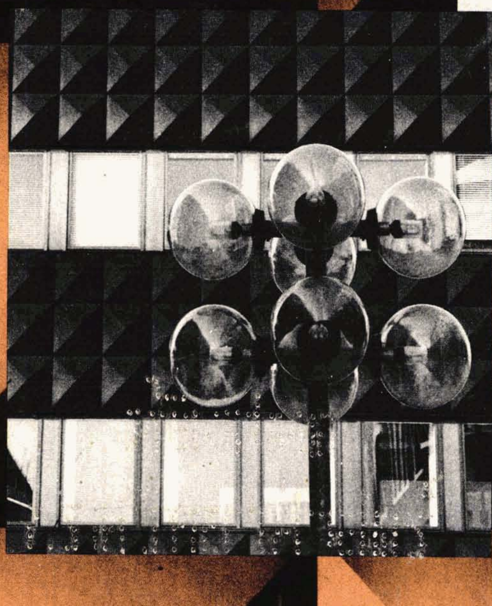
JOURNAL OF COATINGS TECHNOLOGY

JCTAX 61 (779) 1-78 (1989)

December 1989

Outdoor Durability of PVC-Plastisol



Frank Castjohn didn't believe a waterborne enamel could outperform a solvent coating.
Five years later, he's a believer.
As statewide Bridge Maintenance Supervisor for the Louisiana Department of Transportation, Frank Castjohn has tested many different kinds of coatings. But few have impressed him like those made with Maincote® HG-54 waterborne acrylic resin from Rohm and Haas Company.
"We first started testing waterbornes about ten years ago. When Maincote HG-54 resin came along, we decided to test it in a top coat and primer on a bridge along Interstate Highway 12 where it crosses I-55.
"Now, five years later, the adhesion is good, there's no evidence of peeling, flaking or corrosion, and the color retention is excellent. Based on what I see, the waterborne acrylic coating should last another 10-12 years with no problem. In fact, we've already applied it to three other bridges."
Along with delivering corrosion resistance and appearance equal to that of solvent-based paints, coatings containing Maincote HG-54 acrylic resin also meet many VOC limitations.
To learn more about Maincote HG-54, write to: Rohm and Haas Company, Marketing Services, Independence Mall West, Philadelphia, PA 19105.
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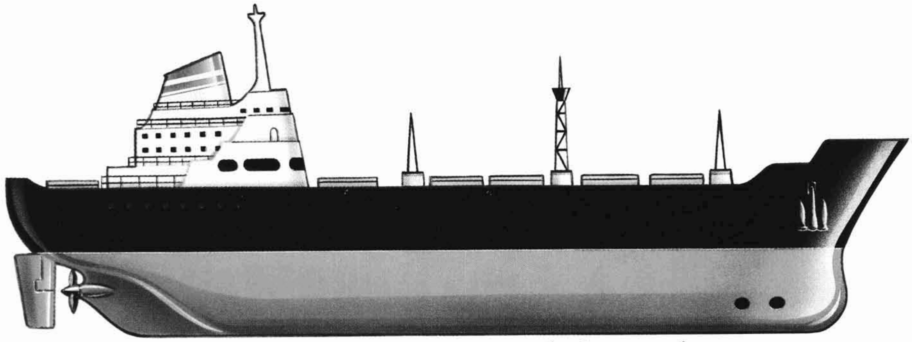
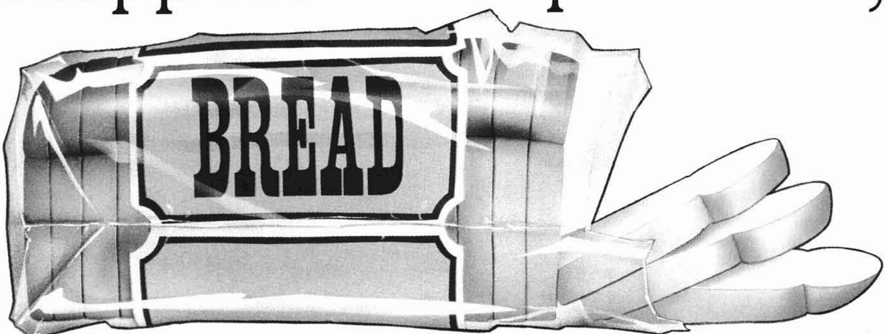
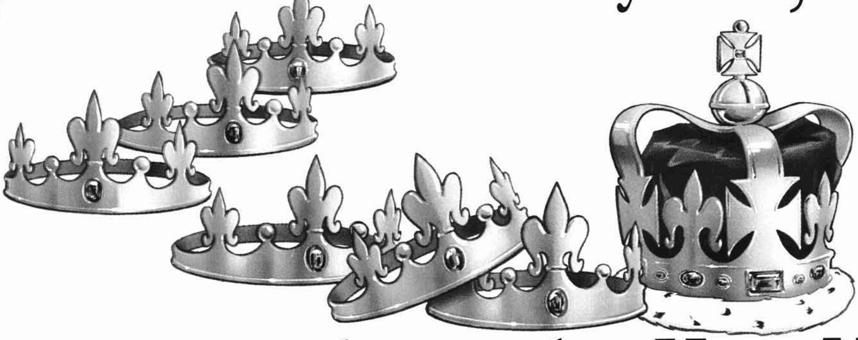


We help protect more ships than sonar,



print more films than Hollywood, and



form more attachments than Henry VIII.

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DECEMBER 1989

jct JOURNAL OF COATINGS TECHNOLOGY

VOLUME 61 NUMBER 779

Federation of Societies for Coatings Technology

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Technical Articles

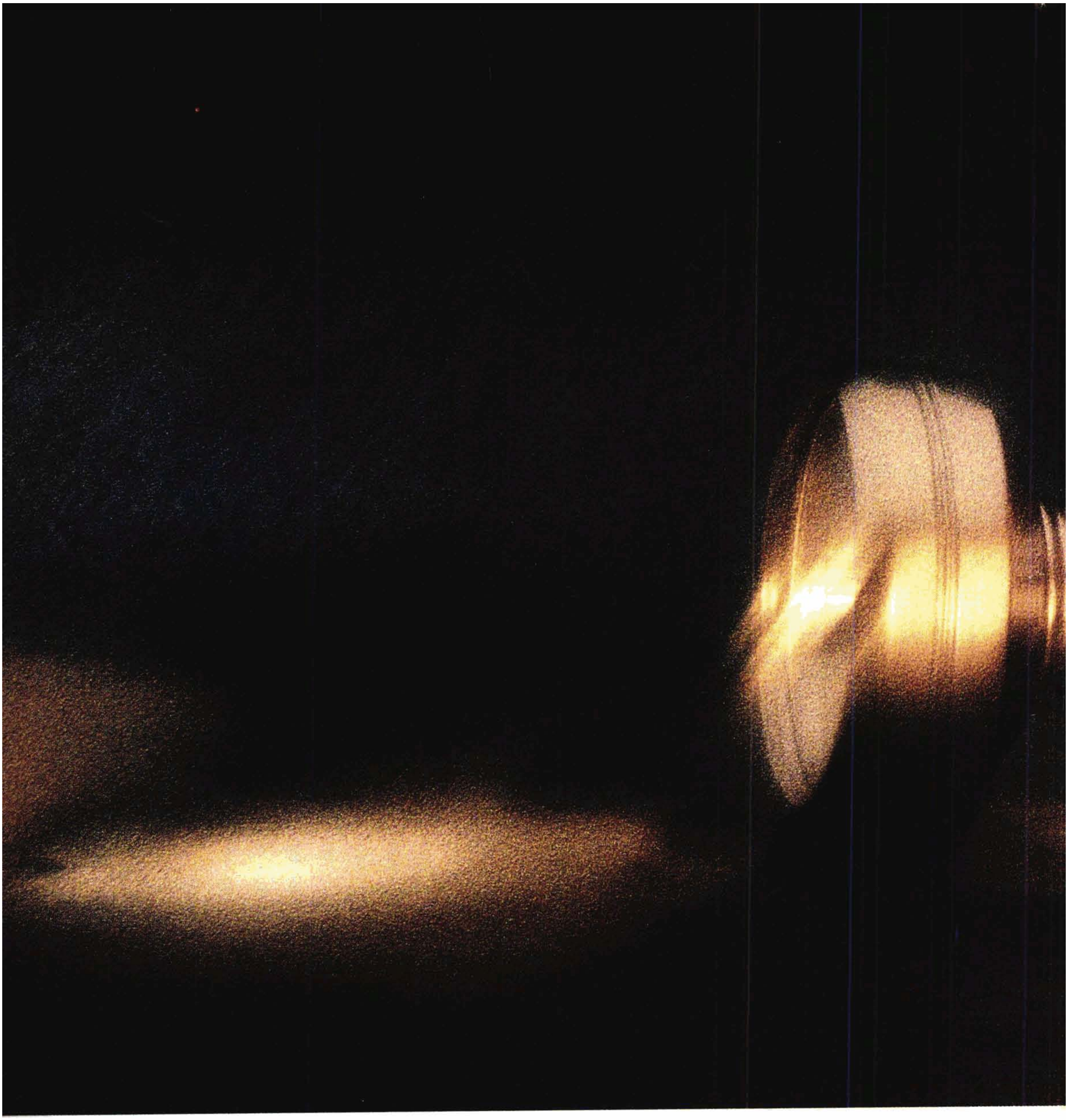
Federation News

Departments

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

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

Subscriptions: U.S. and Canada—1 year, $27; 2 years, $51; 3 years, $73. Europe (Air Mail)—1 year, $55; 2 years, $107; 3 years, $157. Other countries—1 year, $40; 2 years, $77; 3 years, $112.



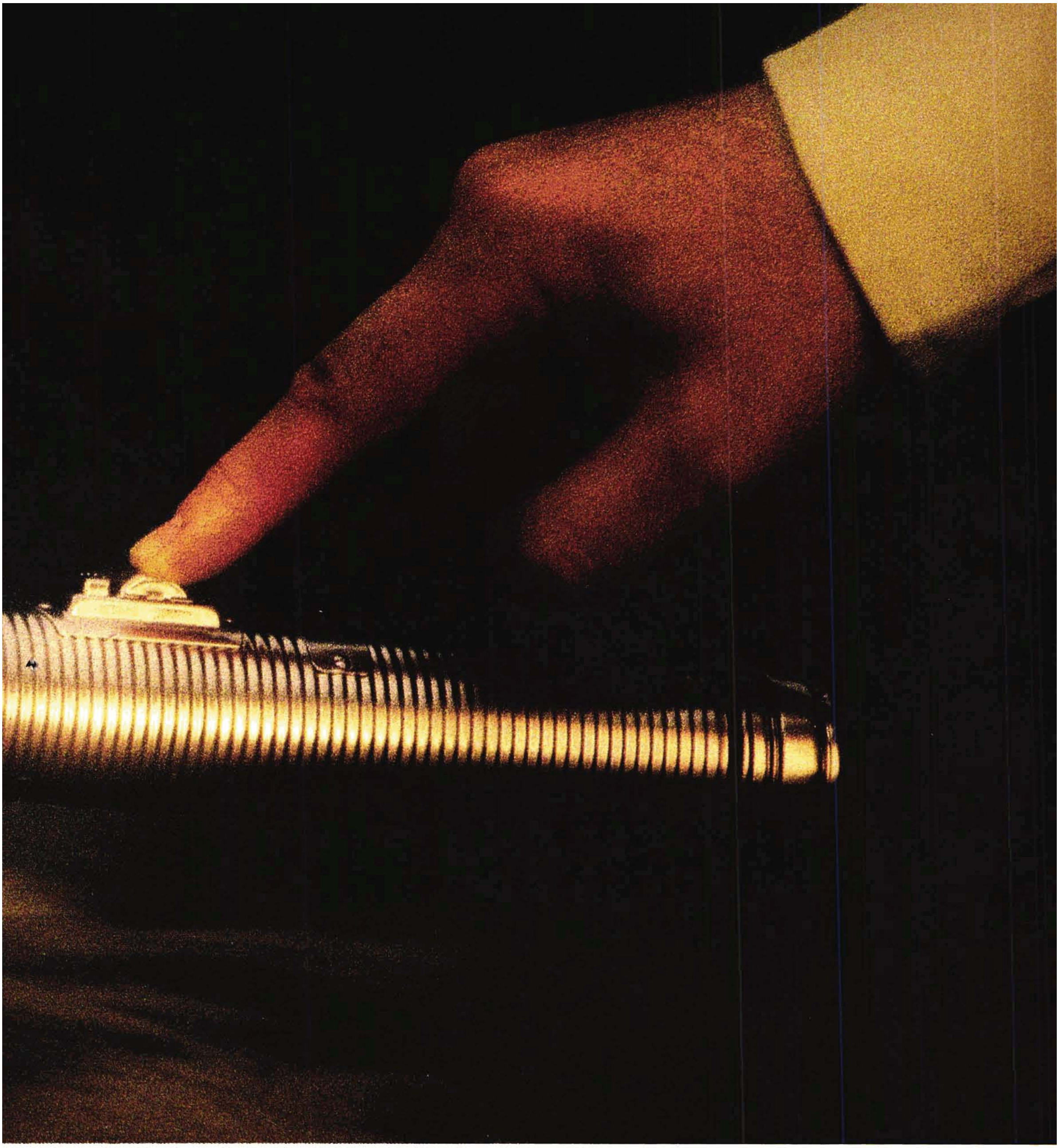
Here's how simple research and development can be.

What can you do when your product quality is threatened by federal regulations?

That's the issue makers of coatings for the auto industry face as government tightens rules for VOCs—Volatile Organic Components.

The dilemma: comply with new standards and sacrifice properties, or maintain properties and fall short of compliance.

There's really no easy way out; yet a phone call to Henry Heck, the Automotive Coatings Project Leader at Dow, resulted in a simple solution.



Henry assembled a Dow development team, gave them the run of the lab (more than a million dollars worth of equipment to work with) and told them to find an answer.

The result: A new hydroxy butyl acrylate monomer than helps coatings resins meet VOC requirements without sacrificing properties. (What's more, resins made from HBA resisted micro-cracking better. As Henry says, "Once you're into it, you might as well go all the way.")

Soon, coatings manufacturers will have a new tool to make topcoats that not only look good to buyers, but look good to regulators.

"Critical mass," says Henry. "That's what helps our customers. Dow is like a giant tool box. If a customer has a problem, or needs a new monomer, the solution's already there, or we can make it."

Productive research and development is just part of the story. If you would like to know more about the Dow tool box, and how it can give you a business advantage, call 1-800-258-CHEM (2436), Coatings.

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DOW

Dow Plastics

jct JOURNAL OF COATINGS TECHNOLOGY

1315 Walnut St., Phila., PA 19107

THE JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology at 1315 Walnut St., Philadelphia, PA 19107. Phone: (215) 545-1507. FAX: (215) 545-7703.

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

	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$27.00	$ 55.00	$ 40.00
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3 Years	$73.00	$157.00	$112.00

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

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

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

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

Comment

Congratulations to Cleveland

To say that much has changed since 1914 would be stating the obvious. Almost every aspect of American life has undergone severe alterations in the past 75 years. Communication, Science, Transportation, Fashion, Families, and Lifestyles are much different now than at the start of World War I. Just as agriculture gave way to the manufacturing industry before the turn of the century, so has manufacturing retreated before the growth of the service industries.

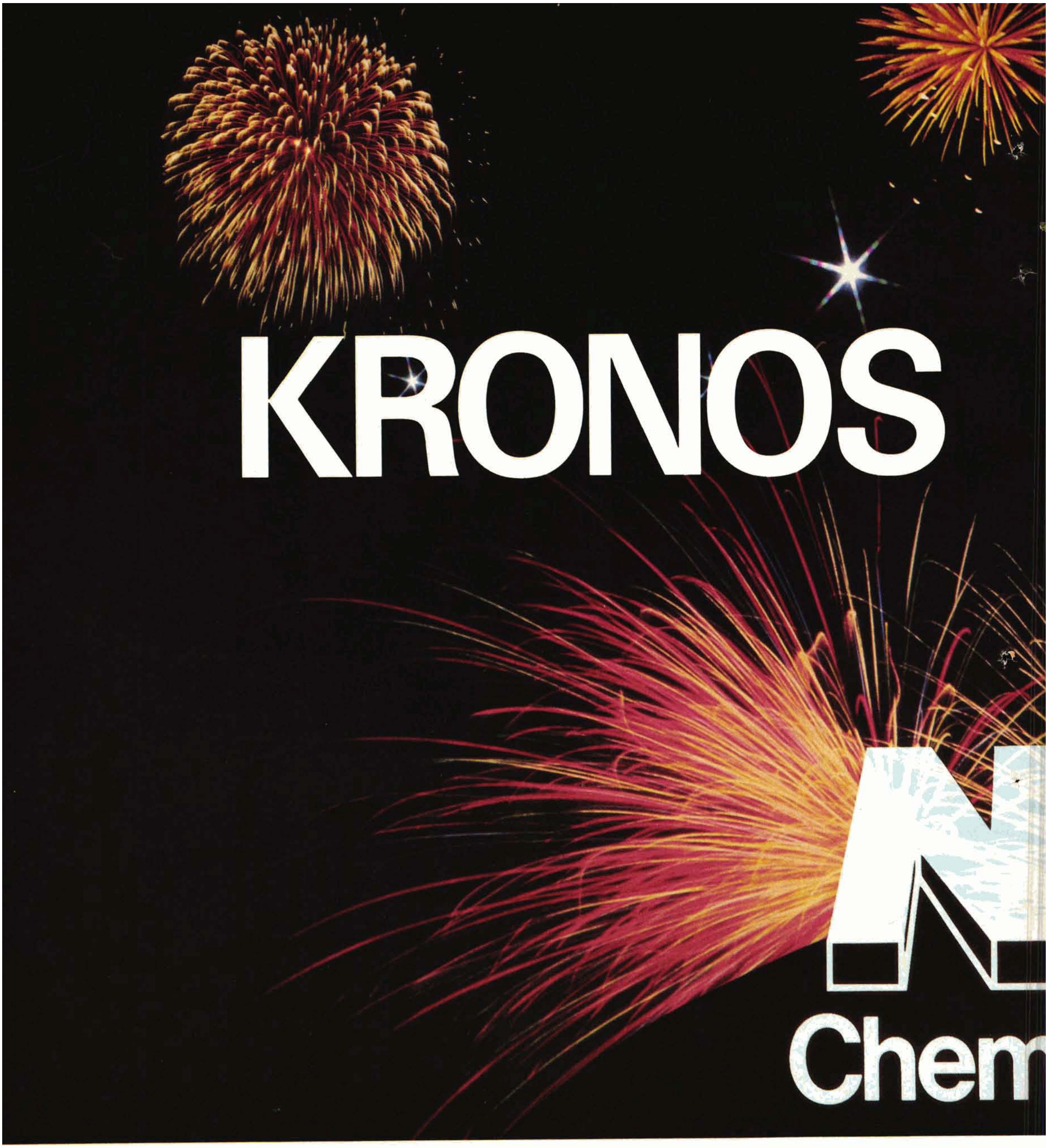
One industry that has not so much retreated as retrenched is the coatings industry. It is alive and well, and an important component of this vital industry, the Cleveland Society for Coatings Technology, celebrates its 75th Anniversary this month.

