris

SCM Chemicals, Baltimore, MD, has named **Donald C. Abbott** Vice President—Finance. Mr. Abbott joins the company from the General Foods Corp., where he was a Financial Director in the international operations. Prior to that, he served for more than 13 years with the Rohm and Haas Co. in Philadelphia.

Two promotions within the marketing department at the Horizon Chemical Division of Staley Continental, Inc., Decatur, IL, have been announced. **J. Michael Reed** has been named Marketing Manager, STA-MEG® Specialty Applications in the Intermediates Business Unit, and **Michael W. Swartzlander** has been appointed Marketing Manager, Methyl Glucoside Derivatives and Intermediates Marketing-International.

Akzo Chemie America, Chicago, IL, has appointed **Charles M. Donohue** to the newly created position of Director, Regulatory Affairs. His department will be responsible for consolidating and expanding occupational safety, environmental compliance, industrial hygiene, etc., which was previously managed by separate departments within the U.S. operations of the Chemical Division.

In addition, **Peter W. Spoor** has joined the Polymer Processing and Coatings group as Business Manager, Thermoset Products. He will spearhead all commercial activities regarding the unsaturated polyester initiator business.

Harry L. Bauer has joined the staff of Witco Corporation, New York, NY, as Manager of Personnel Safety in its Safety, Health, and Environmental Affairs Department. He will be based at the company's administrative center in Woodcliff Lake, NJ.

Thomas J. Krieg has been appointed General Sales Manager of the Chemicals Division, J.M. Huber Corp., Havre de Grace, MD. Mr. Krieg, who joins Huber from the Engelhard Corp., will manage and provide worldwide sales coverage for the division.

Robert C. Sterrett has been named Principal Environmental Engineer for Ashland Chemical Co., Columbus, OH. In his new position, Mr. Sterrett will be responsible for developing and managing the firm's environmental programs and for ensuring all company locations are in continuing compliance with federal, state, and local regulations.

In an expansion move, Consler Scientific Design, Inc., Tampa, FL, has named **Donald M. MacLeod**—General Manager, Tampa; and **George W. Morrow**—Technical Sales Manager, Dixon, IL.

Dino M. Mastrella has joined the Domestic Food Div., of Kelco Div., of Merck & Co., Inc., San Diego, CA, as Sales Representative covering both food and industrial markets in Ontario and western Canada.

Allen J. Lenz, former Director of the U.S. Commerce Department's Office of Trade and Investment Analysis, has joined the Chemical Manufacturers Association as Director of Trade and Economics. In his new position, along with becoming the Association's chief spokesman on economics and trade, Mr. Lenz becomes the Deputy in the Office of the Chemical Industry Trade Advisor.

Rohm and Haas Co., Philadelphia, PA, has named **Ian Harris** Group Market Manager for Trade Sales Coatings. Mr. Harris has been with Rohm and Haas since 1977, and prior to this assignment, he served as Market Area Manager for the firm's elastomeric coatings and asphalt modifiers.

The National Association of Corrosion Engineers (NACE), Houston, TX, has awarded its R.A. Brannon Award to **H.E. "Pete" Rossy, Jr.,** of the Chandelle Co., Houston, for his outstanding service for the development and improvement of the association. Nominated by the NACE Houston Section, Mr. Rossy has made significant volunteer contributions to the association during the past 11 years at the sectional, regional, and national levels.

J. Andrew Doyle has been appointed Executive Director of the National Paint and Coatings Association (NPCA), Washington, D.C. Mr. Doyle succeeds **Larry L. Thomas,** who is leaving the association to head the Society of the Plastics Industry.

Mr. Doyle, who currently serves as NPCA's Deputy General Counsel, joined the staff in 1979 as a Regulatory and Legislative Analyst. After receiving his JD degree in 1983, he was appointed Counsel, and was named Deputy General Counsel in January of 1988. For the past three years, he has served as an officer (currently Board Chairman) of the Hazardous Materials Advisory Council, which represents generators and transporters of hazardous materials, container manufacturers, and hazardous materials emergency response companies.

Thomas Hockswender is a Scientist, Research and Development—Coatings and Resins, for PPG Industries, Inc., Allison Park, PA, and serves as a member of the Editorial Review Board for the JOURNAL OF COATINGS TECHNOLOGY. He received the B.S. Degree from Duquesne University in 1970 and the Ph.D. Degree from Case Western Reserve University in 1973. Dr. Hockswender has been in the coatings industry for 14 years and is responsible for eight U.S. patents and several publications. His areas of interest include polymer synthesis—epoxies, acrylics, urethanes, coatings for automotives, electrocoating, and computer-based modeling and simulation. Dr. Hockswender is a member of the American Chemical Society.

Reichhold Chemicals, Inc., White Plains, NY, announced that **Thomas R. Mitchell** has been named President and Chief Executive Officer. He replaces the retiring **C. Robert Powell.** Having started as a Laboratory Technician in 1957, Mr. Mitchell has been Executive Vice President since 1983. He becomes Reichhold's third Chief Executive Officer since the company's founding by Henry H. Reichhold in 1927.

Morton Chemical Division, Morton Thiokol, Inc., has named **Lloyd J. (Jeff) Martin,** IG sealant and thermal break materials Sales Representative. Based in Plano, TX, Mr. Martin will be responsible for insulating glass manufacturers and industrial adhesives customers in Arkansas, Louisiana, Oklahoma, and Texas.

In addition, **Jim Carlisle** has been appointed Ford Account Executive for Bee Chemical Co., a division of Morton Thiokol, Inc. Following a relocation to Belleville, MI, Mr. Carlisle will be responsible for overseeing the entire Ford service team.

The appointment of **Rolan D. Kjosen** to the position of President of the Chemical Coatings Division of The Sherwin-Williams Co., Chicago, IL, has been announced. Mr. Kjosen had been serving as Vice President of Marketing for the division. He succeeds **Joseph M. DeVittorio** who has joined CPG International as Chief Executive Officer.

In addition, **John C. Billings** has been appointed to the newly created position of Director of Quality for the Chemical Coatings Division. He will coordinate and monitor the division's total quality program.

John D. Trim, Vice President of Corrosion Service Co., Ltd., Downsview, Ontario, has been elected President of the National Association of Corrosion Engineers (NACE), Houston, TX.

A member of NACE since 1956, Mr. Trim has served in many capacities with the association. In addition to having served as NACE Vice President during the past year, he has been a Director on the Board and Chairman of the International Committee, Technical Practices Committee, and Technical Group Committee T-6 on Protective Coatings.

Arco Chemical Co., Newton Square, PA, has added two Market Development Specialists for its line of ARCOSOLV® solvents. **Debra L. Mountford** will service customers in the western United States, and **William L. Bohack** will work with the ARCOSOLV distributors.

Angus Chemical Co., Northbrook, IL, has announced the following promotions: **Gregory P. Jorjorian**—Vice President and General Manager, Biocides; **Gary L. Hess**—Vice President, Marketing; **Kent S. Strong**—Director of North American Sales; and **Dean G. Ross**—Manager, Biocide Packaged Products.

Mr. Strong is a member of the Houston Society.

Marvin K. Holland has been named Senior Sales Specialist—Polymer, for the Adhesives, Sealants, and Coatings Division of H.B. Fuller Co., St. Paul, MN. In his new sales position, Mr. Holland will focus on the fiberglass, textile, paint, and caulk areas of the firm's polymer line of products. His territory will include western Georgia, Tennessee, and Alabama.

Hercules Incorporated, Wilmington, DE, has named **Marlin G. Miller** to the post of Director of Sales for its organic resins. For the past 10 years, Mr. Miller headed midwestern sales, and prior to that was District Manager of Hercules' Boston office. His previous position of Midwestern Sales Manager will be filled by **W. John Moffatt.**

Also, **Alexander L. Searl** and **George MacKenzie** have been named Vice Presidents. They will report to **Arden B. Engebretsen,** Vice Chairman and Chief Financial Officer.