The number of challenges and changes which this industry has faced over the past 25 (not to mention 75) years has been enormous, and the response of the industry and its personnel has been equally impressive. Formation of the Cleveland Society in 1914 (and, later, the Federation, in 1922) was such a response.

Just as much has changed, much still remains the same. Over the years, the dedication, hard work, and efforts of the members of the Cleveland Society have been perpetuating factors in the success of the region's coatings industry and the Federation. Five members, including current members Eugene Ott and Michael Malaga, have served as Presidents of the Federation, and numerous individuals have worked as Chairmen of Federation Committees. It is our wish that the vision and drive that gave birth to the Society will continue to carry it forward into the next millennium.

We congratulate the Cleveland Society on its 75th Anniversary and for its many past accomplishments.

John C. Ballard
President, FSCT



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NL Chemicals, Inc. is creating fireworks by becoming two separate companies!

Our specialty chemicals business is now RHEOX, Inc., makers of BENTONE,® RHEOLATE™ and other high-performance rheological additives.

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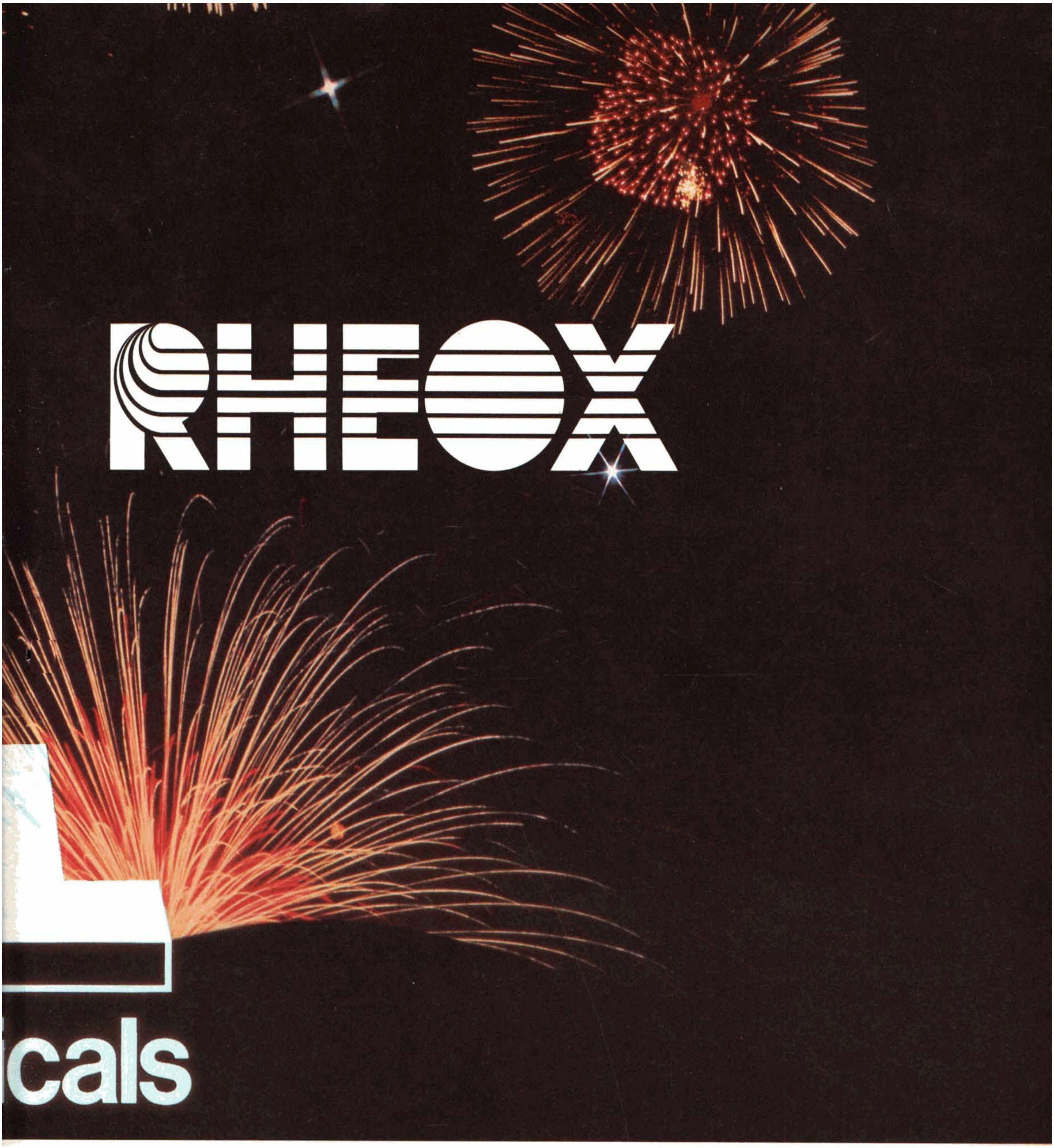
RHEOX
cals

Abstracts of Papers in This Issue

OUTDOOR DURABILITY OF PVC-PLASTISOLS—G. Inge Bäck and L.S. Kopp

Journal of Coatings Technology, 61, No. 779, 29 (Dec. 1989)

A method for predicting outdoor service life of PVC-plastisols on hot-dip galvanized steel for use on buildings has been investigated through 15 years of outdoor exposure and Weather-Ometer testing. Changes in gloss, color, and residual heat stability have been used as the criteria for the decomposition of the PVC-films. Plasticizer retention and dirt pick-up have also been studied. The life span of the tested PVC-plastisols exposed to the most severe climatic conditions is estimated at 15-20 years.

A MULTIPLE-SCATTERING MODEL FOR OPACIFYING PARTICLES IN POLYMER FILMS—B.R. Palmer et al.

Journal of Coatings Technology, 61, No. 779, 41 (Dec. 1989)

A multiple-scattering model is used to define the optimum size and geometry of opacifying particles in polymer films. Application of this theoretical model indicates that 0.22-micrometer diameter rutile spheres are more effective opacifiers than either hollow rutile spheres, rutile spheres encapsulated in air, rutile spheres coated with quartz, or quartz spheres coated with rutile. For a suspension of solid rutile spheres distributed in size, the optimum mode diameter shifts to smaller values the greater the coefficient of variation of the distribution. Moreover, for a given coefficient of variation, opacity decreases more rapidly with diameter for small particles than for particles larger than the optimum size.

These conclusions result from detailed calculations of the luminous reflectance of polymer films in which exact solutions for scattering by coated and uncoated spheres were used. Several parameters not accounted for in previous studies are included in the present model. These parameters are the anisotropy of rutile, the wavelength dependence of its principal refractive indices, the spectral variation of the incident light (tungsten and daylight), and the spectral response of the human eye.

EFFECT OF HYDROXYETHYLCELLULOSE MOLECULAR WEIGHT AND HYDROXYETHYL CONTENT ON GRAFTING REACTIONS OF VINYL MONOMERS DURING LATEX MANUFACTURE—D.H. Craig

Journal of Coatings Technology, 61, No. 779, 49 (Dec. 1989)

The synthesis of hydroxyethylcellulose (HEC)-stabilized vinyl acetate-acrylic and all-acrylic latexes via emulsion polymerization techniques and subsequent analysis of the latex aqueous phase via size exclusion chromatography has shown that both HEC hydroxyethyl content (HEMS) and HEC molecular weight have a net positive effect on monomer-HEC grafting reactions during latex manufacture. Excessive grafting reactions produced dilatancy (shear-thickening) and poor film clarity, apparent only for the all-acrylic system, which required the presence of water-soluble chain transfer agents for practical synthesis. It is concluded that variations in HEC molecular weight and HEMS can profoundly influence the physical properties of latexes prepared in the presence of HEC.

To Be Featured in

January '90 Issue

The January 1990 issue of the JCT will feature highlights of the 1989 Annual Meeting and Paint Show in New Orleans, November 8-10. This Wrap-up Issue will feature 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. The issue will also feature the 1989 Mattiello Memorial Lecture.

Guess which surfactant line reflects everything you want in your water-based inks and coatings. Surfȳnol® surfactants.

What do you want from your surfactant? Coverage over difficult to wet surfaces? Rapid wetting and color development? Defoaming? Low water sensitivity and viscosity? All of the above?

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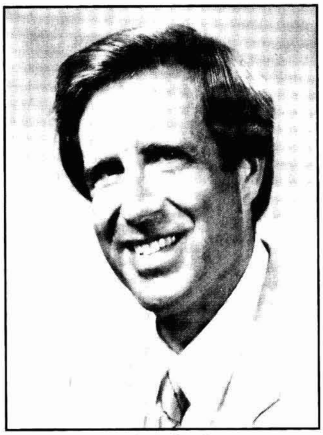
AIR PRODUCTS

John C. Ballard, of Louisville Society, Elected 68th President of the Federation

John C. Ballard, Vice President/Manager—Technical Service, Kurfees Coatings, Inc., Louisville, KY, became the 68th President of the Federation of Societies for Coatings Technology on November 10, at the Federation's Annual Meeting in New Orleans, LA.

Kurt C. Weitz, of Indusmin, a Division of Falconbridge Limited, Toronto, Ont., Canada was named President-Elect and William F. Holmes, formerly of DeSoto, Inc., Garland, TX, was elected Treasurer.


J.C. Ballard

President Ballard

Mr. Ballard most recently served as President-Elect of the Federation. He was Treasurer of the Federation (1987-88), is a member of the Executive Committee, and serves on the Board of Directors. Currently, he is Chairman of the 1990 Mattiello Lecture Committee and is a member of the Finance Committee. Mr. Ballard was an at-large-member on the Board of Directors from 1978 to 1980, and Chairman of the Paint Show Exhibits' Awards and Annual Meeting Program Committees. He is a Past-President of the Louisville Society (1976-77) and is a graduate of the University of Louisville.

Mr. Ballard has been associated with the coatings industry for 32 years. In addition to his efforts on behalf of the Federation, he is an active member of National Decorating Products Association.

President-Elect Weitz

Mr. Weitz is Manager—Technical Support for Indusmin. Formerly Treasurer of the Federation, he has been a member of the Executive Committee since 1985. He was the Toronto Society Representative to the Board of Directors from 1981 to 1988. Mr. Weitz was the Secretary/Treasurer of the Coatings Industry Education Fund, serves on the Finance Committee, and is an Ex Officio member of the Professional Development Committee. In addition, he was a member of the Roon Awards Committee for six years. A Past-President of the Toronto Society (1974-75), Mr. Weitz was graduated from the University of Toronto and has served the coatings industry for 32 years.

Employed by Indusmin for 21 years, Mr. Weitz is credited with the development of nepheline syenite, feldspar, and silica as extender pigments for coatings and plastics. He is a member of the American Chemical Society, and the Society for Plastics Engineers.

Treasurer Holmes

Mr. Holmes has served on the Board of Directors as a member-at-large since 1987. He was the Dallas Society Representative to the Board of Directors from 1973 to 1976. Mr. Holmes is a member of the Finance Committee and served as Chairman of the Annual Meeting Host, Membership, and Technical Advisory Committees. He also was a member of the Educational, Nominating, Annual Meeting Program, and A.F. Voss/APJ Awards Committees. Mr. Holmes is a Past-President of the Dallas Society (1979-80). Most recently, he held the position of Technical Director for DeSoto, Inc., Garland, TX. A graduate of Texas Tech University, Mr. Holmes has been in the coatings industry for 32 years.

Executive Committee

Richard M. Hille, Marketing Manager, General Paint & Chemical Company, Division of Cotter & Company, Cary, IL, has been elected to a three-year term as Society Representative to the Executive Committee. Mr. Hille, a member of the Executive Committee, is the Chicago Society Representative to the Board of Directors. He was a member-at-large on the Board of Directors from 1985 to 1987. Mr. Hille currently serves on the Annual Meeting Program and Professional Development Committees. He was Chairman of the Annual Meeting Program, Annual Meeting Host, and the Manufacturing Committees. President of the Chicago Society (1980-81), Mr. Hille was active on the Society Technical, Educational, and Manufacturing Committees. He is a graduate of the University of Kansas and has been in the coatings industry for over 20 years.

Board of Directors

Carlos E. Dorris, Corporate Manager, Jones-Blair Company, Dallas, TX, a Past-President of the Federation (1986-87) and the Dallas Society (1974-75) has been elected to serve a two-year term on the Board of Directors as Past-President Member. Mr. Dorris was formerly Chairman of the Liaison Committee. He was a member of the Executive Committee and Board of Directors, having been the Dallas Society Representative to the Board from 1977 to 1984. In addition, Mr. Dorris has served on the Environmental Affairs, Finance, Nominating, Paint Show Exhibits' Awards, and Professional Development Committees. Also, he was Chairman of the Southwestern Paint Convention Committee and a member of the Society's Membership, Technical, and Manufacturing Committees. Mr. Dorris, a graduate of the University of Texas, has been active in the paint industry for 26 years.

Elected to serve two-year terms as Members-at-Large on the Board of Directors are John A. Lanning, Product Quality Manager, Porter Paint Company, Louisville, KY and Colin Penny, President of Hampton Paint Manufacturing Company, Inc., Hampton, VA.

Mr. Lanning served on the Board of Directors as an at-large-member from 1985-87. He is Chairman of the Paint Show Exhibits' Awards Committee and is a past-Chairman of the Society Speaker Awards Committee. A Past-President of the Louisville Society (1983-84), Mr. Lanning also has served on the Society's Technical and Membership Committees. Educated at the University of Louisville, he has been a member of the coatings industry for 23 years.

(Continued on page 13)

1989-90 Committee Chairmen Appointed by President Ballard

Chairmen of 30 committees of the Federation of Societies for Coatings Technology for 1989-90 have been named by President John Ballard. A complete roster of all committees will be published in the 1990 FSCT Year Book.

An asterisk (*) indicates re-appointment for 1989-90.

A.F. Voss/American Paint & Coatings Journal Awards—Patricia Shaw, of Davlin Coatings, Inc., Berkeley, CA.*

Annual Meeting Host—Richard Chodnicki, of Van Horn Metz & Co., Inc., Baltimore, MD.

Annual Meeting Program—Gary Gardner, of Tnemec Co., Inc., Kansas City, MO.

Armin J. Bruning Award—Ralph Stanziola, Consultant, Neshanic Station, NJ.*

By-Laws—Fred G. Schwab, of Coatings Research Group, Inc., Cleveland, OH.*

Corrosion—Jay Austin, Halox Pigments, Hammond, IN.*

Education—Sidney Lauren, Nashua, NH.*

FSCT Building (Ad Hoc)—James E. Geiger, of Sun Coatings, Inc., Largo, FL; Chemex Chemicals & Coatings, Inc., Tampa, FL; and Penn Paints, Inc., Sanford, FL.*

FSCT History (Ad Hoc)—Michael Malaga, Seegott, Inc., Solon, OH.*

Finance—James E. Geiger.

George Baugh Heckel Award—Neil S. Estrada, Consultant, Los Altos Hills, CA.

Inter-Society Color Council—Ralph Stanziola.*

Investment—Neil S. Estrada.*

Liaison—Deryk Pawsey, of Rohm and Haas Canada Ltd., Vancouver, B.C., Canada.

Manufacturing—Joseph Walton, of Jamestown Paint & Varnish Co., Jamestown, PA.*

Joseph J. Mattiello Lecture—John Ballard, Kurfees Coatings, Inc., Louisville, KY.

Membership Services—Brenda Carr, of Coatings Development Co., Painesville, OH.

Memorial—A. Clarke Boyce, of Nacan Products Ltd., Brampton, Ont., Canada.*

Nominating—James E. Geiger.

Paint History—Joseph Boatwright, Consultant, N. Ridgeville, OH.*

Paint Industries' Show—Ken Hyde, Reliance Co., Louisville, KY.

Planning—Colin Penny, of Hampton Paint Mfg. Co., Hampton, VA.*

Professional Development—Richard Himics, of Daniel Products Co., Jersey City, NJ.*

Publications—Thomas J. Miranda, of Whirlpool Corp., Benton Harbor, MI.*

Definitions Subcommittee—Stanley LeSota, of Rohm and Haas Co., Spring House, PA.*

Roon Awards—Richard Eley, of Glidden Co., Strongsville, OH.*

Society Secretaries—Joseph L. Mascia, of Campbell Chemical Co., Pittsburgh, PA.*

Society Speakers Awards—David Penrice, of Newtown Industrial Paints Ltd., Tamworth, W. Midland, England.