Jim Anders has been appointed Midwestern Sales Representative for Hilton-Davis, Cincinnati, OH. Mr. Anders will be responsible for the sales of the firm's dry pigments, aqueous dispersions, and flush colors for the paint and plastics industries.

Polaroid Corp., Assonet, MA, has made **Jerome Hartnett** responsible for sales of a line of cast urethane elastomer products in the Midwest. His territories include Illinois, Wisconsin, Minnesota, Missouri, Iowa, western Michigan, and western Indiana. Mr. Hartnett brings 30 years of field sales, marketing management, and branch office management to the position.

Charles B. Edwards and Co., Inc., Minneapolis, MN, has added **Ray Benoit** to their Field Sales staff. Mr. Benoit will be responsible for Missouri, Illinois, Indiana, Kentucky, and Tennessee. He brings 15 years of experience in the plastics industry to his new position.

The Board of Directors of Silberline Manufacturing Co., Inc., Hometown, PA, has elected the following officers: **Joseph B. Scheller**—President/Chief Executive Officer—Treasurer; **Ernest Scheller III**—Vice President—Secretary; and **Ernest Scheller, Jr.**—Chairman of the Board.

Freeman Chemicals, Port Washington, WI, has announced a major restructuring of its sales department. Appointments that have taken place include: **Warren C. Owens**—General Manager, Sales, Eastern Region; **M.J. Foster**—General Manager, Sales, Midwest Region; **Brent A. Baker**—Product Manager, Distribution; and **E.J. (Gene) Grandlic**—Product Manager, High Temperature Cured Resins.

Obituary

William L. Foy, Past-President of the Federation from 1961-62, died on March 16, 1988.

Mr. Foy's association with the paint and coatings industry began over 40 years ago. Prior to World War II, he attended North Dakota State University. Following his return to civilian life, he began his coatings career as a Chemist with Foy Paint Co., in Cincinnati, OH. From 1952-60, he served as Technical Director. After Foy Paint Co. merged with R.F. Johnston Paint Co. in 1961, Mr. Foy was appointed Head of Vehicle Research for Foy-Johnston. He later served as Director for the company. In 1974, Mr. Foy was employed with Muller Industries, Inc. and, in 1979, he moved to St. Louis with LanChem Resin Corp. He remained with this company until his retirement several years ago.

Mr. Foy was a Past-President of the CDIC Society and chaired several Federation committees prior to being named FSCT President.

Baltimore to Host SSPC Conference and Exhibition; 1988 Program to Feature Seminars and Tutorials

The Steel Structures Painting Council's (SSPC) 1988 National Conference and Exhibition will be held on November 13-17, at the Baltimore Civic Center and Omni International Hotel, Baltimore, MD. The theme of this year's symposium is "Economics of Corrosion-Protective Coatings Systems for Structures."

The SSPC trade show is designed to serve professionals in the protective coatings industry including: end users; painting contractors; manufacturers; suppliers; government agencies; estimators, specifiers, and purchasers; and anyone interested in corrosion-protective technology.

The symposium will be developed in four technical sessions where experts will identify and examine the cost impact and activities of various protective coating systems and strategies. Technical session subjects include:

- Economics of surface preparation and application operations;
- Alternative coating materials for cost effectiveness;
- Economic strategies for new construction and maintenance; and
- Cost effectiveness of inspection and quality control.

Eight informal technical seminars will be held on the following topics: water and waste treatment; coatings for concrete; regulations and litigation; research and development; coatings for power generation facilities; bridge coatings forum; repair of lining systems; and low VOC coatings.

Tutorials on four topics are scheduled. Certificates will be presented to each tutorial participant following completion of the course. The following tutorials will be presented: "Implementing the SSPC Painting Contractor Certification Program"—Charles H. Holes, of Steel Structures Painting Council; "Establishing a Corporate Maintenance Painting Program"—John F. Delahunt, of Exxon Research and Engineering Co., and Stanley F. Thompson, of S.G. Pinney & Assoc.; "Estimating Painting and Protection Costs"—Gordon H. Brevoort, of Brevoort Consulting Assoc., Inc., and A.H. Roebuck, of CRT Laboratory; and "Inspection Instruments Workshop"—Kenneth A. Trimber, of KTA-Tator, Inc.

For more information, write SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213-2683.

Color in Design Forum Slated for August 8-11

The International Color Association (AIC) is sponsoring a symposium on "Color in Environmental Design," on August 8-11, at the Winterthur Polytechnic, Winterthur, Switzerland. The Inter-Society Color Council, Detroit, MI, is a member of the AIC.

The symposium will bring together international experts with a special interest in the use of color in the human environment for the best interest of the user. Also attending the meeting will be architects, interior designers, interior space planners, urban planners, landscape architects, psychologists, physiologists, and environmental color researchers from many countries.

The Winterthur is 15 minutes by train from the Zurich Airport and accessible to international participants. The official language of the symposium will be English and proceedings are expected to be published.

For more information, contact Alex Styne, P.O. Box 431468, South Miami, FL 33143; Werner Spillman, Color Course Center, Winterthur Polytechnic, Dept. of Architecture, 8401 Winterthur, Switzerland; or Allan Rodrigues, E.I. Du Pont Co., 945 Stephenson Highway, P.O. Box 2802, Troy, MI 48007-2802.

Hazardous Waste, SARA Title III Seminars Featured in 20 U.S. Cities through December

Seminars focusing on hazardous waste management and SARA Title III are being sponsored by the Environmental Resource Center, Fayetteville, NC. "How to Comply with Hazardous Waste Management Regulations" and "How to Comply with Current SARA Title III and OSHA Right-to-Know Regulations" are being conducted throughout the U.S. until the beginning of December.

The program on hazardous waste covers how to comply with RCRA regulatory requirements including container management, waste accumulation procedures, DOT requirements applicable to hazardous waste management, and emergency response procedures.

The SARA Title III and Right-to-Know seminar explains the following: the law and how to comply with the current regulations; who is covered by the law; MSDS requirements; chemical release notification requirements; how to complete Tier I, Tier II, and Toxic Chemical Release Inventory forms; trade secret confidentiality; and penalties for noncompliance. The program also presents the requirements of the Hazard Communication Standard, which will be expanded this year to include all SIC codes.

The seminars are geared toward personnel who generate or manage hazardous waste, environmental coordinators, plant managers, safety coordinators, environmental engineers, and employees of hazardous waste treatment, storage, or disposal facilities.

Dates and locations for the hazardous waste seminars are: June 30—Seattle, WA; July 11—Rochester, NY; July 13—Syracuse, NY; July 14—Albany, NY; August 8—Springfield, IL; August 10—Milwaukee, WI; August 12—Madison, WI; August 29—Boston, MA; August 31—Indianapolis, IN; September 2—Louisville, KY; October 3—Detroit, MI; October 5—Toledo, OH; October 6—Cleveland, OH; October 31—Tampa, FL; November 2—Birmingham, AL; November 3—New Orleans, LA; November 28—Denver, CO; and November 30—Phoenix, AZ.

The SARA Title III course schedule is as follows: July 1—Seattle, WA; July 12—Rochester, NY; July 13—Syracuse, NY; July 15—Albany, NY; August 9—Springfield, IL; August 11—Milwaukee, WI; August 12—Madison, WI; August 30—Boston, MA; September 1—Indianapolis, IN; September 2—Louisville, KY; October 4—Detroit, MI; October 5—Toledo, OH; October 7—Cleveland, OH; November 1—Tampa, FL; November 2—Birmingham, AL; November 4—New Orleans, LA; November 29—Denver, CO; and December 1—Phoenix, AZ.

For additional information, contact Maryel Tomter, Environmental Resource Center, 608 Southview Circle, Fayetteville, NC 28301.

Emulsion Polymerization and Latex Technology Course Scheduled for Davos, Switzerland, August 22-26

The 11th annual short course "Advances in Emulsion Polymerization and Latex Technology," will be held at the Schatzalp Berghotel, Davos, Switzerland, on August 22-26. The course will provide an in-depth study of the synthesis, characterization, and properties of high polymer latexes.

The short course subject matter will include a balance of theory and practical problems. Lectures will begin with introductory material and will progress through recent research results.

The program is designed for engineers and scientists who are actively involved in emulsion work as well as for those who wish to develop expertise in the area.

Topics to be presented include: "Emulsion Polymerization Mechanisms and Kinetics"; "Adsorption of Surfactants, Electrostatic Stabilization and Flocculation of Latexes"; "Semi-Continuous Emulsion Copolymerization"; "Mixing Scale-Up in Emulsion Polymerization"; "Engineering of Emulsion Polymerization Reactions"; "Adsorption of Polymeric Molecules and Steric Stabilization of Latexes"; "Inverse Emulsion Polymerization"; "Experimental Methods for the Characterization of Latex Particle Size and Particle Size Distribution"; "Latex Preparation by Dispersion Polymerization in Non-Aqueous Media"; "Surface Characterization of Latexes"; "Core-Shell Polymerization"; "Latex Rheology and Rheological Instruments"; "Miniemulsion Processes for Latex Preparation"; "Kinetics of Grafting Reactions in Solution and Emulsion Polymerization"; "Super Absorbent Polymer—Preparation, Properties and Applications"; "Monitoring and Control of Emulsion Polymerization Reactors"; and "Latex Formulations for Coatings Applications."

In addition, the program will include two discussion sessions of problems submitted by the course participants.

The short course registration is limited to 50 participants. For further information, contact Gary W. Poehlein, Graduate Office (Savant), Georgia Institute of Technology, Atlanta, GA 30332-0265.

Biennial Radiation Conference Slated for April 1989

The 7th International Meeting on Radiation Processing (I.M.R.P.) is being held at the Leeuwenhorst Congress Center, Noordwijkerhout, The Netherlands, on April 23-28, 1989. The biennial conference is dedicated to the dissemination and advancement of industrial radiation processing technology.

The I.M.R.P. conference will present state of the art technology which will provide information on the diverse industrial uses of radiation processing. The objectives of these meetings are to examine the industrial applications of electrons, x-rays, and gamma-rays; to analyze common problems; and to present information on new products, processes, technology, and research.

The program will include a mixture of invited lectures, papers, poster sessions, panels, open discussions, and tutorials. Subject matter to be covered includes radiation sterilization, waste treatment, food preservation, polymer modification, materials for application in radiation environments, semiconductors, industrial irradiation facilities, and dosimetry.

For more details on the conference, contact E. Franken, 7th International Meeting on Radiation Processing, P.O. Box 4240, 6710 EE Ede, The Netherlands.

Coatings Education

In keeping with its objectives as an educational organization, the Federation of Societies for Coatings Technology annually awards scholarships to schools where coatings technology is part of the curriculum. As part of a continuing series, the JCT will focus on these schools and highlight details of their coatings programs. The Federation is pleased to be associated with these universities and their efforts in training future members of the coatings industry.

Exploring the Polymer Science Program At the University of Southern Mississippi

The Department of Polymer Science at the University of Southern Mississippi, Hattiesburg, MS, was established in 1970 under the leadership of its first Chairman Shelby Thames. The Department offers programs leading to the B.S., M.S., and Ph.D. Degrees in Polymer Science coupled with an extensive program of polymer research. It is one of only eight full departments of Polymer Science in the U.S., and the only one in the South.

The Department has 13 permanent faculty positions held by graduates of 13 different American universities. Faculty degree training, research interests, and teaching expertise span a broad range, from polymer synthesis to physical properties to polymer engineering.

The Polymer Science program at USM has established a national reputation in the study of coatings and water-soluble polymers and has developed recognition in its work in controlled-release technology, physical characterization of polymers, and polymers with catalytic and reagent applications.

Facilities and Equipment

This month, ground will be broken for a new $17.7 million, 86,000 square-foot critical research agricultural materials center, which will house the Department of Polymer Science/Mississippi Polymer Institute. According to Assistant Professor Robson F. Storey, the building will include a 3,200 square-foot plastics and coatings process development laboratory to aid in new product development for Mississippi polymer industries. Expected completion date for the new center is the Fall of 1990.

Students enrolled in the Polymer Science program have the opportunity to utilize state-of-the-art molecular structure instrumentation (including ESR, NMR, IR, visible, UV, mass, and x-ray spectroscopy), and learn specific methods of polymer analysis (GC, GPC, VPO, MO, light scattering, and viscometry) and physical property characterization (using DSC, TAMA, TGA, Instron Tensile Tester, Brabender Plasticorder, and electron and optical microscopy). Specialized equipment is available for the manufacture, formulation, application, and evaluation of plastics and coatings. Equipment for characterizing polymer processing behavior includes injection molding, pressure and vacuum forming, and extrusion facilities.

Research Support

According to Dr. Storey, annual research support funding now approaches $2 million annually. A major program for the Department of Energy on Polymers for Enhanced Oil Recovery is vital. Industrial and governmental research programs play a significant part in the Department's research efforts. Sponsored programs are diverse and include solution characterization of coatings, controlled-release pesticides and herbicides, anticorrosion and antifouling coatings development, additives and fillers in coatings, water-soluble polymers, morphology of polymers in solution, and polymeric catalysts, to mention a few.

Polymer Institute

In 1983, the Mississippi Legislature established the Polymer Institute at USM to work closely with polymer related industries, to assist with research, and problem solving. As an integral part of the basic research and educational efforts of the Department of Polymer Science, the Institute is to provide industry and government with applied research and development support in key problem areas. This effort is an extension of existing strong ties with industry and government involving exchange of information, support for research, and improved employment opportunities for graduates. Most important, through research and contract research projects such as those currently supported by agencies like the Department of Energy, the Department of Commerce, and the Department of Agriculture, the Department will increasingly address national needs of high priority.

Educational Program

The State Board of Trustees awarded the Department of Polymer Science "Commendation" status as a result of a statewide, five-year program review. This status, given to only a handful of the hundreds of degree programs in the state, reflects national as well as international recognition.

The Department of Polymer Science along with the Southern Society for Coatings Technology (SSCT) serve the coatings industry through presentation of the Annual Water-Borne and Higher-Solids Coatings Symposium held every year at Mardi Gras, in New Orleans, LA. Recently, activities have expanded to include four short course offerings: Polymer Degradation and Stabilization, Fundamental Concepts of Polymer Science, Modern Coatings Technology, and Water-Soluble Polymers.

Polymer Science Program

Career training in polymer science at USM teaches the physical and chemical behavior of polymers, their synthesis and modification, how to make a complete property-profile determination, and the fundamentals of polymer processing. The program of studies includes the science and technology of paints and protective coatings.

Students learn the key properties, applications, and economics of commercial plastics, additives, and manufacturing processes. Graduate and undergraduate students presently number 45 and 85, respectively.

A typical curriculum for undergraduates in the Polymer Science program at USM includes course work in General Chemistry, Polymers in Industry, Organic Chemistry, Organic Polymer Chemistry, Polymer Physical Chemistry, Polymer Rheology, Polymer Surface Coatings,

(continued on page 76)

INDUSTRIAL ADVISORY COMMITTEE (IAC) MEETING—University of Southern Mississippi (USM) Polymer Science senior Darren Lowe (r), explains the effect of silica fillers on polyurethane polymers to Federation President-Elect James E. Geiger. Mr. Geiger attended the April 7-8 meeting of the IAC on the USM campus. The purpose of the meeting, held every 18 months, is to update IAC members of the progress of the Polymer Science Department, and to receive feedback from the IAC members who support its academic and research programs

Polymer Research, Polymer Processing, and Polymer Kinetics.

The graduate program is designed to accommodate students with baccalaureate degrees in Chemistry, Physics, Biology, and Engineering, as well as B.S. Polymer Science graduates. Interdisciplinary research is emphasized, giving students an in-depth experience in solving scientific problems.