Technical Advisory—Gerry Noren, of DeSoto, Inc., Des Plaines, IL.*

Technical Information Systems—Helen A. Skowronska, Cleveland, OH.*

* * *

Delegates to Other Organizations

National Association of Corrosion Engineer—Jay Austin.*

National Paint & Coatings Association Scientific Committee—Gerry Noren.*

Steel Structures Painting Council—Jay Austin.*

John Ballard Elected President of FSCT

Continued from page 12

Colin D. Penny is President, Hampton Paint Mfg. Company, Inc., Hampton, VA. Mr. Penny is Chairman of the FSCT Planning Committee. Mr. Penny is a Past-President of the Baltimore Society (1974-75) and, in 1976, was presented the Herman H. Shuger Memorial Award of the Baltimore Coatings Industry Awards Council. In addition, he served on the Educational Committee of the Baltimore Society. Mr. Penny is a graduate of Bristol College of Technology in England. Active in the coatings industry for 42 years, Mr. Penny has been a member of the Oil and Colour Chemists' Association since 1952 and is a Past-President of the Washington Paint Technical Group.

FSCT Spring Seminar Hosted by Louisville, May 16-17, Will Explore Coatings Technology in the Nineties

A seminar on "Coatings Technology in the 1990s," sponsored by the Federation of Societies for Coatings Technology, will be held May 16 and 17, 1990, at The Galt House, in Louisville, KY.

As we enter the final decade of the twentieth century, a number of key issues face the coatings technologist. These issues, which will impact the coatings industry well into the next century, will be discussed in the programming for the 1-1/2 day seminar.

Speakers representing paint manufacturers, raw material and application equipment suppliers, and government agencies will highlight such issues as: new emerging technologies, including high solids, water-borne, and powder; VOC regulations—where they are and where they are going; hazardous waste minimization and disposal, now and in the future; and health and safety issues.

Keynote Speaker will be Dr. Zeno W. Wicks, Jr., Consultant and Professor Emeritus, Polymers and Coatings Dept., North Dakota State University.

Programming for the seminar is being developed by a committee of members of the Louisville Society for Coatings Technology, under the direction of Chairman Raymond L. Mudd, Technical Director, Porter International.

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

SPC Seminars to Be Held March 19-23 in Chicago

A repeat of the introductory and intermediate-level seminars on Statistical Process Control for the Coatings Industry, conducted by Dr. Peter J. Hunt, President of Productivity Management Consultants, Clearwater, FL, has been announced by the Federation.

The seminars, to be held at the O'Hare Marriott Hotel, Chicago, March 19-23, under the auspices of the Federation's Professional Development Committee, present Statistical Process Control (SPC) methods for application to coatings manufacturing and related areas, such as chemical and pigments, which employ a batch process.

The introductory (Level I) two-day seminar will be held March 19-20. Discussions emphasize the application of Dr. Edwards Deming's concepts which apply statistics to production samples to reduce variation and minimize waste, and focus on identifying appropriate product and machine variables to measure, plotting, and interpreting SPC control charts, evaluating process capability, and implementing an SPC system.

Attendees participate in summarizing sample data, plotting charts, determining process capability, and interpreting results in terms of the process or machine changes warranted.

The intermediate (Level II) three-day seminar to be held March 21-23, stresses the practical application of statistical techniques to respond to manufacturing, research, and management concerns to improve first run capability. The emphasis is on statistical techniques to answer management questions such as the reliability of test equipment, statistical differences between procedures, and the use of correlated variables to control and/or predict outcomes. The seminar theme is understanding when to use a particular technique and how to interpret and use the results to improve product quality.

Registrants should have a basic understanding of SPC (e.g., attendance at the Level I seminar, or equivalent) and a working knowledge of basic algebra.

The format for both seminars is practical rather than theoretical, and offers a "hands-on" understanding to insure proper implementation.

Registration fees are: Level I—$225 for FSCT members, $325 for non-members; Level II—$325 for members, $425 for non-members. The fees include continental breakfast, luncheons, coffee breaks, workbooks, worksheets, and reference materials.

To register, fill out the accompanying form and return with payment to Federation of Societies for Coatings Technology, 1315 Walnut St., Suite 832, Philadelphia, PA 19107.

SPC SEMINARS REGISTRATION FORM

Registration fees: **LEVEL I** — $225 (FSCT Members) / $325 (Non-Members) **LEVEL II** — $325 (FSCT Members) / $425 (Non-Members)

Check must accompany registration form. Make checks payable to Federation of Societies for Coatings Technology. (Payment must be made in U.S. funds payable in U.S. banks.)

NICKNAME (For Registration Badge) ____________

FULL NAME ____________

JOB TITLE ____________

COMPANY ____________ PHONE ____________

ADDRESS ____________

CITY ____________ STATE ____________ ZIP ____________

Name of Federation Society Of Which You Are a Member ____________

Check Appropriate Box For Seminar You Will Attend: ❑ LEVEL I ❑ LEVEL II

No refund for cancelled registrations received less than 5 days prior to seminar

Return form and check to: Federation of Societies for Coatings Technology
1315 Walnut Street, Suite 832, Philadelphia, PA 19107

HOUSING FORM
CHICAGO O'HARE MARRIOTT

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Arrival Date ______ ❑ Before 6 pm ❑ Late* Departure Date ______

Please reserve: ❑ Single ❑ Double/Twin

Room rate is $114, single; $128, double (per night).

*Reservations will be held until 6:00 pm. If arrival is after 6:00 pm, hotels require deposit for one night's lodging to guarantee availability.

Make check payable to "Chicago O'Hare Marriott."

Note: Reservations must be made by February 23, to guarantee room availability and rate.

Return this form to: Federation of Societies for Coatings Technology
1315 Walnut Street, Suite 832, Philadelphia, PA 19107

SPC—Statistical Process Control:
What Is It?
What Can It Do for the Coatings Industry?

SPC is a term that is fast becoming as familiar in the literature of technology and industry as the words oat bran in the field of nutrition. Oat bran may or may not prove to be a fad; SPC is not a fad. It not only has a solidly proven track record in the spectacular rise of Japan's industry after World War II, but is now firmly entrenched in the U.S. auto industry, which took the full shock of Japanese competition.

For the still-uninitiated, SPC may be defined simply as a method that uses statistics to monitor and control production to achieve *consistent* quality at the quality level that a product is designed to meet.

What can SPC do for the coatings industry? The answer is blunt and simple in the case of coatings intended for use in the automotive, aircraft, farm machinery, household appliances, electronics, and prefinished metal building materials industries: SPC is what you need to be using in your own production in order to get your company through the customer's door. For these, and a growing number of other demanding, high-volume industries, documented evidence that your coatings are being produced with statistical process control is a prerequisite for their evaluation and acceptance. This was an inevitable result of the fact that the engineers in the auto industry, in particular, came to realize that if use of SPC in their production were not backed by similar use of SPC by their suppliers, the holes in the web of desired consistency would be large enough to drive their automobiles through.

The cascading effect on coatings raw materials producers was predictable. After all, how can one produce coatings of consistent quality without consistent quality in polymers, pigments, solvents, additives, and so on and so on? Our whole industry is thus, in effect, becoming "hooked," but with a beneficial "addiction."

Achievement of consistent quality by effective statistical process control is much more than a sales aid; it is a profit booster by helping to avoid off-grade production and the expense of re-work, and worse, scrapping. (One can't throw away chemical products any more; there is no "away.")

The Federation's Professional Development Committee (PDC) perceived this trend quite clearly a few years ago, and devoted much effort to organizing a series of seminars on SPC that have proven highly successful. We offer the testimony in a letter from The Valspar Corporation, one of the largest U.S. coatings manufacturers, about the value of these seminars to its production and development personnel.

The Valspar Corporation

1101 Third Street South Minneapolis, MN 55415
Mailing Address P.O. Box 1461 Minneapolis, MN 55440
612/332-7371
FAX: 612-375-7723

June 26, 1989

Mr. Sidney Lauren, Chairman
Educational Committee
40 Dunbarton Drive
Nashua, NH 03063

Dear Sid:

As a facet of a corporate commitment to Statistical Process Control for consistent production of high quality products, The Valspar Corporation has sponsored a total of 70 registrations of members of its research, production, and quality assurance staffs in the Level I and Level II Federation seminars on Statistical Process Control. Our employees who attended the sessions returned with the conviction that personal and corporate goals in this field were aided greatly by their exposure to these seminars. We feel that their time and our money were well spent.

However, I would caution that this is only the very beginning of awareness and that lacking an action plan and real commitment by management to invest the necessary resources, which are not insignificant, you'll have little to show. This is true for any seminar, of course, but maybe even more so for as challenging a subject as SPC.

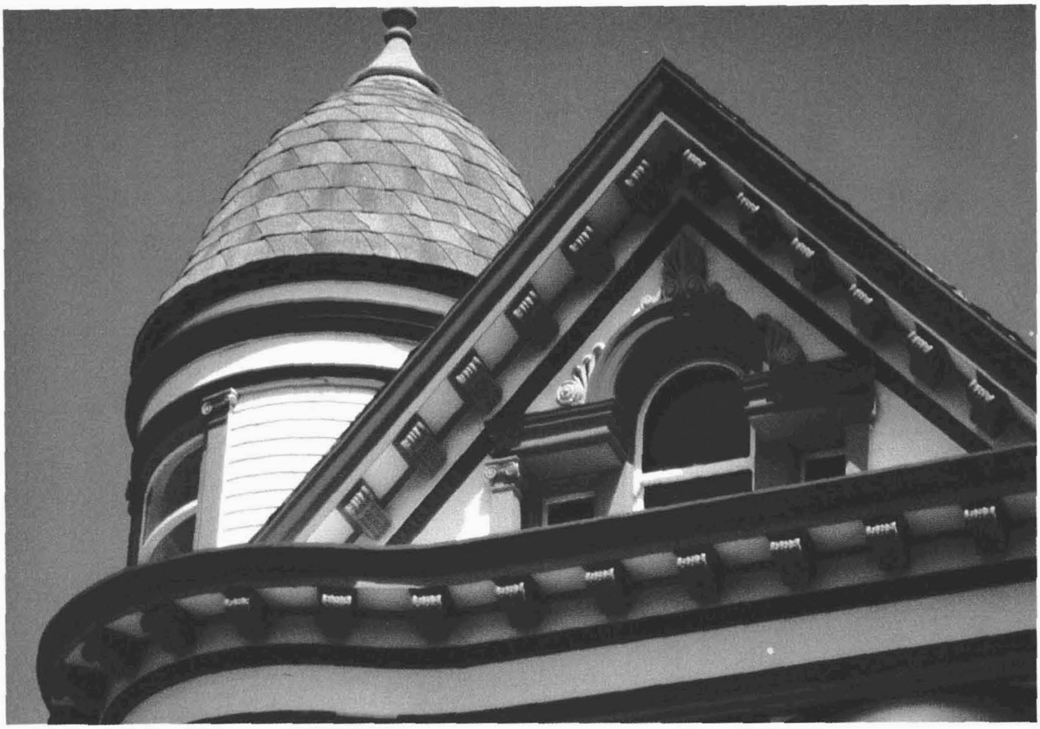
Sincerely,

(signed) John F. Whealy,
Vice President—Quality and Safety

The PDC was fortunate to be able to engage Dr. Peter J. Hunt, a recognized authority on SPC and an exceptionally skillful lecturer, to conduct a series of SPC seminars. Dr. Hunt has helped to guide a major U.S. auto manufacturer in the use of SPC; in the PDC-sponsored seminars designated Level I and Level II, he has shown how the essential principles can be applied to the production of coatings and coatings-related raw materials.

The next seminar series will be presented in Chicago on March 19-20, 1990 (Level I) and March 21-23 (Level II). Your company, whether it is a coatings producer or a related raw materials producer, cannot afford to be unrepresented at one or both of these seminars if it seriously desires to operate in the mainstream of modern coatings production.

Professional Development Committee, FSCT



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Reichhold Chemicals, Inc., is the major producer of specialty resins for the coatings industry. For more information, consult your local Reichhold representative or contact: Reichhold Chemicals, Inc., Post Office Box 13582, Research Triangle Park, North Carolina 27709. Telephone 1-919-544-9225.

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Regulatory UPDATE

DECEMBER 1989

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.

EPA Holds Open Meetings on VOC—The Advisory Committee to negotiate a rule to control fugitive emissions of volatile organic compounds (VOCs) from chemical equipment leaks has been published, and EPA held open meetings November 6-7, 1989. The Panel was formed in order to resolve complaints with the EPA's current fugitive emissions regulations. See 54 Federal Register 42333 (October 16, 1989).

Members of the Panel include: representatives from the Chemical Manufacturers Association (CMA); California's South Coast Air Quality Management District (SCAQMD); the International Institute for Synthetic Rubber Products; and the Natural Resources Defense Council (NRDC). The next two meetings are scheduled for December 6 and 7, 1989, and January 17 and 18, 1990, at locations to be announced. Information the Panel develops may be used to assist in defining maximum available control technology for the air toxics provisions in the Administration's Clear Air bill.

For further information, contact Robert Ajax, Office of Air Quality Planning and Standards, U.S. EPA, (919) 541-5579. Persons needing further information on procedural matters should call Deborah Dalton, Regulatory Negotiation Project, U.S. EPA, (202) 382-5495, or the Committee's facilitator, Philip Harter, (202) 887-1033.

EPA Adjusts Reportable Quantities of Two Extremely Hazardous Substances—EPA is correcting the listing for reportable quantities (RQs) for two extremely hazardous substances (EHSs), hydrogen chloride and methacrylonitrile, under Section 304 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). See 54 Federal Register 43164 (October 20, 1989). A discrepancy currently exists between the RQs listed for these substances under CERCLA's list of hazardous substances versus CERCLA's list of EHSs.

The effective date of this regulation was October 20, 1989. For further information, contact Kathleen Bishop, Project Officer, Chemical Emergency Preparedness and Prevention Office, Office of Solid Waste and Emergency Response, OS-120, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, or the Emergency Planning and Community Right-to-Know Information Hotline, (800) 535-0202, or in Washington, D.C. and Alaska, (202) 479-2449.

EPA Denies Petition to Delist Cadmium Sulfide (CdS) and Cadmium Selenide (CdSe) from Community Right-to-Know List—EPA has denied a petition to delist CdS and CdSe from the list of toxic chemicals under Section 313 of Emergency Planning and Community Right-to-Know List (EPCRA). See 54 Federal Register 42962 (October 20, 1989). The decision was based on a weight of evidence determination that these chemicals cause or can reasonably be anticipated to cause cancer, as well as other serious or irreversible health and environmental effects.

For further information, contact Robert Israel, Petitions Coordinator, Emergency Planning and Community Right-to-Know Information Hotline, U.S. EPA, Mail Stop OS-120, 401 M Street, S.W., Washington, D.C. 20460, (800) 535-0202, or in Washington, D.C. and Alaska, (202) 479-2449.

EPA Proposes Uniform Effective Dates for Reporting Thresholds Under Community Right-to-Know—EPA is clarifying and soliciting comments on its intent to establish uniform effective dates for final reporting thresholds for all facilities required to submit reports under Section 311 and 312, and eliminate the phase-in for threshold reporting. Under this rule, all facilities subject to reporting under Sections 311 and 312, including the construction industry facilities and other facilities newly subject to the reporting requirements, October 17, 1989 was the effective date for final reporting thresholds for Section 311 reports, and March 11, 1991, will be the effective date for final reporting thresholds for reports submitted under Section 312.

EPA is also announcing the availability of the results of an analysis of reporting thresholds under State Right-to-Know laws. See 54 Federal Register 41907 (October 12, 1989).

Comments were due before November 13, 1989, to the Superfund Docket Clerk, Attn: Docket No. 300RR-IF, Superfund Docket-Room 2427, (OS-240), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460.

For further information, contact Kathleen Brody, Project Officer, Chemical Emergency Preparedness and Prevention Office, Office of Solid Waste and Emergency Response, OS-120, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, or the Emergency Planning and Community Right-to-Know Information Hotline, (800) 535-0202, or in Washington, D.C. and Alaska, (202) 479-2449.

ATDSR Announces Availability of Draft Chemical Profiles—The Agency for Toxic Substances and Disease Registry announces that 30 draft toxicological profiles are available:

Document	Hazardous Substance	CAS No.
1	Acrolein	107-02-8
2	Acrylonitrile	107-13-1
3	Ammonia	7664-41-7
4	Asbestos	1332-21-4
5	Bromoform	75-25-2
	Chlorodibromomethane	124-48-1
6	Chlorobenzene	108-90-7
7	Chloromethane	74-87-3
8	Copper	7440-50-8
9	Creosote	8001-58-9
10	Di-n-butyphthalate	84-74-2
11	1,2-Diphenylhydrazine	122-66-7
12	1,1-Dichloroethane	75-34-3
13	cis-1,2-Dichlorethene	156-59-2
	trans-1,2-Dichlorethene	156-60-5
	1,2-Dichlorethene	540-59-0
14	Endrin/Edrin Aldehyde	72-20-8
		7421-93-4
15	Ethylbenzene	100-41-4
16	Ethylene Oxide	75-21-8
17	Hexachlorobenzene	118-74-1
18	Naphthalene	91-20-3
	2-Methylnaphthalene	91-57-6
19	Nitrobenzene	91-20-3
20	Polycyclic Aromatic Hydrocarbons (PAHs)	
	Acenaphthene	83-32-9
	Acenaphthylene	208-96-8
	Anthracene	120-12-7
	Benzo(a)anthracene	56-55-3
	Benzo(a)pyrene	50-32-8
	Benzo(b)fluoranthene	205-99-2
	Benzo(g,h,i)perylene	191-24-2
	Benzo(k)fluoranthene	207-08-9
	Chrysene	218-01-9
	Dibenzo(a,h)anthracene	53-70-3
	Fluoranthene	206-44-0
	Fluorene	86-73-7
	Indeno(1,2,3-cd)pyrene	193-39-5
	Phenanthrene	85-01-8
	Pyrene	129-00-0
21	Plutonium	7440-07-5
22	Radium	7440-14-4
23	Radon	10043-92-2
24	Silver	7440-22-4
25	Thorium	7440-29-1
26	Toxaphene	8001-35-2
27	1,1,1-Trichloroethane	71-55-6
28	2,4,6-Trichlorophenol	88-06-2
29	Uranium	7440-61-1
30	Total xylenes	1330-20-7

The ATDSR is required under the Superfund Amendments and Reauthorization Act (SARA) of 1986 to list the 200 hazardous substances commonly found at hazardous Superfund sites which pose the most significant potential threat to human health, and prepare toxicological profiles for each. See 54 Federal Register 42568 (October 17, 1989). This is third list of profiles and they are available, via a request in writing to Edward J. Skowronski, Program Manager, Division of Toxicology Agency for Toxic Substances and Disease Registry, Mailstop E-29, 1600 Clifton Road., Atlanta, GA 30333. One copy of each requested substance will be produced free of charge.

Comments are due in six copies by February 16, 1990 to Edward J. Skowronski at the above address.

EPA Denies Petition to Delete Decabromodiphenyl Ether (DBDPE) from the Community Right-to-Know List—EPA has denied a petition to delete DBDPE from the list of toxic chemicals under Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). See 54 Federal Register 46424 (November 3, 1989).

The decision was based on evidence that the chemical may cause developmental and chronic toxicological effects in humans. As a result of the review of the petition, EPA will consider initiating a rulemaking to add octabromodiphenyl ether (OBDPE) to the EPCRA Section 313 list, due to evidence that it can be reasonably anticipated to cause developmental toxicological effects in humans. Written comments should be submitted in triplicate before January 2, 1990 to: OTS Docket Clerk, TSCA Public Docket Office, (TS-793), U.S. EPA, Room NE-G004, 401 M Street, S.W., Washington, D.C. 20460, Attn: Docket Control Number OPTS-400036.

For further information, contact Robert Israel, Petitions Coordinator, Emergency Planning and Community Right-to-Know Information Hotline, U.S. EPA, Mail Stop OS-120, 401 M Street, S.W., Washington, D.C. 20460, (800) 535-0202, or in Washington, D.C. and Alaska, (202) 479-2449.

Final Test Rule Issued for Isopropanol—EPA has promulgated a final test rule, requiring manufacturers and processors of isopropanol to perform testing for health effects. See 54 Federal Register 43252 (October 23, 1989). The testing requirements include subchronic toxicity, reproductive toxicity, developmental toxicity, neurotoxicity, developmental neurotoxicity, mutagenicity, oncogenicity, and pharmacokinetics.

This rule became effective on December 4, 1989, and is in response to the Interagency Testing Committee's (ITC) designation of isopropanol for priority testing consideration in its 19th Report, November 1986. This final rule is part of the implementation of Section 4 of TSCA, which contains the authority for EPA to require the development of data relevant to assessing the risk to health and environment posed by exposure to particular chemical substances or chemical mixtures.

EPA has received written comments on the test rule from the Isopropanol Panel of the Chemical Manufacturers Association (CMA). Panel members include: Arco Chemical Company, Exxon Chemical Company, Shell Oil Chemical Company, and Union Carbide Corporation. Other commenters include Proctor and Gamble Company and the Natural Resources Defense Council.

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

EPA Asks for Comments on RCRA Ground Water Monitoring—The EPA has proposed interim final guidance for its RCRA ground water monitoring program. The document provides guidance to those facilities with facility permit applications about statistical evaluation of ground water monitoring data and how these are affected by new requirements. See 54 Federal Register 37501 (September 11, 1989).

Comments were due before December 8, 1989, to EPA Docket Clerk, Office of Solid Waste, (OS-321), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, Attn: Docket Number F-89-HWGWS-FFFF. For more information, contact Jim Brown at Office of Solid Waste, (OS-321), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-4658.

Natural Toxicology Program: Peer Review of Draft Technical Reports—The National Toxicology Program (NTP) held a two-day meeting to begin peer review of several draft technical reports recently completed by NTP. See 54 Federal Register 42571 (October 17, 1989). The nine chemicals whose reports are to begin peer review are:

Chemical	CAS No.	Proposed Levels of Carcinogen Activity
Ethylene Thiorea	96-45-7	Clear evidence in male and female rats and mice.
Furfural	98-01-1	Clear evidence in male mice, some evidence in male rats, no evidence in female rats and mice.
Methylbromide	74-83-9	Not yet reviewed (mice only).
DL-Amphetamine	60-13-9	No evidence.
2 Choroacetophenone	532-27-4	No evidence in male rats, male and female mice, equivocal evidence in female rats.
0-Chlorobenzalmaono-nitrile	2698-41-1	No evidence.
Epinephrine	55-31-2	No evidence.
Tetranitromethane	509-14-8	Clear evidence in male and female rats and mice.
Vinyl toluene	25013-15-4	No evidence.

All of the above studies were long-term studies. In addition, toxicology draft Technical Reports on the following three chemicals will begin peer review:

Chemical	CAS No.
D&C Yellow No. 11	8003-22-3
Pentachlorobenzene	608-93-5
1,2,4,5-Tetrachlorobenzene	95-94-3

The meeting was held in Research Triangle Park, NC, November 20-21, 1989. For more information about the meeting or about the peer reviews, contact Larry G. Hart, Executive Secretary, NTP, P.O. Box 12233, Research Triangle Park, NC 27709, (919) 541-3971.

EPA Holds Symposium on Regulatory Approaches for VOC Emissions from Consumer Products—EPA held a two-day symposium, on reducing volatile organic compounds (VOC) emissions from use of consumer products, on November 14-15, 1989. EPA has been evaluating the air emissions of VOCs from a number of consumers products, which have been grouped into six categories: personal care products (e.g., hair spray); home care products (paint, paint remover); automotive products; adhesives and sealants; household pesticides; and aerosol spray paints. See 54 Federal Register 43481 (October 25, 1989).

As part of EPA's review, they held this symposium. Participants in the symposium included affected industry representatives, personnel from state and local air pollution control agencies and from the EPA, and other interested parties.

The objectives of the symposium were to:

—discuss the approaches EPA is considering;

—begin a dialogue between EPA, the states, and industry on this issue; and

—develop an approach for continued participation for states and industry in EPA's considerations of approaches.

For more information, contact Bruce Moore, U.S. EPA, Office of Air Quality Planning and Standards, Emission Standards Division, (MD-13), Research Triangle Park, NC 27711, (919) 541-5460.

National Toxicology Program Announces Availability of the Fifth Annual Report on Carcinogens—NTP announced the availability of the Fifth Annual Report on Carcinogens. See 54 Federal Register 42570 (October 17, 1989). The Annual Report on Carcinogens, prepared by the NTP, U.S. Public Health Service, is issued by the Secretary of the Department of Health and Human Services (DHHS). The Secretary is required to publish an annual report that contains "a list of all substances (i) which either are known to be carcinogens or which may reasonably be anticipated to be carcinogens and (ii) to which a significant number of persons residing in the United States are exposed . . ." The law also states that the reports should provide available information on the nature of exposures, the estimated number of persons exposed, and the extent to which the implementation of Federal regulations decreases the risk to public health from exposure to these chemicals.

Attempts are made in the report to list substances that are currently being used, or for which there is some evidence for continuing exposures in the workplace or in the general environments of persons residing in the United States. This report does not contain all known carcinogens or substances reasonably anticipated to be carcinogens.

Single copies of the report will be available in December, without charge, from the National Toxicology Program, Public Information Office, (MD B2-04), P.O. Box 12233, Research Triangle Park, NC 27709.

EPA Extends Community Right-to-Know Reporting Requirements Threshold—EPA published an Interim Final Rule on October 12, 1989, extending, for manufacturing facilities, the reporting thresholds established for the first two years of reporting under the October 15, 1987 rule. For manufacturers, promulgation of the Interim Final Rule limits the hazardous chemicals that must be reported under Sections 311 and 312 to those which are present in an amount equal to or greater than 10,000 pounds, or which are EHSs present in an amount greater than or equal to 500 pounds (or 55 gallons) or the threshold planning quantity (TPQ), whichever is lower. This limit is imposed for one more year from the current effective date (i.e., October 17, 1989). See 54 Federal Register 41904 (October 12, 1989).

Comments on this extension were due before November 13, 1989, to Superfund Docket Clerk, Attn: Docket No. 300 RR-IF, Superfund Docket-Room 2427, (OS-240), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460.

Food and Drug Administration Postpones Closing Date for Provisional Listing of FD&C Red Dye No. 3—The Food and Drug Administration (FDA) promulgated a final rule postponing the closing date for a provisional listing of Red Dye No. 3 for use in coloring cosmetics and externally applied drugs and of the lakes of Red Dye No. 3 for use in coloring food, drugs, and cosmetics. The new closing date for the provisional listings will be January 29, 1990. See 54 Federal Register 43961 (October 30, 1989).

The postponement has been provided to allow for uninterrupted use of the color additive and its lakes while the FDA evaluates the FDA's review of FD&C Red Dye No. 3. The FDA will also be preparing documents for the Federal Register to announce and explain the FDA's decision on the regulatory status of the color additive.

For further information, contact Gerald L. McCowin, Center for Food Safety and Applied Nutrition, (HFF-330), Food and Drug Administration, 200 C Street, S.W., Washington, D.C. 20204, (202) 472-5676.

Bills Introduced in Congress to Postpone UST Financial Assurance Requirements—Several bills in Congress have been introduced that affect the financial assurance requirements for underground storage tanks (USTs) that non-petroleum marketing companies worth less than $20 million must have by October 26, 1990.

In the Senate, Sen. C. Burns (R-MT) has introduced a bill, S.1560, that would delay the requirements for one year (until 1991). The House bills H.R. 3321, introduced by Rep. G. Molinari (R-NY), and H.R. 2903, by Rep. V. Smith (R-NE), would both reduce the dollar amount required for coverage required under the financial responsibility regulations. For more information, contact Steve Faulkner, House Energy and Commerce, (202) 225-2927.

House Subcommittee Approves Waste Reduction Bill—The House Transportation and Hazardous Materials Subcommittee of the Energy and Commerce Committee approved H.R. 1457, The Waste Reduction Act. The bill would:

•require manufacturing facilities in almost 20 different industries to report to EPA about their waste minimization efforts on an annual basis. The information would be reported through the toxic release inventories required under Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as Community Right-to-Know.

The bill now goes to the full House Energy and Commerce Committee for consideration. Similar legislation introduced in the Senate (S. 585) has not had any action on it.

EPA Establishes Waste Minimization Clearinghouse—The EPA has established an information clearinghouse in order to promote pollution prevention among generators. The Pollution Prevention Information Clearinghouse (PPIC) is an international communications network containing four separate systems: (1) a hardcopy reference library of information on pollution prevention, (2) an electronic information exchange system (EIES) that can be accessed with a modem and a computer, (3) a telephone hotline (the RCRA/Superfund Hotline) for those without computers, and (4) information packets containing general and industry-specific materials on prevention opportunities.

For more information, contact Myles Morse at the Office of Environmental Engineering and Technology Demonstration at (202) 475-7161, or Priscilla Flattery at EPA's Pollution Prevention Office, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 245-3557.

Clean Air Update:

Senate—

S.816, the Senate bill on air toxics has been marked-up and approved by the Senate Environmental Protection Subcommittee, of the Environment and Public Works Committee. (The provisions of S.816 was reviewed in the September 1989 issue of the FSCT *Regulatory Update*.) Amendments include the following:

•establishing an independent chemical safety board that would investigate major accidents involving accidental releases of toxic chemicals. It would be patterned after the National Transportation Safety Board.

Consideration of the bill moves to the full Committee on Environment and Public Works. For more information, contact Jimmie Powell, Senate Committee on Environment and Public Works, (202) 224-8832.

EPA Supplements Proposed Rule on Burning Hazardous Waste in Boilers and Industrial Furnaces—EPA is requesting comments on regulatory approach alternatives addressing a variety of issues under its proposed rule controlling burning of hazardous waste in boilers and industrial furnaces, originally published in May 1987. See 52 Federal Register 16982 (May 6, 1989). As a result of a large amount of comments received on the original proposal, EPA is considering alternative approaches to the following and requests comments:

•control of CO, metals, hydrogen chloride, particulate emissions;

•the small quantity burner exemption;

•the definition of a waste that is indigenous when burned for reclamation;

•revisions to the definition of halogen acid furnaces;

•applicability of the metals and organic emissions controls to smelting furnaces involved in materials recovery; and

•the status of residues from burning hazardous waste under the Bevill amendment.

See 54 Federal Register 43718 (October 26, 1989).

Comments are due by December 26, 1989, on only the above issues to: RCRA Docket Section, (OS-305), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, Attn: Docket No. F-80-BBSP-FFFFF. For more information, contact Dwight Hlustick, Combustion Section, Waste Management Section, Office of Solid Waste, (OS-322), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460, (202) 382-7917, or the RCRA Hotline at (800) 424-9346, or in Washington, D.C. (202) 382-3000.

Information Requirements Under Control of Hazardous Energy Sources (Lockout/Tagout) Become Final—The Occupational Safety and Health Administration (OSHA) recently promulgated its rule on control of hazardous energy sources (lockout/tagout). See 54 Federal Register 36604 (September 1, 1989). At that time, the information collection requirements were not final and were due to be approved by the Office of Management and Budget. The information collection requirements [paragraphs (c)(4), (c)(9), and (f)(2)] have been approved and are therefore effective October 31, 1989. See 54 Federal Register 42498 (October 17, 1989).

The information requirements are approved through September 30, 1992. For more information, contact James F. Foster, Occupational Safety and Health Administration, Room N3649, U.S. Department of Labor, 200 Constitution Avenue, N.W., Washington, D.C. 20210.

National Toxicology Program Reviews Six Chemicals for Possible Study—The National Toxicology Program (NTP) is reviewing six chemicals for possible study. The NTP is holding a two-day meeting to review these chemicals and other matters. See Federal Register 46306 (November 2, 1989):

Chemical	CAS No.
4-Acetylaminofluorene	28322-02-3
P-Aminobenzoic Acid	150-13-3
Elmiron	37319-27-8
Monochloroacetone	64-17-1
Ethanol	7895-5
Propylene glycol monomethyl ether	107-98-2

For further information, contact Victor A. Fung, Chemical Selection Coordinator, National Toxicology Program, Room 2B55, Building 31, National Institutes of Health, Bethesda, MD 20892, (301) 496-3511.

Food and Drug Administration Considers Food Additive Petitions—The Food and Drug Administration (FDA) announced that it is considering the following petitions to change its food additive regulations:

- Adeka Argus Chemical Company has filed a petition for the safe use of sodium 2,2'-methylene bis(4,6-di-tert-butylphenyl) phosphate as a clarifying agent in propylene polymers intended for contact with food. For further information, contact Andrew D. Laumbach at the address below. See 54 Federal Register 43338 (October 24, 1989).

The FDA also announced the withdrawal without prejudice of a petition by Betz Laboratories, Inc., for the safe use of N-(2-nitrobutyl) morpholine as a slimicide in the manufacture of paper and paperboard that contact food. See 54 Federal Register 43861 (October 27, 1989). For more information, contact Marvin D. Mack, Center for Food Safety and Applied Nutrition, (HFF-335), Food and Drug Administration, 200 C Street, S.W., Washington, D.C. 20204, (202) 472-5690.

SUMMARY CALENDAR OF REGULATORY ACTIONS

October 17, 1989	EPA's one-year extension of current Community Right-to-Know thresholds begins. (See this issue.)
October 20, 1989	EPA adjustment of RQs for hydrogen chloride and methacrylonitrile effective. (See this issue.)
October 31, 1989	Information requirements on OSHA control of hazardous energy sources (lockout/tagout) rule effective. (See this issue.)
November 13, 1989	Comments were due on EPA's one-year extension of Community Right-to-Know thresholds. (See this issue.)
November 13, 1989	Comments were due on EPA's proposals for uniform effective reporting dates for Community Right-to-Know. (See this issue.)
November 14-15, 1989	EPA held symposium on regulatory approaches to controlling VOC emissions from use of consumer products. (See this issue.)
November 27, 1989	Information on seven carcinogens nominated for toxicological testing by National Toxicology Program (NTP) was due to NTP. (See this issue.)
December 1, 1989	Fifth Annual Report on Carcinogens available from NTP. (See this issue.)
December 4, 1989	EPA test rule on isopropanol effective. (See this issue.)
December 7, 1989	Data due to support FDA consideration of packaging materials for use under high temperature conditions in microwave ovens. (See November 1989 issue.)
December 6-7, 1989 January 16-17, 1990	Future open meetings on negotiation of equipment leak rule by EPA. (See this issue.)
December 8, 1989	Comments due on RCRA ground water monitoring guidance. (See this issue.)
December 26, 1989	Comments due on approaches for burning hazardous substances in boilers and industrial furnaces. (See this issue.)
January 1, 1990	New Jersey limits on VOC content on architectural coatings effectiveness. (See May 1989 issue.)
January 2, 1990	Comments due on EPA denial of petition to delete DBDPE from Community Right-to-Know list. (See this issue.)
January 29, 1990	New closing date for provisional listing of Red Dye No. 3 and its lakes. (See this issue.)
February 16, 1990	Comments due on draft ATDSR toxicological profiles. (See this issue.)
June 13, 1990	OSHA extends administrative stay on formaldehyde occupational exposure. (See October 1989 issue.)
October 26, 1990	UST financial assurance requirements deadline for non-petroleum marketing companies with a net worth less than $20 million. (See this and May 1989 issues.)

Hercules Announces Business Units Restructuring; Files Protest Against Importation of Nitrocellulose

Hercules Incorporated, Wilmington, DE, has unveiled a corporate restructuring of existing business units designed to decentralize decision making, enhance the company's productivity, focus more clearly on markets and customers, and position the firm to meet its growth goals for the 1990s.

According to Hercules' management, the decentralization process will require several steps to develop and implement. The initial step has been to restructure the business units of the former Specialty Chemicals and Engineered Polymers Companies and The Aqualon Group, a manufacturer of water-soluble polymers, of which Hercules acquired full control in July from Henkel KGaA.