Masters and doctoral research work focuses on Polymer Synthesis/Modification, Plastics Flammability, Polymer Analysis/Characterization, Polymer Rheology, Polymer Morphology, Polymer Composites, Polymer Reagents/Catalysts, and Polymer Physics, with many projects involving coatings applications.

Scholarship Information

Scholarships are awarded annually to undergraduate students majoring in Polymer Science at USM. Scholarship awards are based on student academic performance. Performance is measured by overall grade point average and class standing. The majority of undergraduate scholarship monies are derived from the Annual Water-Borne and Higher-Solids Coatings Symposium, sponsored by the Department and the SSCT. Additional support comes from the SSCT, the Federation of Societies for Coatings Technology, and directly from industry. Forty-five scholarships are awarded annually.

All graduate students accepted into the USM Polymer Science program will have their regular or out-of-state tuition fully waived, receive a $10,000 stipend, and in special cases, receive an allowance for relocation expenses. Stipends derive from research grants. In addition, graduate teaching assistantships are also available for first year students and selected advanced students.

Faculty

Faculty members have diverse expertise including extensive industrial experience. They maintain high levels of interaction with professional organizations (e.g., Federation of Societies for Coatings Technology, American Chemical Society, Society of Plastics Engineers) and industry. Each staff member sustains at least one industrial contract as an important part of outside research efforts.

The distinguished list of USM permanent faculty members in the Department of Polymer Science includes: Chairman Gordon L. Nelson (Professor, Ph.D., Yale University, 1970); Dennis V. Canfield (Assistant Professor, M.S., John Jay College of Criminal Justice, 1976); Anselm C. Griffin (Professor, Ph.D., University of Texas, 1975); Roger D. Hester (Professor, Ph.D., Georgia Institute of Technology, 1974); Charles E. Hoyle (Associate Professor, Ph.D., Northwestern University, 1976); Charles L. McCormick (Professor, Ph.D., University of Florida, 1973); Lon J. Mathias (Associate Professor, Ph.D., University of Michigan, 1976); Kenneth A. Mauritz (Associate Professor, Ph.D., Case Western Reserve University, 1975); Kevin McLaughlin (Assistant Professor, Ph.D., Texas A&M, 1985); Roger S. Porter (Professor, Ph.D., University of Washington, 1956); Raymond B. Seymour (Professor, Ph.D., University of Iowa, 1937); Robson F. Storey (Assistant Professor, Ph.D., University of Akron, 1983); and Shelby F. Thames (Distinguished University Research Professor, Ph.D., University of Tennessee, 1964).

The Polymer Science Department at the University of Southern Mississippi is making great strides as a leader in training students for the coatings industry. Undergraduate students have an ACT average of 28, placing them in the upper five percent of college students in the U.S. Students receive in-depth training in the basic sciences and mathematics, and do so in the concept of polymers in general, and coatings in particular.

Book Review

APPLICATIONS OF POLYMERS

Edited by
Raymond B. Seymour and
Herman F. Mark

Published by
Plenum Publishing Corp.
233 Spring Street
New York, NY 10013
vii & 156 pages (1988) $49.50

Reviewed by
Thomas J. Miranda
Whirlpool Corporation
Benton Harbor, MI

This book is a compilation of a series of papers which were presented at the American Chemical Society Symposium honoring Dr. O. A. Battista. In addition to the papers presented, a number of additional papers were added which were not part of the original presentations.

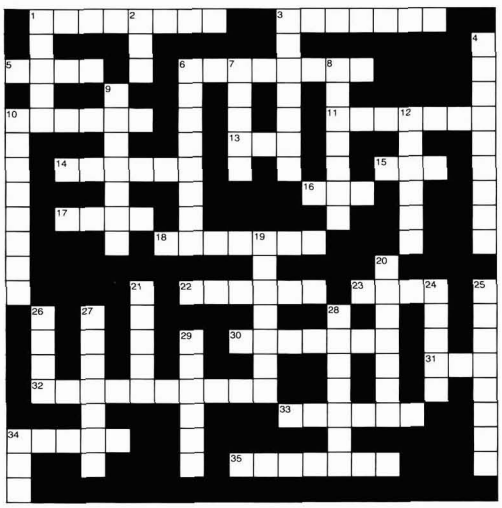
This book describes some of the numerous applications of polymers in membranes, foams, medicinals, conductors, insulators, fibers, films, packaging, and applications requiring high modulus at elevated temperatures.

Unfortunately, some of the chapters are non chapters, in that only a single page abstract is presented. The more developed chapters cover the topics in good detail and do satisfy the thrust of the book.

This book provides more insight in polymer applications.

CrossLinks

by Earl Hill



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Solution to be Published in July issue

ACROSS

1. Minute part of a substance
3. Planographic printing process
5. Minute hole or bubble
6. Synthetic elastomer, chemically resistant
10. Indirect type of printing process
11. Type of phenolic resin
13. Fluidity measurement unit (c.g.s.)
14. Irregular surface effect; blotch (syn.)
15. To place over; to cover partially
16. Top of the can
17. Absence of gloss
18. Molecular diffusion process
22. A cylinder (syn.)
23. Singular part of a cycle
30. Container
31. Material used in printing
32. "Turps"
33. Extender pigment, usually inert
34. Oxidation product of drying oils, O_____
35. Diluent; viscosity reducer

DOWN

1. A measure of alcoholic strength
2. Charged subatomic particle (Chem.)
3. Geometrically patterned wood floor
4. Natural mineral wax, O_____
6. This pigment produces pearlescent finishes
7. Colored, iron oxide pigment
8. Anti-slip finish (syn.)
9. Achromatic
10. Not too many mers (Polymer Chem.)
12. Opposite of transparent
19. The edge of wallpaper
20. An artist's working surface
21. Anti-skinning agent
24. One of matter's three phases
25. A type of hardness measurement, R_____
26. A glove-like device used by painters
27. Epoxide (Org. Chem.)
28. Bright metal foil used in specialty finishes
29. Outcome of creative research (hopefully)
34. Natural source for pigments

Literature

Spray Painting Video

Literature introduces a videotape that shows a new system designed to automate spray painting. Major features of the system include a hard disk memory; on-line editing; two station, 180 part positioner with rotating fixture tables; programming and operation training; and a three day start up by factory personnel. For more information and a copy of the five minute VHS videocassette featuring the PartPainter Automation Cell, write The Wizard Group, Division of Thermwood Corp., P.O. Box 436, Dale, IN 47523.

Waterproofing Products

A product bulletin introduces a complete line of waterproofing products that meet all current EPA and California Air Resource Board standards. These water-based products, classified as systems, are designed to withstand harsh environmental conditions as well as structural stress. Additional details, on UI-7012, -7083, -7085, -7086, and -7088 can be obtained from Urethane Plastics, Inc., 550 W. Crowther Ave., Placentia, CA 92670.

High-Solids Resins

Four high-solids resins formulated to improve the properties of industrial baking enamels are introduced in recently released literature. The resins are designed to improve adhesion, resistance, and stability. For more data on Cargill 57-5890, 57-1250, 21-2101, and 57-4550, contact Richard Johnson, Specialty Service Products Manager, Cargill, Inc., P.O. Box 5630, Minneapolis, MN 55440.

Specialty Surfactants

A 20-page booklet on a family of specialty silicone surfactants has been issued. The products are polyalkylene oxide-modified methylpolysiloxanes designed to find use in a wide range of applications. The booklet discusses features and benefits and contains a comprehensive table of performance benefits. Other tables list typical physical properties, as well as structural information and performance data. Copies of the booklet on "Silwet Surfactants," designated SC-822, are available from Union Carbide Corp., Specialty Chemical Div., Dept. L-3494, 39 Old Ridgebury Rd., Danbury, CT 06817-0001.