Concurrently, two new corporate positions have been created, reporting to F.L. Buckner, President and Chief Operating Officer. E.D. Crittenden has been named Senior Vice President with responsibility in the implementation phase of the corporate decentralization and other special assignments. J.E. Knox was appointed Vice President—Marketing.

As part of the restructuring, The Aqualon Group will remain a wholly owned subsidiary, with the addition of product lines relating to the coatings market.

Effective October 1, T.L. Gossage replaced Dr. Crittenden as President and Chief Executive Officer of The Aqualon Group, reporting to Mr. Buckner. Mr. Gossage was most recently President—Hercules Specialty Chemicals Company.

In addition, newly restructured business groups and executives include: C.D. Miller, President—Fibers, including the synthetic pulp business unit; W.E. Hosker, President—Resins, including the peroxides business; D.J. MacArthur, President—Flavors and Food Ingredients, including cellulose and food gums; R.J.A. Fraser, President and E.J. Rice, Vice-President—Paper; and P.A. Bukowick, President and J.E. McCord, Vice President—Film, including the FreshHold® Package System.

In other news, Hercules has filed a petition with the U.S. Department of Commerce and the U.S. International Trade Commission to request the imposition of antidumping duties on imports of industrial nitrocellulose from Korea, the United Kingdom, the People's Republic of China, Yugoslavia, Brazil, Japan, and the Federal Republic of Germany.

In its complaint, Hercules, the only remaining U.S. manufacturer of nitrocellulose, alleges that nitrocellulose manufacturers in the previously mentioned countries are selling industrial cellulose in the U.S. at prices lower than in their home markets and, in many cases, at prices below their cost of production. This has resulted in lost sales, price suppression, and reduced production for Hercules.

Industrial cellulose is used primarily in the production of coatings, printing inks, and specialty products.

Dow Corning Unveils New Silicone Rubber Facility

Dow Corning, Midland, MI, has opened a new 70,000 sq ft plant for the development and compounding of high-quality silicone rubber materials. The facility is part of a multi-million dollar expansion program which began in 1988.

The new plant is twice as large as the firm's previous Kendallville, IN, facility, now closed. Laboratory space in the new building is estimated to be 10 times that of the old plant. The building's resources include a complete range of mixers, two-roll mills, and extrusion equipment for compounding and preforming of silicone materials, much of which is now monitored by computer.

New equipment for material testing and evaluation has been added, in a temperature- and humidity-controlled environment. A completely segregated specialty mixing area to handle custom materials and compounds is also featured in the new facility.

PPG Purchases Paint Units from Clorox Co.; Opens New Auto Tech Center in Troy, MI

PPG Industries, Inc., Pittsburgh, PA, has acquired the Olympic HomeCare Products and Lucite HomeCare subsidiaries from the Clorox Company, Oakland, CA, for $130 million cash. The transaction was announced by the companies on September 21 and the deal closed on September 30.

The sale was subject to certain conditions, including clearance by government authorities.

Olympic HomeCare produces and markets stains and paints under the Olympic brand name, and Lucite HomeCare produces and markets paint under the Lucite brand name. Combined annual sales of the units exceed $100 million.

PPG's acquisition includes plants in Ballard, WA; Batavia, IL; Louisville, KY; Langley, British Columbia, Canada; and headquarters offices in Bellevue, WA. Olympic and Lucite units employ approximately 350 people.

PPG also opened its automotive technical center in Troy, MI. The two-story, 81,000-sq ft center houses 140 automotive sales, marketing, and technical employees representing coatings, glass and fiber glass, PPG's automotive advance color stylist team, as well as automotive glass tooling and design services and a quality assurance laboratory.

The center which will not produce glass or paint, includes a five-axis milling machine used to make tooling aids and checking fixtures for producing manufacturing tooling at PPG's North American manufacturing plants.

New ICI Plant in Louisiana To Produce CFC Substitute

ICI Americas Inc., Wilmington, DE, will construct a plant to produce substitutes for chlorofluorocarbons in St. Gabriel, LA.

Ground breaking for the St. Gabriel site will take place in 1990, with the plant scheduled to go on-line in 1992. The project represents an investment of $100 million and will directly employ about 30 people and require additional support services from the community.

The new facility will manufacture commercial quantities of an alternative fluorocarbon, to be marketed under the tradename "KLEA." The new material will replace CFC-12.

ICI supports the Montreal Protocol, an international agreement signed by major industrial nations in 1987, which calls for a freeze on CFC consumption this year, a 20% reduction by 1993, and a 50% reduction by 1998.

Metal Roofing Market Report Foresees Tough Times For Metal Roofing/Building Industries in United States

The Corporate Research Center, Union, NJ, has released its 239-page "CRC Report on Metal Roofing Market in the U.S."

According to the report, the metal roofing and all-metal building industries are about to encounter challenging times. A slowing economy, increased metal costs, and rising inflationary pressures are going to have major implications for those involved with metal roofing and pre-engineered metal buildings over the next several years.

The "Metal Roofing Market" report explains what can be expected for metal roofing products, coatings, insulation, and fasteners for 1990 and 1991. In some instances, projections extend into 1992.

The literature contains present views, opinions, and expectations from more than 1200 participants, including roofing and sheet metal contractors, home improvement centers, consultants, architects, builders and developers, owners, engineers, and manufacturers and associations involved in commercial, industrial, farm and residential construction, ownership, development, and repair.

The report combines all statistics and data on an overall industry basis. The results highlight the similarities, divergencies and anomalies in outlook, expectation, and concern that exist between different sectors of the metal roofing industry.

The specific analysis of demand and preference between steel, aluminum, copper, terne, and alloys are featured, as are comparative evaluations and expectations for coatings, insulation, and fasteners.

The report is available for $350 from Corporate Research Center, 2204 Morris Ave., Union, NJ 07083.

UCAR Licenses Phenolic Resins Technology; ARCO to Purchase Polyol and Glycol Businesses

UCAR Coatings Resins, a unit of Union Carbide Chemicals and Plastics Company Inc., Danbury, CT, has licensed the technology for the production of phenolic washed resins to Schenectady Chemicals, Inc., Schenectady, NY.

The licensing is part of the announced restructuring of the phenolic resins business, which includes phasing out phenolic resin production at Union Carbide's Bound Brook, NJ, plant by the end of this year. However, through agreements with other suppliers, Union Carbide will continue to market a variety of phenolic resins primarily for use in the coatings industry.

As the Bound Brook production is phased out, Schenectady Chemicals will increase production rates and make all adjustments necessary to continue to supply Union Carbide customer needs for phenolic washed resins.

Phenolic washed resins are used primarily in the production of adhesives and sealants.

Also, Union Carbide has reached an agreement to sell its worldwide urethane polyols and propylene glycols businesses to ARCO Chemical Company, Newtown Square, PA, for $220 million.

ARCO assumes all regulatory risk, including the deposition of any nontransferable assets involved in the transaction.

The acquisition includes Union Carbide's production facilities and other assets for polyols and propylene glycols production at the South Charleston and Institute plants in West Virginia, related laboratory and production application equipment, associated technology, and related domestic and international support functions.

Occidental's Cain Chemical Renamed Oxy Petrochemicals

The petrochemicals operations of Occidental Petroleum, formerly known as Cain Chemical Inc., will now operate under the name Oxy Petrochemicals Inc.

The name change, which became effective September 21, is designed to achieve a closer identification with the parent firm.

The Houston, TX-based Cain Chemical was acquired by Occidental in May 1988, to complement its existing chemical business, Occidental Chemical Corporation.

In other news, Sumitomo Bakelite Company, Ltd., Tokyo, Japan, has purchased 50% of Occidental's Singapore-based phenolic molding compounds plant, Occidental Chemical Company Pte Ltd.

The plant, located in Jurong on Singapore's southwest coast, produces 10,000 metric tons per year of phenolic molding compounds and employs 70 people.

The existing customer base in the Far East will continue to be served by Occidental's sales network. Sumitomo Bakelite intends to concentrate sales efforts on an emerging group of customers made up of Japanese appliance and electronic component manufacturers establishing new plants in Southeast Asia.

ARCO Dedicates Joint Venture Polyols Plant in Indonesia

ARCO Chemical Company, Newtown Square, PA, has announced the completion and startup of its 20,000 tons per year joint venture polyols plant in Anyer on the West Coast of Java in Indonesia. ARCO Chemical and P.T. Gema Supra Abadi are partners in the joint venture company, P.T. Gema Polytamia Kimia, which is headquartered in Jakarta.

Polyols are used to make urethane foams, which find application in bedding, furniture, and automotive seating. The polyols plant is the first of its kind in Indonesia. Production is targeted for domestic markets as well as for growing urethanes markets throughout Asia.

Eastman Increases Capacity For Cellulose Esters at TN Plant

The Eastman Chemicals Division of Eastman Kodak Company, Kingsport, TN, has announced plans for a multi-million dollar expansion of cellulose esters production capacity at Tennessee Eastman Company in Kingsport, TN. The expansion will provide additional fiber ester and plastic ester capacity.

Construction is scheduled to begin in early 1990. Production increases will occur in phases with expansion completion expected in 1992. Expansion plans include increased capacities for cellulose acetate for filter tow operations, cellulose acetate butyrates, cellulose acetate propionates, and acid recovery operations.

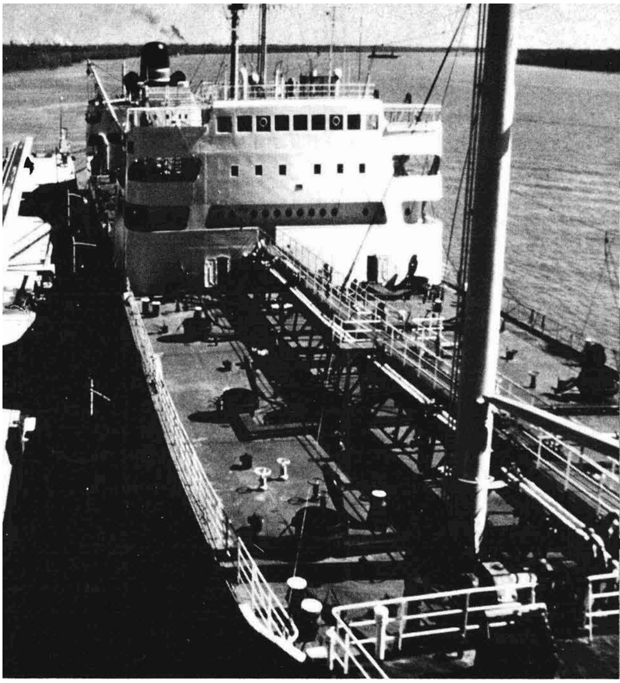
Evans Clay Company Purchases Huber's Airfloat Kaolin Business

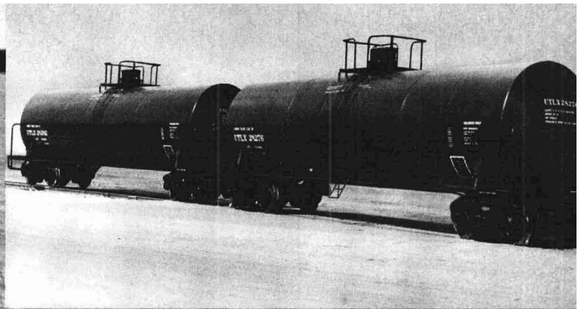
Evans Clay Company, Summit, NJ, has purchased the airfloat kaolin business of the J.M. Huber Clay Division's Huber, GA, operation.

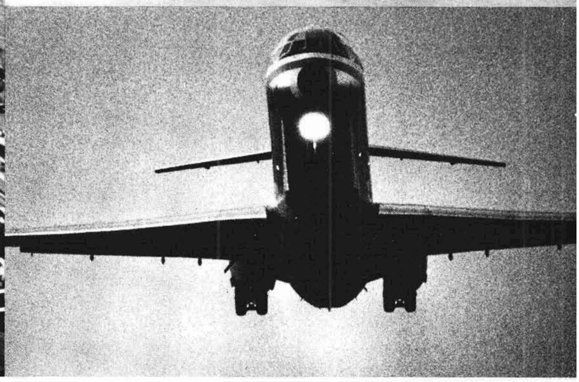
The sale was limited to the purchase of crude clay reserves and trade names and production rights to four airfloat kaolin clay products: Hi-White, Hi-White R, Huber 65A, and Kaolex D-6. No employees or plant equipment were involved in the transaction.

Full transition of the business will take place by December 31, at which time the acquired products will be manufactured by Evans Clay Co. at its McIntyre, GA, plant.

Huber will continue to produce its other lines of airfloat kaolin clay products at its Langley, SC, operation and waterwashed kaolin clay products at the Huber, GA, operation.







XB 4122 is a low viscosity unmodified epoxy resin that's as tough as it is flexible.

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NL Chemicals Restructures as Two Companies

To meet the challenges of multiple geographic markets and growing globalization, two new companies, Kronos, Inc. and Rheox, Inc., have been created to respectively operate the titanium dioxide business and specialty chemicals business formerly known as NL Chemicals, Inc.

Kronos, Inc.'s production exceeds 350,000 tons of titanium dioxide pigment per year, with manufacturing facilities located in Canada, West Germany, Belgium, and Norway. A sixth plant is underway in Lake Charles, LA, which will increase the company's pigment capacity by 90,000 tons. Kronos is headquartered in Houston, TX.

Rheox, Inc. is a producer of rheological additives for solvent-based systems, with products sold under the trade names of Bentone®, Thixatrol®, Thixcin®, M-P-A®, Barael® and Rheolate™. The company also manufactures Nalzin® 2 anticorrosive pigments for high performance coating systems. Rheox has headquarters and research and development laboratories in Hightstown, NJ, and five manufacturing facilities, located in St. Louis, MO; Charleston, WV; Newberry Springs, CA; Livingston, Scotland; and Nordenham, West Germany.

Reichhold's Naval Stores Acquired by Arizona Chemical

Arizona Chemical Company, Panama City, FL, a subsidiary of International Paper, has purchased Reichhold Chemicals, Inc.'s former Newport Division, a source of naval store products.

The acquisition includes all of Reichhold's naval store business, other than the paper-sizing operation. Arizona Chemical will operate the three plants that collectively produce hydrocarbon resins, resin esters, terpene phenolics, polyterpenes, and hard resins used in inks and adhesives. The facilities are located in Gulfport, MS; Oakdale, LA; and Pensacola, FL.

Expert System Development Survey Seeks Participants

A survey is being conducted to compile a directory of computer expert systems addressing the areas of materials selection, corrosion, performance of materials, engineering systems integrity, and engineering life prediction. The directory will include completed systems and those under development.

The newly formed Working Party on Expert Systems in Materials Engineering organized the survey. The collaborative effort between the European Federation of Corrosion, the Materials Testing Institute (MTI), St. Louis, MO, and the National Association of Corrosion Engineers (NACE), Houston, TX, was formed to provide a forum for the exchange of information between developers of expert systems.

In an earlier survey, 25 systems were catalogued by the group. Additional contributions also are being sought.

Anyone interested in participating should contact the Working Party Secretariat, A.S. Krisher, MTI, Suite 203, 12747 Olive St. Rd., St. Louis, MO 63141-6269 or T.S. Lee, NACE, P.O. Box 218340, Houston, TX 77218.

Steel Structures Painting Council Implements New Painting Contractor Certification Program

A Painting Contractor Certification Program developed to address the need to improve the quality of coating application in the field has been implemented by the Steel Structures Painting Council (SSPC), Pittsburgh, PA.

The program is designed to determine if a painting contractor has the personnel, organization, qualifications, and capability to produce surface preparation and coating application of the required quality for a given category of work.

Currently, the program concentrates on the field application of coatings to complex structures in the industrial market. The three-year course evaluates an applicant's management procedures, technical capabilities, quality control, and safety.

To become certified, a contractor must describe his total operation in a series of written submittals which, combined with information gathered by trained, independent program evaluations (auditors), using specific program procedures and guidelines, form a core of information that is utilized by SSPC to determine if the applicant has met or exceeded program requirements.

New Paint Company Formed By ICI and Swire Pacific

ICI Paints, and Swire Pacific, Hong Kong, have agreed to form a new joint paint company, ICI Swire Paints Limited, to serve the markets of Hong Kong and the People's Republic of China.

The Hong Kong-based company will be 60%-owned by ICI and 40%-owned by Swire Pacific. It will involve a total project investment of $7.8 million by the partners. Initially, the venture will concentrate on decorative and vehicle refinish paints, coatings for the interior and exterior of food and beverage cans, and specialist paints for industrial application. Also, the new partnership will incorporate all existing ICI and Swire paints businesses in the territory.

The new business will supply customers through a combination of manufacture in Swire's existing factory in Hong Kong and the import of products from ICI Paints manufacturing facilities in Asia Pacific and worldwide. Plans exist for an additional manufacturing facility to be located in either Hong Kong or China.

ACS and Soviet Organizations Sign Protocol

The American Chemical Society, through its Chemical Abstracts Service division, and the USSR Academy of Sciences and State Committee for Science and Technology have signed a protocol of intent to cooperate. The protocol calls for the parties to work toward a long-term relationship that will provide the basis for cooperative projects between Soviet scientific and technical organizations and the Chemical Abstracts Service.

The State Committee for Science and Technology of the USSR Council of Ministers is a body of the Soviet government that guides research, establishes research priorities, and funds research activities in the Soviet Union. The USSR Academy of Sciences comprises a government-financed system of scientific institutes specializing mainly in fundamental research.

Chemical Abstracts Service, a database producer in science and technology, is a cooperator with Fachinformationszentrum Karlsruhe in the Federal Republic of Germany, the Japan Information Center of Science and Technology, and the STN International online scientific and technical information network.

The initial cooperative project under the protocol is the establishment of two STN International demonstration and training centers in the USSR. The centers will demonstrate online searching of scientific and technical information to Soviet officials and scientists and train scientists and information specialists in online searching.

Cabot Carbon to Construct Fumed Silica Plant in U.K.

Cabot Carbon Limited has announced plans to invest $55 million to build a fumed silica plant in Barry, Wales, U.K. using proprietary technology.

Construction of the 11,000 metric-ton plant and associated facilities will begin in January 1990. The planned completion date of the project is late 1991.

Cabot Carbon Limited is a subsidiary Cabot Corporation, Waltham, MA.

One preservative protects against more scum, filth and slime.

Nobody likes lowlife. Particularly in their products.

That's why it's reassuring to know there's a preservative that hates microorganisms as much as you do. It's called Kathon®LX 1.5% microbicide from Rohm and Haas.

Kathon LX 1.5% microbicide gives better protection against more fungi, bacteria, and yeasts than any other preservative. In fact, it arrests their growth before they even start to rob your formulation.

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No wonder it's called the "Ultimate Protector."

To learn more or to secure a sample, write: Marketing Services Department, Rohm and Haas Company, Independence Mall West, Philadelphia, PA 19105.

JOURNAL OF COATINGS TECHNOLOGY

GUIDE FOR AUTHORS

GENERAL

The JOURNAL OF COATINGS TECHNOLOGY is published monthly by the Federation of Societies for Coatings Technology for its membership of approximately 7,300 in 26 Constituent Societies in the United States, Canada, Great Britain, and Mexico. The JOURNAL is devoted to the advancement of knowledge in the science and technology of surface coatings, the materials comprising such coatings, and their use and performance.

The Editors invite submission of original research papers, review papers, and papers under the special headings *Open Forum* and *Back to Basics*, as well as *Letters to the Editor*. All manuscripts will be assumed to be previously unpublished writing of the authors, not under consideration for publication elsewhere. When review papers contain tables or graphs from copyrighted articles, the authors will be required to obtain permission for use from the copyright holders. When the organization with which the authors are affiliated requires clearance of publications, authors are expected to obtain such clearance before submission of the manuscript. Papers presented to associations other than the Federation must be released by written communication before they can be considered for publication in the JOURNAL OF COATINGS TECHNOLOGY. Authors are obligated to reveal any exceptions to these conditions at the time a manuscript is submitted.

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

Papers in which proprietary products or processes are promoted for commercial purposes are specifically nonacceptable for publication.

SUBMISSION OF MANUSCRIPTS...

...for the Journal

Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 1315 Walnut St., Philadelphia, PA 19107. The cover letter should address copyright clearance, and release issues discussed above and should specify paper category: *Original Research, Review, Open Forum*, or *Back to Basics*.

Letters to the Editor: The JOURNAL will consider for publication all correspondence relevant to the coatings industry and to the contents of the JOURNAL. When a letter concerns an article appearing in the JOURNAL, the original author is usually given an opportunity to reply.

...by Constituent Societies For Annual Meeting Presentation

Ten complete copies of the manuscript are required for committee review. The set of copies should be addressed to the Editor at the address listed previously.

...for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to the Chairman of the 1990 Roon Awards Committee, Richard Eley, The Glidden Co., 16651 Sprague Rd., Strongsville, OH 44136. (For complete details, see "Roon Awards" section of the JOURNAL in January 1990 issue.)

MANUSCRIPT PREPARATION

In general, authors are advised to use the "Handbook for Authors" published by the American Chemical Society as a guide to the preparation of manuscripts (ACS, 1155 Sixteenth St., Washington, D.C. 20036). Another excellent reference work is "How to Write and Publish a Scientific Paper," by Robert A. Day (ISI Press, 3501 Market St., University City Science Center, Philadelphia, PA 19104).

Authors are encouraged to consider submissions in several categories and to prepare their manuscripts accordingly. The categories are:

Original Research Papers: The main technical content of the JOURNAL OF COATINGS TECHNOLOGY will continue to be original research papers. Editors support the trend in scientific writing to a direct, less formal style that permits limited use of personal pronouns to avoid repetitious or awkward use of passive voice.

Review Papers: Papers that organize and compare data from numerous sources to provide new insights and unified concepts are solicited. Reviews that show how advances from other fields can beneficially be applied to coatings are also desired. Reviews that consist mainly of computer searches with little attempt to integrate or critically evaluate are not solicited.

Open Forum: Topics for this category may be nontechnical in nature, dealing with any aspect of the coatings industry. The subject may be approached informally. Editors encourage submission of manuscripts that constructively address industry problems and their solutions.

Back to Basics: Papers that provide useful guides to Federation members in carrying out their work are solicited. Topics in this category are technical but focus on the "how to" of coatings technology. Useful calculations for coatings formulation and procedures that make a paint test more reproducible are examples of suitable topics. Process and production topics, i.e., paint manufacture, will also be reviewed in the *Back to Basics* category.

If a submitted paper consists of the text of a presentation made previously to a monthly or special meeting of a Society for Coatings Technology, or to another technical group, the name of the organization and the date of the presentation should be given. If someone other than the author of the paper made the presentation, this information, too, should be noted. Papers originally composed for oral presentation will have to be revised or rewritten by the author to conform to the style described in this guide.

Manuscripts should be typed with double spacing on one side of $8^1/2 \times 11$ 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

Main headings and sub-headings should be used to improve readability, and to break up typographical monotony. The text should *not* be presented as an alphanumeric outline.

The main headings usually should be INTRODUCTION, EXPERIMENTAL, RESULTS AND DISCUSSION, and SUMMARY or CONCLUSIONS. Sub-headings will be specific to the subject.

Only as much review as is necessary should be given to provide an introduction to the subject; the main burden for extensive background should be placed on the list of references.

Standard scientific and technical terminology should be used to convey clear and unambiguous meaning, but the use of technical jargon or slang should be avoided. Authors should bear in mind that the JOURNAL has an international audience, for many of whom English is a second, not native, language. Use of regional idioms or colloquialisms should be avoided. The use of obscure abbreviations is also discouraged. When appropriate, abbreviations should be made in parenthesis immediately following first mention of the term in the text, and then used alone whenever necessary.

Recent issues of the JOURNAL should be consulted for desired style and technical level.

Metric System

Metric system units should be used wherever applicable with the equivalent English units shown afterwords in parentheses. The ASTM Metric Practice Guide, E 380-72 (American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103) is a convenient reference.

Tables, Graphs, and Drawings

Tables, rather than descriptive text, should be used only when they are genuinely helpful. They should be proportioned in accordance with the height and width limitations of the JOURNAL'S pages. Each table should be typed on a separate sheet, rather than included in the text, and appended to the manuscript. Each table should be numbered and have a descriptive caption. Tables should be referenced in the text (e.g., "See *Table* 1").

In numerical data in tables, numbers less than one should have a zero before the decimal point.

Graphs should be on good quality white or nonphotographic blue-lined 8 1/2 x 11 inch paper. Each graph should be drawn on a separate sheet, numbered, and the captions listed on a *copy* of the original graph. Graph captions and legends should also be typed on a separate sheet from original for typesetting.

Drawings should conform to the guidelines given for Graphs and should be proportioned to fit the height-to-width ratio of the JOURNAL'S pages and columns.

Photographs

All photographs should be sharp, clear, black-and-white prints no larger than 8 x 10 inches in size. Photos should be clearly labeled on the reverse side, taking care not to mar the image.

Color prints and slides are unacceptable.

When illustrations are secured from an outside source, the source must be identified and the Editor assured that permission to reprint has been granted.

Nomenclature

Whenever possible, generic names should be used in preference to trade names. When trade names must be used to avoid ambiguity, and the name is a registered trademark, the symbol R, in a circle or parentheses, should be given immediately following, and the manufacturer listed as a footnote. In general, trade names should be used only in footnotes or in an appendix, rather than in the text.

If special nomenclature is used, include a nomenclature table giving definitions and dimensions for all terms.

Nomenclature of chemical compounds should conform to the style of *Chemical Abstracts* and the IUPAC rules. For oligomeric or polymeric materials, characteristics such as molecular weight, polydispersity, functional group content, etc. should be provided.

Equations

Equations must be typed, or written clearly, with equations numbered sequentially in parentheses to the right. If Greek letters are used, write out their names in the manuscript margin at the first point of use. Place superscripts^{a} and subscripts$_{b}$ accurately. Avoid the use of superscripts in a manner that can lead to their interpretation as exponents.

Summary

The paper should be concluded with a summary which is intelligible without reference to the main text. The summary may be more complete than the abstract, listing conclusions drawn from the text. A well written summary can serve to inspire the busy reader to turn back to the paper, to read it thoroughly.

Acknowledgment

If used, it should follow the summary.

References

These should be listed in the numerical order in which they are cited in the text, and should be placed at the end of the manuscript. Names of authors may or may not be shown in the text with reference numbers. If possible, include titles of articles referenced in the literature. The following are examples of acceptable reference citations for periodicals, [1,2,3] books, [4] and patents.[5]

(1) Pascal, R.H. and Reig, F.L., "Pigment Colors and Surfactant Selection," *Official* DIGEST, *36*, No. 475 (Part 1), 839 (1964).

(2) Davidson, H.R., "Use and Misuse of Computers in Color Control," JOURNAL OF COATINGS TECHNOLOGY, *54*, No. 691, 55 (1982).

(3) Stephen, H.G., "Hydrogen Bonding—Key to Dispersion?," *J. Oil & Colour Chemists' Assoc.*, *65*, No. 5, 191 (1982).

(4) Patton, T. (Ed.), "Pigment Handbook," Vol. 1, John Wiley & Sons, Inc., New York, 1973.

(5) Henderson, W.A. Jr. and Singh, B. (to American Cyanamid Co.), U.S. Patent 4,361,518 (Nov. 30, 1982).

OTHER INFORMATION

Galley proofs will be sent to the author for checking about six weeks prior to publication.

Offprints may be purchased in quantities of 100 or more. Authors will receive price quotations. Each author will receive a complimentary copy of the JOURNAL issue in which his or her paper was published.

* * * *

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G. Inge Bäck and L.S. Kopp†
Swedish Steel Strip Products*

A method for predicting outdoor service life of PVC-plastisols on hot-dip galvanized steel for use on buildings has been investigated through 15 years of outdoor exposure and Weather-Ometer testing. Changes in gloss, color, and residual heat stability have been used as the criteria for the decomposition of the PVC-films. Plasticizer retention and dirt pick-up have also been studied. The life span of the tested PVC-plastisols exposed to the most severe climatic conditions is estimated at 15-20 years.

INTRODUCTION

PVC-Plastisols

A PVC-plastisol is a dispersion of very finely divided polyvinylchloride resin in organic plasticizers which are not capable of dissolving the resin at room temperature. In addition to this, a PVC-plastisol contains pigments and additives. Generally, a PVC-plastisol consists of: PVC-resin, 60 parts by weight; plasticizers, 30 parts by weight; and pigments and additives, 5-10 parts by weight. The plasticizers used are usually phthalates and the PVC-resins are of the dispersion type with relatively high molecular weights, prepared by the emulsion process.

The formation of a continuous PVC-film is obtained by heating the plastisol to 180-200°C until the resin particles are dissolved by the plasticizer and cause the PVC-particles to gel or fuse. At room temperature, the plasticizers have no or little effect on the PVC-particles and act as a dispersant. This is why PVC-plastisols can not "dry" at room temperature. *Figures* 1 and 2 illustrate "under-cured" and sufficiently "cured" PVC-plastisol films.

To achieve adhesion between the PVC-film and the substrate, a special type of primer is required. For all panels in this investigation, the dry film thickness of the primer is approximately 6 μm and the dry film thickness of the plastisol is 180-200 μm, with the substrate being hot-dip galvanized (HDG) steel Z 275 (275 g of zinc per m^2 both sides) pretreated with Bonderite® 1303.

Bonderite 1303 is a chemical conversion coating which forms complex metal salts on the zinc surface to give enhanced corrosion protection and good adhesion to the primer.

Decomposition of Plastics, Especially PVC, Through UV-Radiation and Heat

Ultraviolet (UV) radiation has a very high energy level in comparison with visible and infrared radiation. The shorter the wavelength the higher the energy.[1] The breakdown of polymers caused by radiation with wavelengths of 280-400 nm is obvious, but to have a decomposing effect, the energy must be greater than the lowest bonding energy within the polymer molecule. Besides, only radiation that is absorbed by the polymer molecule has a decomposing effect.[2]

It has been found that most polymers have a high UV-absorption under 280 nm but the absorption in the range 280-400 nm can vary considerably.[1] Radiation below 280 nm is not present in solar radiation at the surface of the earth.[3]

The molecular structure of PVC is shown in *Figure* 3.

The radiation from the sun contains more than enough energy to break down the C-Cl and C-H bonds in polyvinylchloride. (Bond strength for C-Cl is 78.5 kcal/gmol and for C-H 98.8 kcal/gmol.[2]) The absorption by PVC in the relevant radiation range is very high and approximately 80% is absorbed.

Through the influence of UV-radiation and/or heat, unstabilized PVC decomposes easily due to the formation of hydrogen chloride (*Figure* 4).[1] As can be seen in this figure, conjugated double bonds are formed which can be

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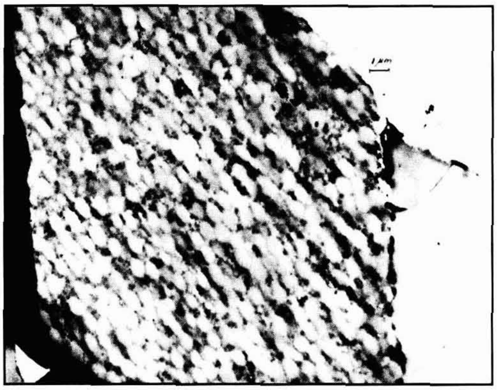


Figure 1—Not completely fused (gelled) plastisol. The oblong lighter particles are PVC and the dark ones are pigments. Approximately 6000x

oxidized and they form chromophore groups causing discoloration. The conjugated double bonds can be established by analysis of the absorption of UV-light and chromophore carbonyl groups are confirmed by infrared analysis.[1]

Through measurement of fluorescence and yellowing, the critical wavelengths for different polymers have been established.[1] Wavelength of maximum damage for PVC is 320 nm.[3]

Stabilization of PVC Against Breakdown Caused by UV-Radiation and Heat

Although complete prevention of the decomposition of polymers through UV-radiation is not possible, the life span can, through the proper choice of stabilizers and pigments, be prolonged so that polymeric materials can compete against and often surpass the life span of traditional building materials.

When stabilizing PVC, one has to consider both UV-radiation and heat: heat because of the high temperature used when gelling the plastisol (usually around 200°C),

Figure 2—The same plastisol as in *Figure* 1, but completely gelled to form a continuous film. Single PVC-particles can no longer be seen but for a few pigment particles. Approximately 6000x

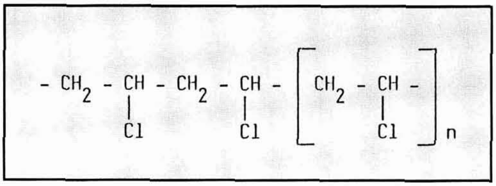


Figure 3—Theoretical molecular structure of PVC

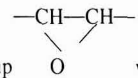
and UV-radiation when the plastisol is exposed outdoors and subjected to sunshine. The decomposition product is, in both cases, hydrogen chloride.

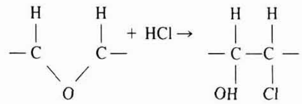
When looking at the earlier described decomposition mechanism of PVC, it can be seen that stabilizers for PVC must have one or more of the following capabilities: to absorb UV-radiation and convert it into "harmless" energy; to act as an acceptor for hydrogen chloride; to act as an antioxidant; and to eliminate the conjugated double bonds.

Among the vast numbers of compounds that have been used to stabilize PVC, the following can be mentioned: basic leadsulphate and -sulphite; metal-organic compounds containing barium, cadmium, calcium, zinc, tin, and lead; epoxy-compounds; and UV-absorbers (benzotriazoles, hydroxybenzophenones, etc.). Usually a mixture of two or more stabilizers is used for maximum protection of PVC.

A common stabilizer combination is an organic barium-cadmium compound together with an epoxy compound. A modern approach in PVC stabilization is to use tin stabilizers alone or in combination with barium/cadmium compounds. In the latter, cadmium reacts with hydrogen chloride in the following manner:

$$Cd(C_{17}H_{35}COO)_2 + 2HCl \rightarrow CdCl_2 + 2C_{17}H_{35}COOH$$

The very reactive epoxy-group  will react with hydrogen chloride in the following manner:



Both these reactions will bond hydrochloric acid and keep it from further attacks on the PVC-molecule preventing embrittlement.

Epoxy-compounds can also eliminate eventual conjugated double bonds. Some cyclic compounds function as UV-absorbers, for example, benzotriazoles and hydroxyphenones (see *Figure* 5[2]). Apart from the stabilizers mentioned here, many pigments have a stabilizing effect through their ability to absorb UV-radiation.[4]

Plasticizers

As mentioned earlier, PVC-plastisols contain approximately 30% plasticizer. These are usually phthalates of various molecular weight and different evaporation rates. It is important to chose plasticizers with a low evaporation rate to increase the life span of the PVC-plastisol.

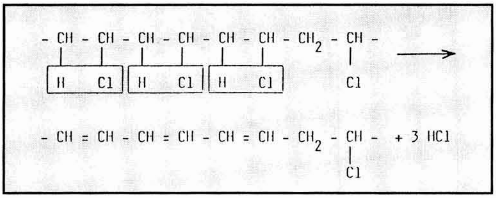


Figure 4—Formation of hydrogen chloride by decomposition of PVC

PVC-resins can only bond strongly, by polar attraction, a limited amount of plasticizer. The rest migrates to the surface and will thus be lost through evaporation (easier than the strongly bonded plasticizer). Gesner[5] has shown that 70% of the dioctylphthalate (DOP) in a 55-45 mixture of PVC-DOP is more strongly bonded to the PVC-resin than the rest of this plasticizer.

EXPERIMENTAL

Test Sites

Test panels (100 × 150 mm unbacked) in 28 different colors were exposed at Bullerforsen and Bohus Malmön (Kattesand) at 45° facing south. In addition to this, panels were exposed at Bullerforsen on an insulated box at 0°, 45°, and 90° facing south. Dirt pick-up was studied on selected panels exposed at Bohus Malmön.