Powder Topcoat

A recently released product bulletin introduces a powder topcoat finish that reportedly provides a smooth, nonporous surface. Applications of this coating, designed to provide corrosion resistance, a low coefficient of friction and nonstick characteristics, include use on chemical equipment, liquid transfer pipes, and valve components. Additional information may be obtained by writing the Du Pont Company, Fabricated Products Dept., "Teflon" Finishes, Wilmington, DE 19898.

Paint Formula Management

A two-page technical data sheet which describes a computer program package for paint and coatings formula management has been released. The literature details the product's capabilities for applications including formula retrieval, ingredient search, batch ticket queuing, and inventory tracking. Additional information may be obtained by contacting Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543.

Automotive Industry Technology

A bulletin which describes a company's range of products and technology for the automotive industry has been released. The bulletin provides information on resins and technology for fast-cure sheet molding compounds, used to produce composite body panels, and structural reaction injection molding resins and technology, used to produce structural parts. To obtain copies, request Bulletin No. 1722 of Ashland Chemical Co., P.O. Box 2219, Columbus, OH 43216.

NPCA Consumer Brochures

The National Paint and Coatings Association is offering a 15% discount during the month of June on its "paint pointer" consumer brochure series and display racks. The six do-it-yourself brochures contain illustrations and step-by-step information on decorating with paint. Designed as a countertop display, the racks are made of 22-gauge steel and are emblazoned with the "Picture-It-Painted" logo. Interested individuals should contact Katrina Norfleet, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005.

Solvent

A new brochure describes a solvent which is designed for high solvency and low evaporation rate. Included are typical properties and a table comparing the product's performance with those of three other solvents. For additional information, request Publication No. 176E from Joanne Vance, Coatings Chemicals, Eastman Chemical Products Inc., P.O. Box 431, Kingsport, TN 37662.

High-Performance Solvent

A solvent intended for manufacturers of pigment flushes, vehicles, and inks for the lithographic market is the subject of recently published literature. For more information about EXX-PRINT 588 D or other EXX-PRINT solvents and oils for inks, varnishes, and flushes, contact Exxon Ink Specialists at P.O. Box 60800, Houston, TX 77205.

Product Catalog

A catalog has been published which details the full physical properties of a firm's line of epoxy resins, reactive diluents, and curing agents. The catalog lists over 80 products, including multifunctional novolac resins, reactive diluents, and curing agents for low VOC coatings. For copies, contact Trimont Chemicals, Inc., 1224 Mendon Rd., Cumberland, RI 02864.

Epoxy Resin

A 100% solids epoxy resin that is designed to improve flexibility and adhesion properties of alkyd and epoxy coatings is the subject of a new technical bulletin. Formulations of this low reduced viscosity resin are used in chip-resistant automotive coatings, as adhesives for plastic or aluminum, and potting and electrical encapsulation compounds. For more details, contact Reichhold Chemicals, Inc., Chemicals Coatings Div., P.O. Box 1433, Pensacola, FL 32596.

Filtration Equipment

An eight-page brochure provides information on a company's line of filtration equipment, services, and distribution network. For further information on "Filterite Solutions to Filtrations Problems," contact Filterite, 2033 Greenspring Dr., Timonium, MD 21093.

ASTM Fire Test Standards

The second edition of "ASTM Fire Test Standards" is now available for purchase. Included are 77 current ASTM standards for the fire testing of materials, products, and assemblies. The primary audience is fire researchers and fire prevention engineers, building code authorities, and professionals working in test laboratories. Published in January 1988, the book is priced at $49 for nonmembers and $39.20 for members. To order, contact ASTM, 1916 Race St., Philadelphia, PA 19103-1187.

Colorant Merchandising System

A new color merchandising and paint tinting system that offers nearly 1,000 colors in a point-of-sale merchandising program is introduced in a technical brochure. For copies or information on Gallery One™, contact Sheldon T. McMahon, Harshaw/Filtrol Partnership, 30100 Chagrin Blvd., Cleveland, OH 44124.

Infrared Module

A new infrared emitter module is the subject of a technical data sheet. These modules are designed as part of an infrared system which is used in printing, textile processing, building materials manufacture, and glass preparation and in the automotive industry for painting, coating, finishing, and electronics application. For more information, contact Jim Ford, Heraeus Amersil Inc., 650 Jernee Mill Rd., Sayreville, NJ 08872.

Wavelength Monitor

Information has been released on a new fixed wavelength monitor and a chart recorder to complement a company's liquid chromatography product line. Details on HBI UV-106A Fixed Wavelength Monitor and on the HBI mV/Volt Chart Recorder can be obtained by writing to Haake Buchler Instruments, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001.

Brown Pigment

Technical information is available which details a brown pigment intended for use in automotive OEM and refinish coatings, high performance industrial coatings, and plastic applications. To obtain copies, contact Hoechst Celanese Pigments Dept., 500 Washington St., Coventry, RI 02816.

Oligomer Series

Information has been released which details a new urethane diol oligomer series. The resin, which is TSCA listed, can be used as a primary resin or resin modifier in amino or isocyanate crosslinked systems. It is offered in three standard commercial versions, 85% in methoxypropyl acetate, 90% in water, or solventless. For complete details, write to Richard J. Shain, Sales Development Manager, King Industries, Science Rd., Norwalk, CT 06852.

Co-Tackifier Resin

A new adhesive resin co-tackifier with a low softening point and low volatile content has been introduced in literature. The resin is designed for use with other tackifiers, such as aromatic modified polyterpenes, and other hydrocarbon and rosin ester tackifiers. More information may be obtained by contacting John F. Kwiatek, Marketing Manager, Newport Division, Reichhold Chemicals Inc., P.O. Box 1433, Pensacola, FL 32596.

Saturated Polyester Resin

Technical information features a general industrial grade resin which is supplied in a 100% solids form and contains crosslinkable hydroxyl groups. The resin is designed for industrial applications, including baking enamels and two component urethane finishes. For more information on Lexorex C-908-100, contact Inolex Chemical Co., Jackson & Swanson Sts., Philadelphia, PA 19148-3497.

Water-Borne Emulsions

Literature has been released which describes two new water-borne emulsion resins. Arolon® 860-W-45 is an acrylic copolymer emulsion designed for primer and topcoat use on numerous metals and engineering grade plastics. Arolon® D845-W-45 is a thermoplastic styrene acrylic emulsion resin designed for use in air or force dry applications over metal substrates. For a data sheet on either product, write NL Chemicals, Inc., P.O. Box 700, Hightstown, NJ 08520.

Mixers

A revised 28-page catalog highlights the features and benefits of portable, fixed mount, and stationary mixers. Diagrams, photographs, and charts provide additional details. For more information, contact Betty Felix at Mixing Equipment Co., 135 Mt. Read Blvd., Rochester, NY 14603.

Translucent Topcoat

A new high performance translucent topcoat for exterior wood is the focus of a newly published technical bulletin. Formulated to retard the destructive effects on wood by ultraviolet radiation, the product reportedly provides higher film build. For more information on Cetol® Filter 7, write: Akzo Coatings, 1696 Maxwell St., Troy, MI 48084.

PIP Video

A videotape of the 1987 Allen W. Clark show, highlighting last season's "Picture-It-Painted" community service activities is now available from the National Paint & Coatings Association. The presentation features nearly 40 projects ranging from citywide graffiti-removal projects to the restoration of national historic landmarks. NPCA offers the videotape, on loan or for purchase, for individual use, as well as for presentation at local gatherings and other community-related meetings. Interested individuals should contact Katrina Norfleet, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005.

Diaphragm Pumps

A full-color brochure which features performance curves and product specifications on a new series of diaphragm pumps is now available. The pumps are intended for both permanent and portable use and are safe in explosive environments. For more details, contact Roper Pump Company, P.O. Box 269, Commerce, CA 90091.

Wettable Powder

A 10-page brochure highlights properties and applications of a wettable powder formulated for mixing with water. The material's physical and microbiological properties, suggested applications, and performance comparisons are provided. Additional details may be obtained by contacting Francois Casati, Abbott Laboratories, North Chicago, IL 60064.