Bullerforsen (N60°30′, E15°20′) is situated in Borlänge, approximately 2 km north of Domnarvet Steelworks and approximately 2 km south of Kvarnsveden Papermill at the river Dalälven. The environment can be described as "mild industrial."

Bohus Malmön (N58°12′, E11°22′) is an island situated 130 km north of Gothenburg. The test site can be found on a rock 40 m above sea level and 300 m from the shore (Skagerack). The environment is marine with high humidity and salinity, with prevailing winds from the sea. Average maximum temperature during May, June, July, and August shows a higher temperature for Bullerforsen (20°C) than for Bohus Malmön (17°C).[6]

It is worth mentioning that during the months of May, June, July, and August, 60% of the total UV-radiation during one year is received. The UV A-radiation (315-400 nm) counts for 4-6% of the total energy radiated.

Average temperatures and the total radiated energy (kWh/m^2) per year for some different locations can be seen in *Table* 1.

Table 1—Average Temperature and Radiated Energy for Some Different Locations

Location	Average Temperature °C	Radiated Energy kWh/M^2/yr
Teeside, England	8.5[7]	1046[7]
Miami, Florida	23.8[7]	1743[7]
Bullerforsen, Sweden	7.0[8]	641[6]
Bohus Malmön, Sweden	5.5[8]	622[6]

Weather-Ometer Testing

For accelerated testing of different materials, a Weather-Ometer was used. This apparatus, available in many different configurations, is designed to imitate "natural" weather (e.g., sunshine and rain) but with a higher intensity in order to cause quicker changes in the exposed materials than by natural outdoor aging.

In this investigation, an Atlas XW-R Sunshine Carbon Arc Weather-Ometer with the "dew-cycle" (ASTM D 3361) was used. According to this norm, the materials to be tested were subjected to one-hour radiation from an unfiltered open carbon arc followed by one-hour of cold water spray (7°C) on the back of the test panels causing water to condense (dew formation) on the front side of the panels. Black panel temperature was 63 ±5°C and relative humidity 50 ±5% during the light period. During the dark period, the temperature was 32 ±3°C and relative humidity 95 ±3%.

The carbon arc radiates 29 W/m^2 of 280-340 nm and 124 W/m^2 of 340-400 nm according to the manufacturers brochure; another source reports 48.5 J/cm^2/hr of radiation under 400 nm.[7]

Residual Heat Stability (RHS)

As mentioned previously, hydrogen chloride is emitted when PVC decomposes. Decomposition is retarded by the addition of stabilizers. When the stabilizers are totally consumed, the thermal decomposition starts. By measuring the time to hydrogen chloride emission at elevated temperature (200°C), a measure of heat stability is received. A comparison of the times to HCl-emission from exposed and unexposed PVC-plastisols indicates then the state of decomposition and hence an indication of service life (see *Appendix* for procedure).

Plasticizer Retention

To investigate the amount of plasticizer left in the PVC film after exposure, the following procedure was used. Approximately 4 cm^2 of PVC-film was dissolved in tetrahydrofuran. After centrifuging to remove the undissolved material, the PVC resin was precipitated by adding an excess of methanol and then filtering. The solution was then subjected to evaporation and the residue dissolved in

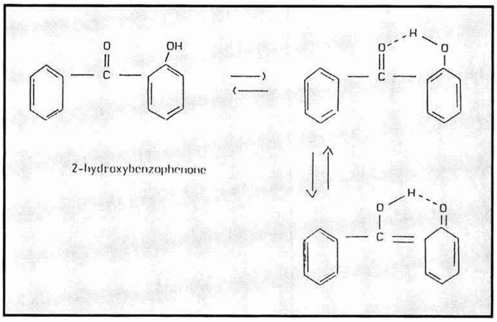


Figure 5—The shift between the two tautomere forms seems to be an energy consuming reaction (using the energy from UV-radiation) without affecting the polymer and leaves the stabilizer molecule unharmed[2]

Table 2—Gloss Retention at Bullerforsen. Panel No. E69-161-015

Months of Exposure	Gloss Retention %
0	100
4	64
10	87
22	91
34	91
46	91
60	68
73	45
84.5	45
95.5	45
103.5	41
114	41
125.5	32
136	32
167	12

Linear regression analysis gives[9]: Y-intercept = 94.89; slope = −0.50. Months to gloss equal to 3% of original: $3 = 94.89 - 0.50x$; x = months; and $x = \frac{94.89 - 3}{0.50} = 183.78$.

a mixture of methylene chloride and n-hexane. The amount of phthalates was then determined by liquid chromatography.

Color-Difference Measurements

Color-differences have been measured with Color-Eye and the values calculated according to ASTM D 2244 into NBS-units.

Gloss Measurements

Gloss was measured according to ASTM D 523 at 60°.

Scanning Electron Microscopy (SEM)

Three different colors exposed at Bohus Malmön were photographed in SEM at 5000x magnification.

RESULTS

In our opinion and based on our experience, the service life of a PVC-plastisol film (200 μm) is over when the retained gloss is approximately 3% and/or the time to HCl-emission [residual heat stability (RHS)] approximately 5% of the time to HCl-emission on unexposed material. After this, the plastisol becomes brittle and starts to flake. Service life in relation to color change is more difficult to judge, since this is greatly dependent on the choice of pigments. In the United States, where warranties often are given on coated metal sheets for building purposes, a maximum color difference of E = 7 NBS-units is often used. Consequently, we have chosen this as a criterion.

Table 3—Change in RHS at Bohus Malmön. Panel No. E69-161-015

Months of Exposure	RHS %
0	100
111	76
144	66

Linear regression analysis gives[9]: Y-intercept = 100.0; slope = −0.23. Months to RHS equal 5% of original: $5 = 100 - 0.23x$; x = month; and $x = \frac{100 - 5}{0.23} = 413.04$.

Color-, gloss-, and RHS-values were treated with linear regression analysis.[9] The length of life for our plastisols can then be calculated from the following formulas:

Months of exposure to obtain 3% gloss retention: $\frac{\text{Y intercept} - 3}{\text{slope}}$ see *Table* 2 (1)

Months of exposure to obtain 5% RHS: $\frac{\text{Y intercept} - 5}{\text{slope}}$ see *Table* 3 (2)

Months of exposure to obtain a color change of E = 7: $\frac{7 - \text{Y intercept}}{\text{slope}}$ (3)

Figures 6-17 show the results comparing light and dark colors.

Figures 18-20 show a comparison of the two test sites. *Figures* 21 and 22 show a comparison between the test sites and Weather-Ometer.

Figures 23 and 24 show the results from the exposure with insulated backing (Bullerforsen) during 12 years.

Figures 25-29 show SEM-photos of exposed and unexposed plastisols. *Figures* 30 and 31 show buildings with plastisol-coated sidings. *Figures* 32-34 show dirt retention of plastisols: severe during the first two years of exposure, diminishing thereafter, and completely gone after six to seven years.

Figure 35 shows plasticizer retention on outdoor exposure.

A formula for the calculation of the approximate length of life of 200 μm plastisol coatings is proposed based on accelerated testing and presented in the next section.

Comments to the Results

GLOSS-COLOR-RHS: Color changes during outdoor exposure did not give a true picture of the decomposition of PVC-plastisols and, consequently, no indication of the life of the coating. Provided that lightfast pigments were used, the only factors affecting color change were dirt pick-up and changes in gloss. Both changes in gloss and heat stability can be related to the durability of the PVC-film. (See previous section.)

That RHS-tests showed a longer service life of the coating than gloss changes did probably depends on the fact that gloss changes only occur on the very surface of the coating while heat stability is measured in the entire film.

LIGHT COLORS COMPARED WITH DARK: "Dark colors" equal colors with Y-value below 25, "light colors" equal colors with Y-value ≥ 25. Y equals the value on the lightness scale, according to CIE—1931 and 1964 Color Spaces (see, e.g., ASTM D 2244).

Dark colors showed greater changes than light ones. The difference was so great that one could talk of two separate qualities. The reason for this was that darker colors got warmer in the sunshine which accelerated the decomposition of the PVC. In addition to this, dark colors

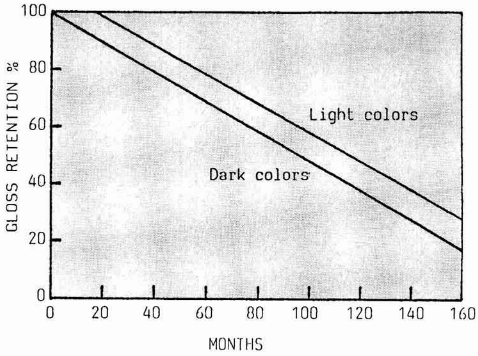


Figure 6—Changes in gloss. All panels

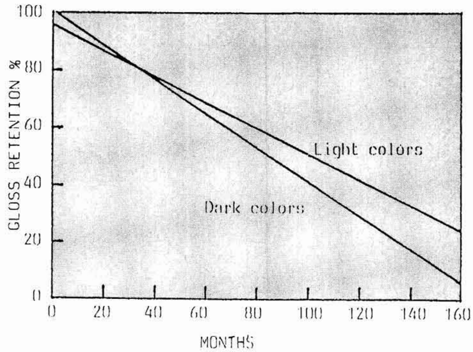


Figure 9—Changes in gloss at Bullerforsen

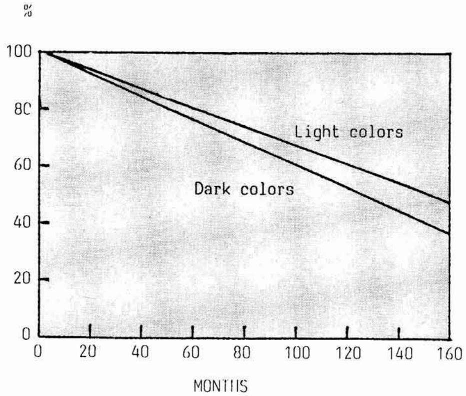


Figure 7—Changes in RHS. All panels

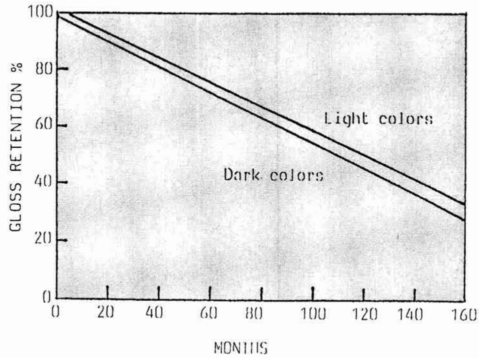


Figure 10—Changes in gloss at Bohus Malmön

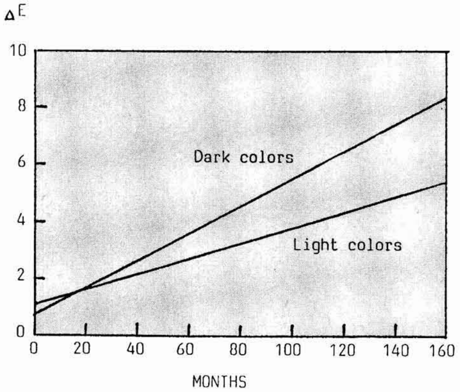


Figure 8—Changes in color. All panels

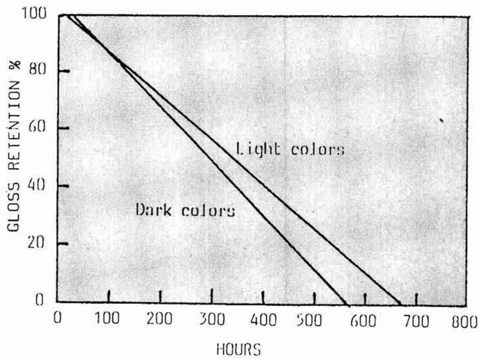


Figure 11—Changes in gloss in Weather-Ometer

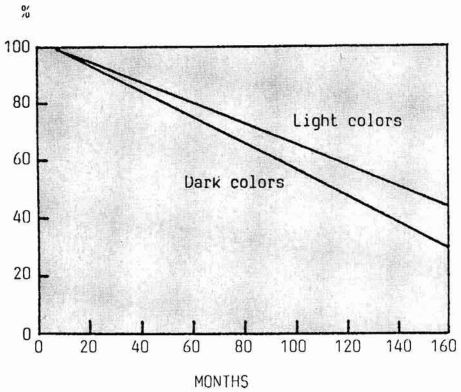


Figure 12—Changes in RHS at Bullerforsen

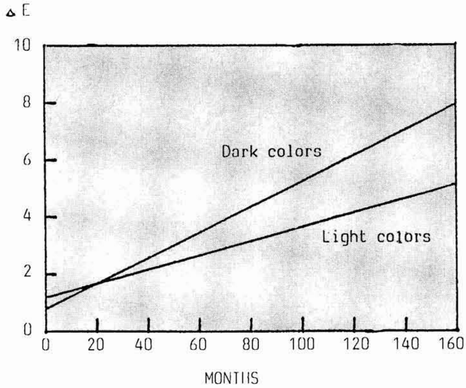


Figure 15—Color changes at Bullerforsen

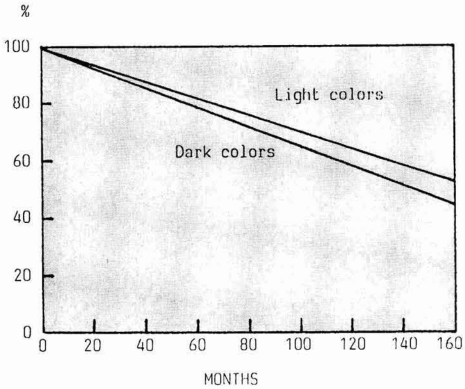


Figure 13—Changes in RHS at Bohus Malmön

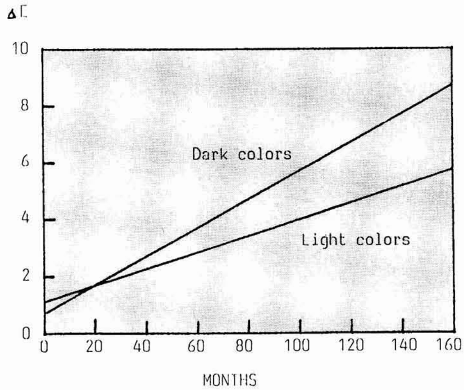


Figure 16—Color changes at Bohus Malmön

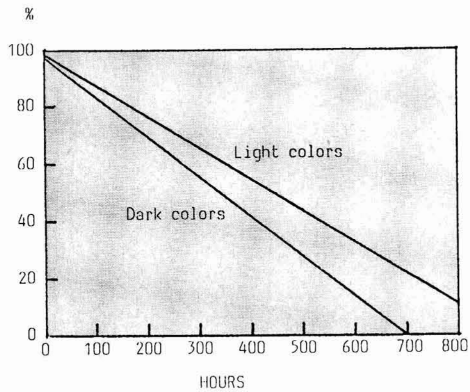


Figure 14—Changes in RHS in Weather-Ometer

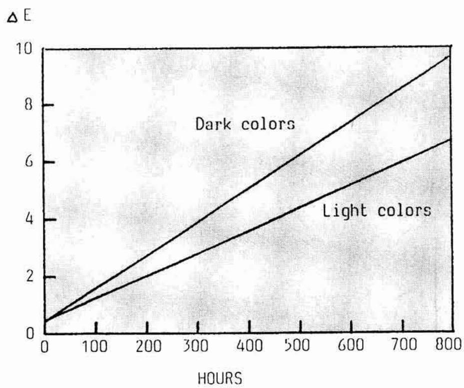


Figure 17—Color changes in Weather-Ometer

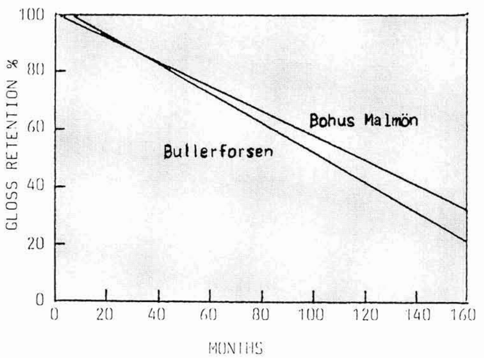


Figure 18—Comparison of gloss retention between the two test sites. All panels

have a lower pigment volume, resulting in poorer UV screening. The exception is carbon-black pigmented coatings, which in spite of low pigment volume, have high UV screening. A third reason was that decomposition products stood out more vividly against a dark background.

SEM-PHOTOS: *Figures* 25-27 show photos (5000 ×) of three different colors exposed for 15 years at Bohus Malmön. Some erosion and cracking can be seen after exposure but the main part of the coating is still intact. *Figure* 28 shows one of the colors unexposed. *Figure* 29 shows a completely decomposed PVC-plastisol coating.

COMPARISON OF THE TEST SITES: As shown in *Figures* 18 and 19, the coatings exposed at Bullerforsen aged faster than those exposed at Bohus Malmön. The reason for this is probably the result of the difference in average temperature during the summer months. Reverse relations are shown in color changes on exposure (*Figure* 20), probably due to greater dirt pick-up at Bohus Malmön.

DIRT PICK-UP: Because of their different chemical composition, plastisols have a greater tendency to pick up dirt on outdoor exposure than many other types of organic coatings. The cosmetic effect of dirt pick-up was at a maximum after two years. From that time, it diminished and was completely gone after six to seven years. This is probably a result of the condensation of plasticizer on the plastisol surface during oven curing at high temperatures. This tacky layer picks up dirt from the atmosphere but will decompose in time due to UV-radiation in the sunlight and will be washed off by rain. The fact that a decrease in gloss often occurs during the first exposure, followed by an increase in gloss thereafter, supports this theory (see *Table* 2).

Figures 32 and 33 show two different colors exposed at Bohus Malmön which clearly indicate this process. Also the color measurements shown in *Figure* 34 are instructive.

Dirt pick-up is only visible on light colors.