Programmable Viscometer

A new programmable viscometer is introduced in a product bulletin. Information on this rotational, continuously-sensing instrument is available by contacting Brookfield Engineering Laboratories, Inc., Dept. NR-58, 240 Cushing St., Stoughton, MA 02072.

Round Gallon Container

Information has been released which describes a round gallon container which is blow molded of high-density polyethylene. The barrier is intended to reduce permeation for many hydrocarbon-based solvents, including pesticides, polishes, cleaning compounds, paint-related materials, oils, fuels, inks, and automotive fluids. For more details, contact Air Products and Chemicals, Inc., Allentown, PA 18195.

Glass Colors

New enamels designed for the decoration of dinnerware, vitroceramic, boro-silicate, and opal glass are detailed in a technical data sheet. These enamels can be supplied as powder, oil paste, and thermoplastic paste. Methods of use include direct and indirect screen printing as well as spraying. For more information, contact Degussa Corp., Ceramic Colors and Specialty Products, 104 New Era Dr., South Plainfield, NJ 07080.

Solvent Safety

Information on the proper and safe handling of chlorinated solvents has been translated into Spanish and is now available. An illustrated, 80-page booklet and a four-color wall poster provide safety recommendations in Spanish for using perchloroethylene, trichloroethylene, 1,1,1,-trichloroethane, and methylene chloride. Originally published in English for OSHA and NIOSH, "Como llevarse bien con los solventes" ("How to Get Along with Your Solvent") can be obtained from Dow Chemical Co., Chemicals and Metals Dept., 2020 Willard H. Dow Center, Midland MI 48674.

Diatomite Filteraids

How liquids too difficult to filter by other commercial filtrations processes can be handled by a line of diatomaceous earth filteraids is described in a six-page brochure. For a copy of "Kenite Diatomite," contact: Witco Corp., Inorganic Specialties Div., 520 Madison Ave., New York, NY 10022.

Water-Soluble Polymers

Literature describes the chemistry of and applications for a line of water-soluble polymers. Solution and film properties are also detailed. Additional information will be provided by The Aqualon Company, Little Falls Centre One, 2711 Centerville Rd., Wilmington, DE 19850-5417.

Curing Agents

A water-borne hardener for use with liquid epoxy resins is the subject of technical literature. The product reportedly can be combined directly with liquid epoxies without first having them emulsified and is free of organic solvents and neutralizing acids. Full details can be provided by CIBA-GEIGY Corp., Plastics and Additives Div., Hawthorne, NY.

Thermosetting Latex

A 12-page booklet on a thermosetting latex designed for building product finishes requiring long-term exterior durability has been issued. Typical uses noted in the booklet include medium-to-low-gloss coil coatings for residential and industrial metal siding, as well as primers and topcoats for hardboard siding. Copies of the booklet, "UCAR Vehicle 462 for Thermoset Exterior Coatings," designated F-60614A, are available from Union Carbide Corp., UCAR Emulsion Systems, Dept. L-4488, 30 Old Ridgebury Rd., Danbury, CT 06817-0001.

Coming Events

For information on FSCT meetings, contact FSCT, 1315 Walnut St., Philadelphia, PA 19107 (215-545-1506).

(June)—Federation Seminars on "Project Management for the Coatings Chemist." June 6-7, Holiday Inn-International Airport, S. San Francisco, CA; June 13-14, Orlando Marriott, Orlando, FL; and June 20-21, Days Inn, Airport, Philadelphia, PA.

(Oct. 19-21)—66th Annual Meeting and 53rd Paint Industries' Show. McCormick Place, Chicago, IL.

(May 16-19)—Federation "Spring Week." Seminar on the 16th and 17th; FSCT Incoming Society Officers Meeting on the 18th; FSCT Board of Directors Meeting on the 19th. Los Angeles Airport Marriott, Los Angeles, CA.

(Nov. 8-10)—67th Annual Meeting and 54th Paint Industries' Show. Rivergate, New Orleans, LA.

(Oct. 19-21)—68th Annual Meeting and 55th Paint Industries' Show. Convention Center, Washington, D.C.

(June 9-11)—Rocky Mountain Society. Paint and Coatings Symposium. Vail, CO. (Dick Mullen, G-3 Industries, 17554 E. Belleview Place, Aurora, CO 80015).

(June 10-12)—Joint meeting of St. Louis and Kansas City Societies. Holiday Inn, Lake of the Ozarks, MO.

(June 13)—Golden Gate Society Conference '88. "In Step with the Times—Are You?" Holiday Inn, S. San Francisco, CA. (Ernest "Bud" Harmon, Borden Chemical Co., 41100 Boyce Rd., Fremont, CA 94538).

(Mar. 14-16)—Western Coatings Societies' 19th Biennial Symposium and Show. Disneyland Hotel and Convention Center, Anaheim, CA. (Andrew R. Ellis, NL Chemicals, 231 E. Imperial Highway, Suite 221, Fullerton, CA 92635).

(Apr. 5-7)—Southern Society. Annual Meeting. Hyatt Regency Westshore, Tampa, FL.

(June 13-14)—"The Fundamentals of Color" Seminar sponsored by Macbeth, a division of Kollmorgen Corp. Rexdale, Ontario, Can. (Jeanne Dolan or Karen Degnan, Macbeth, Little Britain Rd., P.O. Box 230, Newburgh, NY 12550-0382).

(June 13-15)—5th Annual International Bridge Conference and Exhibition. Sponsored by Engineers' Society of Western Pennsylvania. Pittsburgh Hilton Hotel, Pittsburgh, PA. (Engineers' Society of Western Pennsylvania, Pittsburgh Engineers' Building, 337 Fourth Ave., Pittsburgh, PA 15222).

(June 13-16)—"Colorimetry: An Intensive Short Course for Scientists and Engineers" sponsored by the Munsell Color Science Laboratory, Rochester Institute of Technology, Rochester, NY. (Munsell Color Science Laboratory, RIT, One Lomb Memorial Dr., P.O. Box 9887, Rochester, NY 14623-0887).

(June 13-17)—International Conference on Composite Interfaces II. Case Western Reserve University, Cleveland, OH. (Professor H. Ishida, General Chairman, ICCI-II, Dept. of Macromolecular Science, Case Western Reserve University, 10900 Euclid Ave., Cleveland, OH 44106-1727).

(June 13-17)—"Applied Rheology for Industrial Chemists." Course sponsored by Kent State University, Kent, OH. (Carl J. Knauss, Chemistry Dept., Kent State Univ., Kent, OH 44242).

(June 13-25)—"Coatings Science" Short Course sponsored by North Dakota State University, Fargo, ND. (Frank Jones, NDSU, Fargo, ND 58105).

(June 14-16)—"Strategy of Experimentation" Seminar sponsored by Du Pont Co. Wilmington, DE. (Du Pont Quality Manage-

ment Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(June 15-16)—Surfex '88. Oil and Colour Chemists' Association. Harrogate International Conference Center, Yorkshire, England. (R.H. Hamblin, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF England).

(June 19-22)—62nd Colloid and Surface Science Symposium. Pennsylvania State University, State College, PA. (R. Nagarajan, 161 Fenske Laboratory, University Park, PA 16802).

(June 19-24)—81st Annual Meeting and Exhibition of The Association Dedicated to Air Pollution Control and Hazardous Waste Management. Dallas Convention Center, Dallas, TX. (Meetings Dept., APCA, P.O. Box 2861, Pittsburgh, PA 15230).

(June 21-23)—"Strategy of Formulation Development" Seminar sponsored by Du Pont Co. Chicago, IL. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(June 23-24)—"Ceramic Matrix Composites" Seminar sponsored by the University of Wisconsin-Milwaukee, Milwaukee, WI. (Richard G. Albers, Program Director, Center for Continuing Engineering Education, UW-Milwaukee, 929 N. Sixth St., Milwaukee, WI 53203) .

(June 26-29)—ASTM Committee D-1. Omni International Hotel, Baltimore, MD. (David Bradley, ASTM, 1916 Race St., Philadelphia, PA 19103).

(June 27-30)—SUR/FIN '88 Exhibition and Conference sponsored by the American Electroplaters and Surface Finishers Society. Los Angeles Convention Center, Los Angeles, CA. (AESF, Central Florida Research Park, 12644 Research Parkway, Orlando, FL 32826).

(June 28-Nov. 30)—"Color" Seminars sponsored by Applied Color Systems, Inc. June 28-29—Cleveland, OH; July 27-28—Kansas City, MO; Aug. 30-31—Hunt Valley, MD; Oct. 12-14—New Orleans, LA; and Nov. 29-30—Greenville, SC. (ACS, Inc., P.O. Box 5800, Princeton, NJ 08543).

(June 30-Aug. 31)—"How to Comply with Hazardous Waste Management Regulations" seminar sponsored by Environmental Resource Center. June 30—Seattle, WA; July 11—Rochester, NY; July 13—Syracuse, NY; July 14—Albany, NY; Aug. 8—Springfield, IL; Aug. 10—Milwaukee, WI; Aug. 12—Madison, WI; Aug. 29—Boston, MA; and Aug. 31—Indianapolis, IN. (Maryel Tomter, Environmental Resource Center, 608 Southview Circle, Fayetteville, NC 28301).

(July 1-Sept. 1)—"How to Comply with Current Title III and OSHA Right-to-Know Regulations" seminar sponsored by Environmental Resource Center. July 1—Seattle, WA; July 12—Rochester, NY; July 13—Syracuse, NY; July 15—Albany, NY; Aug. 9—Springfield, IL; Aug. 11—Milwaukee, WI; and Aug. 12—Madison, WI; and Aug. 30—Boston, MA. (Maryel Tomter, Environmental Resource Center, 608 Southview Circle, Fayetteville, NC 28301).

(July 11-15)—14th International Conference on "Organic Coatings Science & Technology." Sponsored by the State University of New York. Athens, Greece. (Angelos V. Patsis, Director, Materials Research Laboratory, CSB 209, State University of New York, New Paltz, NY 12561).

(July 12-14)—"Strategy of Experimentation" Seminar sponsored by Du Pont Co. Chicago, IL. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(July 14-16)—30th Annual Convention of the Oil and Colour Chemists' Association Australia. The Surfers, Queensland. (D. Corless, SCM Chemicals Ltd., P.O. Box 465, Auburn, NSW 2144, Australia).

(Aug. 1-5)—"Coatings and Films" Conference sponsored by the Gordon Research Conferences. Proctor Academy, Andover, NH. (Alexander M. Cruickshank, Gordon Research Conferences, Gordon Research Center, University of Rhode Island, Kingston, RI 02881-0801. After June 13, Dr. Cruickshank can be contacted at: Colby-Sawyer College, New London, NH 03257).

(Aug. 2-4)—"Strategy of Formulations Development" Seminar sponsored by Du Pont Co. San Diego, CA. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Aug. 8-11)—Color in Environmental Design Symposium sponsored by the International Color Association (AIC). Winterthur Polytechnic, Dept. of Architecture, Winterthur, Switzerland. (Allan Rodrigues, E.I. Du Pont de Nemours & Co., 945 Stephenson Highway, P.O. Box 2802, Troy, MI 48007-2802).

(Aug. 15-17)—"Radiation Curable Coatings" Short Course sponsored by North Dakota State University, Fargo, ND. (Frank Jones, NDSU, Fargo, ND 58105).

(Aug. 16-18)—"Process Safety Management" Seminar sponsored by Du Pont Co., Wilmington, DE. (Du Pont Safety Services, Barley Mill Plaza, P19-1104, Wilmington, DE 19898).

(Aug. 22-26)—11th Annual Short Course "Advances in Emulsion Polymerization and Latex Technology." Schatzalp Berghotel, Davos, Switzerland. (Dr. Gary W. Poehlein, Graduate Office (Savant), Georgia Institute of Technology, Atlanta, GA 30332-0265).

(Sept. 5-7)—"Estimating for Painting Contractors and Maintenance Engineers." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, UMR, Rolla, MO 65401-0249).

(Sept. 12-16)—"57th Introductory Short Course—The Basic Composition of Coatings." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, UMR, Rolla, MO 65401-0249).

(Sept. 13-14)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Wyndham Hotel/Greenspoint, Houston, TX. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Sept. 13-15)—"Strategy of Experimentation" Seminar sponsored by Du Pont Co. Boston, MA. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Sept. 13-15)—Liquitec Expo '88. Philadelphia Civic Center, Philadelphia, PA. (Liquitec Expo, P.O. Box 630, West Paterson, NJ 07424).

(Sept. 18-24)—XIXth Congress of FATIPEC. Aachen, Germany. (C. Bourgery, FATIPEC Secretary General, 76 Blvd. Pereire, 75017 Paris, France).

(Sept. 19-22)—Verbundwerk '88 Science and Technology of Composite Materials. Wiesbaden, W. Germany. (Demat Exposition Managing, 6000 Frankfurt, AM Main, Postbox 110 611, W. Germany).

(Sept. 20-22)—Third Annual Hazardous Waste and Hazardous Materials Management Exhibition and Conference. Convention Center, Cleveland, OH. (Ursula Barril, Northwest Center for Professional Education, 13555 Bel-Red Rd., C-96870, Bellevue, WA 98009).

(Sept. 23)—"Quality Technology for Managers" Seminar sponsored by Du Pont Co. San Francisco, CA. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Sept. 25-30)—"Polymers in Information Storage Technology" Symposium sponsored by the American Chemical Society. Los Angeles, CA. (K.L. Mittal, IBM-Corporate Technical Inst., 500 Columbus Ave., Thornwood, NY 10594).

(Sept. 27-28)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Holiday Inn Crowne Plaza, Los Angeles, CA. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Oct. 1-4)—Canadian Paint and Coatings Association 1988 Convention. Hotel Newfoundland, St. John's, Newfoundland. (Harold Duffett, The Standard Manufacturing Co. Ltd., P.O. Box 6090, St. John's, Newfoundland, Canada).

(Oct. 3-7)—"17th Introductory—Paint Formulation." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, UMR, Rolla, MO 65401-0249).

(Oct. 4-6)—"Strategy of Experimentation" Seminar sponsored by Du Pont Co. Wilmington, DE. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Oct. 4-7)—12th World Congress on Metal Finishing, INTERFINISH 88. Palais des Congres, Paris, France. (SEPIC INTERFINISH, 17 rue d'Uzes, 75002 Paris, France).

(Oct. 5-7)—Fall Meeting of the National Coil Coaters Association. Westin Hotel, O'Hare Airport, Chicago, IL. (NCCA, 1900 Arch St., Philadelphia, PA 19103).

(Oct. 5-7)—Update '88 Canadian Region—Eastern Conference sponsored by the National Association of Corrosion Engineers.

Prince Hotel, Toronto, Ont., Canada. (A. Simcoe, Chairman, Valspar Inc., 645 Coronation Dr., West Hill, Ont., M1E 3R6).

(Oct. 9-12)—17th Annual Conference of the North American Thermal Analysis Society. Lake Buena Vista, FL. (Heidi K. Chen, Akzo Chemie America, 8401 W. 47th St., McCook, IL 60525).

(Oct. 10-13)—15th International Naval Stores Meeting. Intercontinental Ritz and Meridien Hotels, Lisbon, Portugal. (Manco L. Snapp, Jr., Arizona Chemical Co., Panama City, FL).

(Oct. 13-14)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Capri Hotel, Vancouver, B.C., Canada. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Oct. 17-19)—National Paint & Coatings Association Annual Meeting. Palmer House, Chicago, IL. (NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Oct. 18-20)—Fall National Plant Engineering and Maintenance Show and Conference. Georgia World Congress Center, Atlanta, GA. (Conference Director, National Plant Engineering and Maintenance Conference, 999 Summer St., P.O. Box 3833, Stamford, CT 06905).

(Oct. 25-26)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Sheraton Airport Hotel, Minneapolis, MN. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Oct. 25-27)—"Strategy of Formulations Development" Seminar sponsored by Du Pont Co. Wilmington, DE. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Oct. 26-28)—"Principles in the Stabilization and Controlled Degradation of Polymers," "Principles of High Performance Composites," and "Fundamentals of Adhesion: Theory, Practice and Applications" Short Courses sponsored by the State University of New York. Hotel Thayer, West Point, NY. (Angelos V. Patsis, Chairman, Dept. of Chemistry, DSB 209, State University of New York, New Paltz, NY 12561).

(Oct. 31-Nov. 4)—"Introduction to Polymer Chemistry." Course sponsored by the University of Missouri-Rolla, Rolla, MO. (Coatings and Polymer Science Program, Dept. of Chemistry, UMR, Rolla, MO 65401-0249).

(Nov. 1-2)—"Paint Volatile Organic Compounds (VOC)." Two-day Workshop sponsored by ASTM. Hyatt Cherry Hill, Cherry Hill, NJ. (Margaret Cassidy, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Nov. 4-6)—41st Annual Show and Convention of National Decorating Products Association. McCormick Place, Chicago, IL. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

(Nov. 7-9)—Paint Research Association. Eighth International Conference. Amsterdam, The Netherlands. (Mr. Dip Dasgupta, Head of Information Dept., Paint RA, Waldegrave Rd., Teddington, Middlesex TW11 8LD England).

(Nov. 7-11)—Seventh International Congress on Marine Corrosion and Fouling. Universidad Politécnica de Valencia, Valencia, Spain. [Cátedra de Construcción III, Departamento de Construcciones Arquitectónicas, Universidad Politécnica de Valencia, Camino de Vera, s/n, 46022 Valencia (Spain).]

(Nov. 8-9)—"Polymer Flow Using the Torque Rheometer" Seminar sponsored by Haake Buchler Instruments, Inc. Holiday Inn Metro Airport, Detroit, MI. (HBI, Inc., 244 Saddle River Rd., Saddle Brook, NJ 07662-6001).

(Nov. 8-10)—"Process Safety Management" Seminar sponsored by Du Pont Co., Wilmington, DE. (Du Pont Safety Services, Barley Mill Plaza, P19-1104, Wilmington, DE, 19898).

(Nov. 13-17)—Steel Structures Painting Council. National Conference and Exposition. Civic Center, Baltimore MD. (SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213).

(Nov. 15-17)—"Engineering for Electroplating" Seminar. Sponsored by Products Finishing magazine. Hotel Inter-Continental, Atlanta, GA. (Julianne Hall, Products Finishing, 6600 Clough Pike, Cincinnati, OH 45244-4090).

(Nov. 15-17)—"Strategy of Experimentation" Seminar sponsored by Du Pont Co. Houston, TX. (Du Pont Quality Management Services, Barley Mill Plaza, Bldg. P27-2110, Wilmington, DE 19898).

(Nov. 28-Dec. 3)—Materials Research Society Fall Meeting, Symposia, and Exhibition. Boston, MA (MRS, 9800 McKnight Rd., Ste. 327, Pittsburgh, PA 15237).

(Nov. 29-Dec. 1)—"Engineering for Electroplating" Seminar. Sponsored by Products Finishing magazine. Omni San Diego, San Diego, CA. (Julianne Hall, Products Finishing, 6600 Clough Pike, Cincinnati, OH 45244-4090).

(Dec. 3-9)—Chemtech China '88. China International Exhibition Centre, Beijing, China. (SHK International Services Ltd., 22/F., 151 Gloucester Rd., Hong Kong).

(Dec. 12-14)—Winter National Plant Engineering and Maintenance Show and Conference. Anaheim Convention Center, Anaheim, CA. (Conference Director, National Plant Engineering and Maintenance Conference, 999 Summer St., P.O. Box 3833, Stamford, CT 06905).

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(Feb. 1-5)—International Symposium on Industrial Metal Finishing. Karaikudi, India. (Central Electrochemical Research Institute, Karaikudi-623 006, Tamil Nadu, India).

(Mar. 13-17)—Color '89. Sixth Congress of the International Color Association (AIC). Centro Cultural San Martín, Buenos Aires, Argentina. (Color '89, Grupo Argentino del Color, c/o División Optica, Inti, C.C. 157, 1650 San Martín (BA), Argentina).

(Apr. 8-9)—Eastern Decorating Products Show sponsored by the National Decorating Products Association. World Trade Center, Boston, MA. (Lillian Smysor, NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

Advertisers Index

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'Humbug' from Hillman

Dr. Peter A. Lewis, as Marketing Manager of Sun Chemical, Pigments, has dreamed up the promotional idea of printing one (or more) liners on the back of business cards. The question is—does it help or discourage business? Here are some samples:

- VIRTUE—learned at mother's knee; VICE—learned at some other joint.
- If horseshoes are lucky, why is every losing horse wearing four of them?
- Six Phases of a Project:
  (1) Exultation and excitement
  (2) Disenchantment and disillusionment
  (3) Confusion
  (4) Search for the guilty
  (5) Punishment of the innocent
  (6) Recognition for uninvolved
- Let a smile be your umbrella and your face will rust.
- Please pay in advance!!!; if you're drinking to forget.
- A loser plays hide and seek and nobody looks.
- I know you believe you understand what you think I said, but I am not sure you realize that what you heard is what I meant.
- CHIVALRY—defending a woman from any man but you!
- SYNDROME—a king-sized house of ill repute.
- A censor knows when to cut it out.
- I am firmly against anything I can't do.

Warning: There are more for future issues.

Fearful thought for the day: What would happen if Peter and Bob Ahlf merged their talents(?)!!!???

H. Earl Hill, some months ago, quoted the following quotes as quoted by Rick Selvin in the Erie, PA, *Times*, as quoted from "Hammer and Tongues: The Best of Women's Wit and Humour" by Michele Brown and Ann O'Connor (St. Martin's Press):

Mrs. Alfred Kinsey: I don't see much of Alfred anymore since he got interested in sex.

Jane Mansfield: I got married and we had a baby nine months and ten seconds later.

Hermione Gingold: I've discovered what we in England call drafts, you in America call cross-ventilation.

Elizabeth Taylor on rumors she would be posing for Playboy: Oh, sure—and next month, I'm dressing up as a sea bass for the front cover of *Field and Stream*.

Joan Rivers: Princess Di wears more clothes in one day than Ghandi wore in his whole life.

Mrs. Woodrow Wilson: When Woodrow proposed to me, I was so surprised I nearly fell out of bed.

Barbra Streisand on the furor over casting Egyptian-born Omar Sharif in "Funny Girl" during the Six Day War: You think Cairo was upset—you should have seen the letter I got from my Aunt Rose.

Brooke Shields: What does "good in bed" mean? When I'm sick and stay home from school propped up with lots of pillows watching TV and my Mom brings me soup—that's good in bed.

After a year of mulling it over, Sid Lauren decided to remind us that Pat McCurdy, in his column "Viewpoint" in *Chemical Week* concluded that "there are really only two kinds of people in this world." Some of those "only two kinds" we list below:

There are people who tap gauges before trusting the reading, and there are those who don't.

There are people who open boxes on dotted lines and there are those who don't.

There are people who turn the headlights off before restarting the car and those who don't.

For computer users: There are people who leave the printer on the paper crease and those who don't.

There are people who clean up airliner sinks after using, even though not asked, and there are those who don't.

There are people who clean up airliner sinks after using, even though asked, and there are those who don't.

There are people who routinely check on puddles under their car, and there are those who don't.

There are people who turn off lights when they're not needed and there are those who don't.

There are people who pass on hills and at blind corners and there are those who don't.

There are people who always read instructions before proceeding, and there are those who don't.

There are people who write stuff like this and people who don't.

— Herb Hillman
Humbug's Nest
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