SERVICE LIFE OF PVC-PLASTISOLS: The PVC-molecule is very sensitive to the influence from heat and UV-radiation. The decomposition mechanism is well understood and documented.

Results of the decomposition are discoloration and embrittlement caused by the emission of hydrogen chloride. Hydrogen chloride will also accelerate the decomposition. Through the addition of stabilizers, which are chemical compounds that react with hydrogen chloride and thus retard the decomposition process, the time to break down is prolonged.

Since stabilizers are consumed in reaction with hydrogen chloride, this fact will determine the length of life for a PVC-plastisol (the consumption of stabilizers already starts during the gellation process in the coating ovens). By checking the heat stability of unexposed and exposed PVC-plastisols, a picture of the decomposition speed can be found.

The residual heat stability curves in *Figure* 7 show (by extrapolation) the time to 5% RHS to be of the order of 23 ± 3 years. When this stage of decomposition is reached, the next step will be cracking of the film. How long this stage will last is not known, but three to five years is a reasonable estimate. After this, the coating will peel.

The average life span of a plastisol coating should, thus, be around 25 years. If the difference in color (light to dark) is taken into consideration, the life span of light

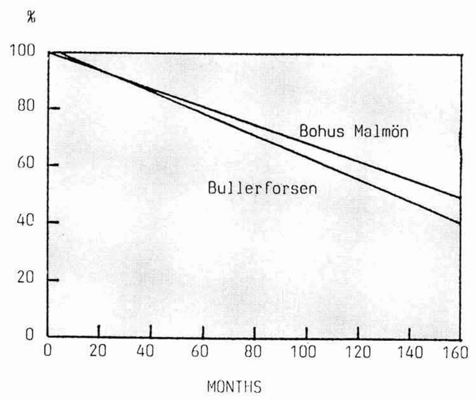


Figure 19—Comparison of RHS between the two test sites. All panels

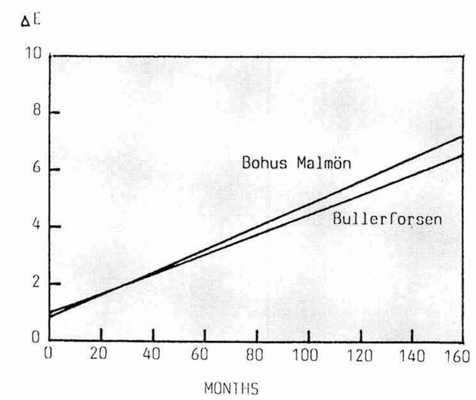


Figure 20—Comparison of color changes between the two test sites. All panels

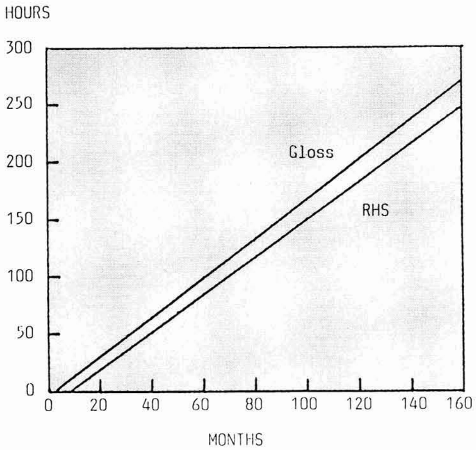


Figure 21—Comparison between exposure at Bullerforsen and in Weather-Ometer. All panels

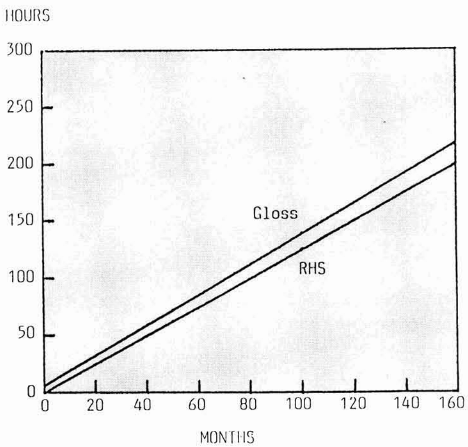


Figure 22—Comparison between exposure at Bohus Malmön and in Weather-Ometer. All panels

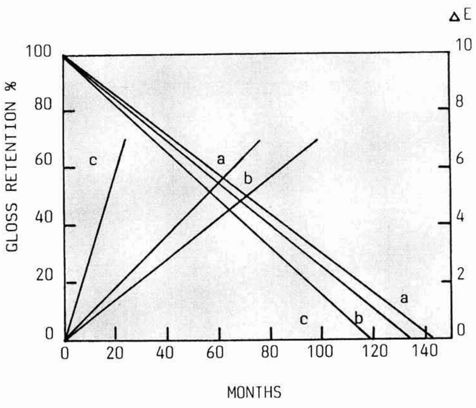


Figure 23—Comparison of gloss- and color-retention for insulated and uninsulated panels exposed at different angles. a: insulated 0° and 90°; b: uninsulated 45°; and c: insulated 45°

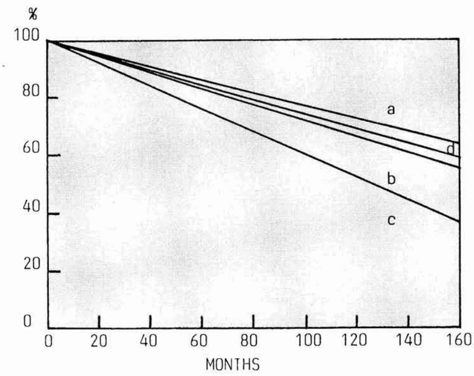


Figure 24—Comparison of RHS for insulated and uninsulated panels exposed at different angles. a: insulated 90°; b: uninsulated 45°; c: insulated 45°; and d: insulated 0°

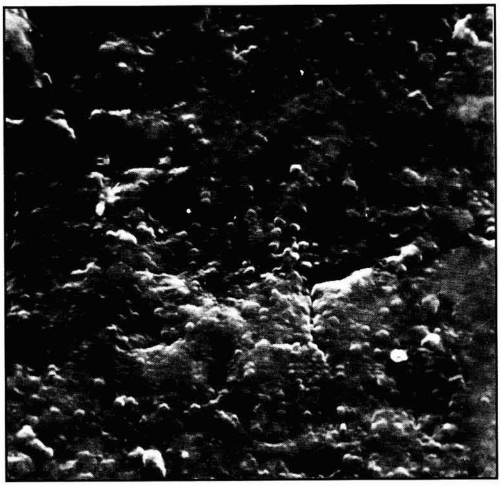


Figure 25—Dark blue plastisol. Fifteen years at Bohus Malmön, 5000x. Gloss retention = 28%; RHS = 50%

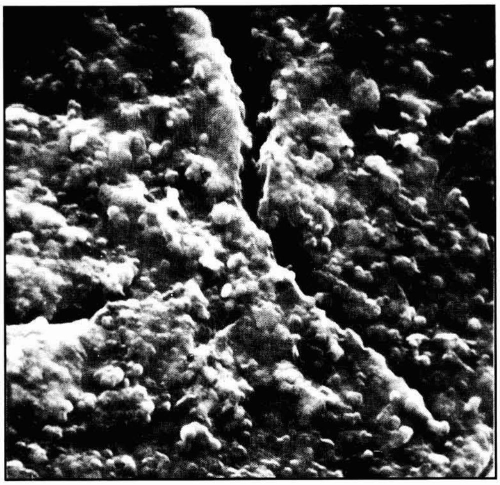


Figure 26—Medium grey plastisol. Fifteen years at Bohus Malmön, 5000x. Gloss retention = 16%; RHS = 40%

Figure 27—Dark grey plastisol. Fifteen years at Bohus Malmön, 5000x. Gloss retention = 14%; RHS = 29%

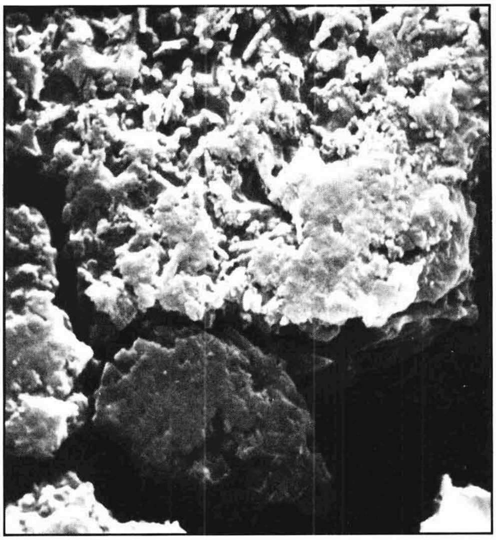


Figure 29—Dark red plastisol. Five years at Bohus-Malmön, 5000x. Gloss retention = 4%; RHS = 3%

colors is approximately 30 years and for dark colors approximately 20 years. Film thickness is important for the life of PVC-plastisols. A 100 μm film has a considerably shorter life span than a 200 μm film of the same quality PVC-plastisol.

All that has been stated previously and the conclusions that have been drawn apply only to the plastisols used in this investigation.

Theoretically, the PVC-molecule should have a better outdoor durability than it actually had. Contaminations during the manufacture of PVC-resins and lack of cleanliness during the process led to reduced heat stability.[10]

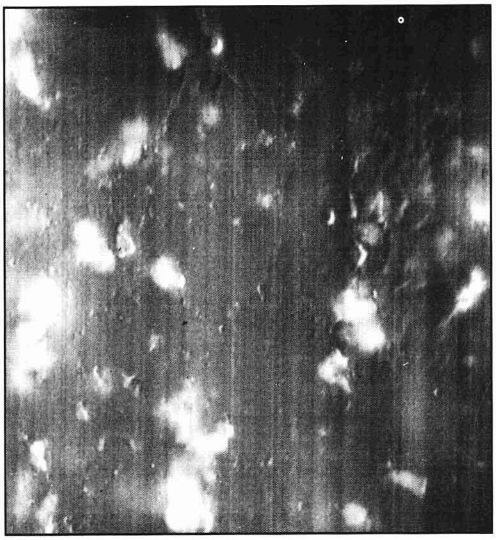


Figure 28—Dark grey plastisol. Unexposed, 5000x

Furthermore, malformations (crosslinking, chain shortening, etc.) in the molecule formed during the polymerization process provided weak points where decomposition could start.

If a "cleaner" and more uniform PVC-resin could be manufactured, it would most probably have increased heat stability and, thus, give a longer service-life to PVC-plastisols. If this improvement could be great enough, and at a reasonable cost, is as yet unknown. This will be the task of polymer chemists in cooperation with the petrochemical industry.

The creation of the very stable PVF_2-molecule could be said, with a slight exaggeration, to be an example of such an improvement, having good stability without the addition of stabilizers.

Since PVC-plastisols contain large amounts of plasticizers to give sufficient flexibility, one has to bear in mind that those organic compounds are volatile and will slowly evaporate during outdoor exposure. The choice of

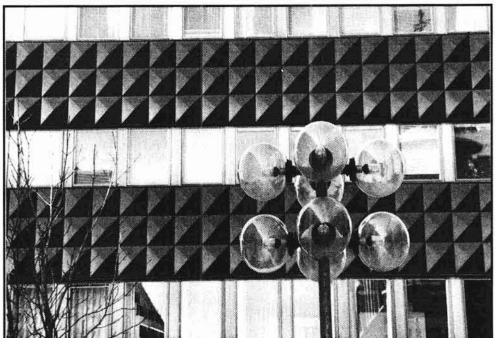


Figure 30—Plastisol coated steel panels. Public Library, Borlänge, Sweden, erected 1971

Figure 31—Plastisol coated steel panels. Office building, Uddevalla, Sweden, erected 1974

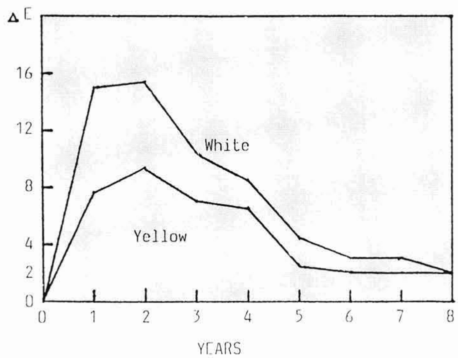


Figure 34—Dirt pick-up of white and yellow plastisols visualized through color measurements

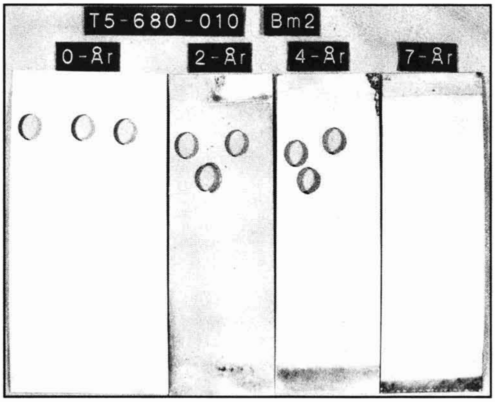


Figure 32—Dirt pick-up of a white plastisol. 0, 2, 4, and 7 yr

plasticizers will, thus, have an influence on the outdoor durability of PVC-plastisols.

An approximate value for the life of a 200 μm plastisol coating can be calculated using the following formula:

$$L = t \times \frac{LA}{LT}$$

where:

L = approximate life span in months;
t = time of outdoor exposure at 45° south in months;
LA = time in accelerated testing to gloss = 3% or RHS = 5%; and
LT = time in accelerated testing to the same gloss or RHS as at t months.

To test the validity of the formula the following calculations were made from one of the plastisols in the series:

Panel No. E69-161-015 (black):
t — after 175 months at Bohus Malmön RHS = 60%;
LA— after 854 hr in the Atlas Weather-Ometer RHS = 5%;
LT— after 360 hr in the Atlas Weather-Ometer RHS = 60%; and the

$$\text{Life span—}175 \times \frac{854}{360} = 415 \text{ months.}$$

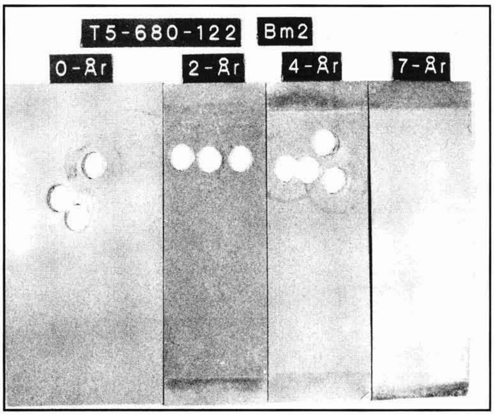


Figure 33—Dirt pick-up of a yellow plastisol. 0, 2, 4, and 7 yr

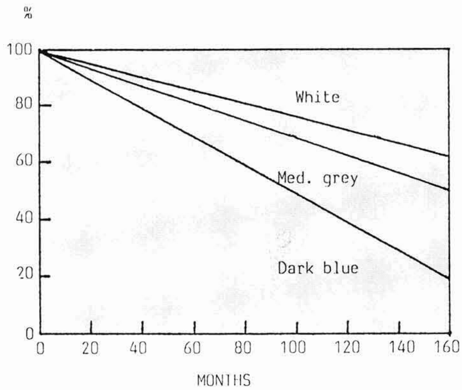


Figure 35—Plasticizer retention of three plastisols exposed at Bullerforsen

Table 4—Comparison of Gloss- and RHS-Retention Values Between Bohus Malmön and Weather-Ometer

Test	Time	Gloss-%	Time	RHS-%
Bohus Malmön.....	50 months	81	50 months	85
Bohus Malmön.....	100 months	59	100 months	70
Bohus Malmön.....	104 months	57	114 months	66
Bohus Malmön.....	150 months	37	150 months	55
Weather-Ometer....	140 hr	81	100 hr	89
Weather-Ometer....	186 hr	59	200 hr	78
Weather-Ometer....	300 hr	57	300 hr	66

Table 5—Outdoor Exposure Time Corresponding to 300 Hr in "Dew-Cycle" Weather-Ometer (ASTM D 3361)

Test Site and Color	Years to the Same Gloss	Years to the Same RHS
Bullerforsen/light	8	8
Bullerforsen/dark	7	8
Bullerforsen/all	7	8
Bohus Malmön/light..................	9	10
Bohus Malmön/dark..................	9	10
Bohus Malmön/all.....................	9	10

Calculations made from the actual exposure values of RHS using linear regression analysis gave a life span at Bohus Malmön of 413 months (see *Table* 3).

The same plastisol exposed at Bullerforsen resulted in:

t — after 167 months at Bullerforsen the gloss = 12%;

LA— after 688 hr in the Atlas Weather-Ometer the gloss = 3%;

LT— after 624 hr in the Atlas Weather-Ometer the gloss = 12%; and the

Life span—$167 \times \frac{688}{624} = 184$ months.

Calculations from the actual exposure values for gloss gave a value of 183 months to obtain a gloss of 3% (see *Table* 2).

COMPARISON BETWEEN OUTDOOR EXPOSURE AND EXPOSURE IN WEATHER-OMETER: As mentioned previously, all plastisols in this investigation were exposed in an Atlas Weather-Ometer using the "dew-cycle" for 300 hr. As a comparison, the mean values for gloss retention and RHS from Bullerforsen and Bohus Malmön were used (see *Table* 4).

As can be seen, 300 hr in the Weather-Ometer corresponded to 104 months when comparing RHS. In the same manner, all values from outdoor exposure were compared to 300 hr of Weather-Ometer exposure, as shown in *Table* 5.

By calculating the mean values from the regression equations for each panel you can have one "average" equation, for example gloss retention for dark colors exposed at Bohus Malmön or the change in RHS from all panels exposed at Bullerforsen, etc.

When comparing the equations from outdoor exposures with those from the Weather-Ometer exposure one gets straight lines, which in a diagram shows how many hours one has to expose in the Weather-Ometer to obtain the same gloss- or RHS-level as from outdoor exposure. *Figures* 21 and 22 show these relationships for the two test sites.

EXPOSURES WITH INSULATED BACKING: The service-life given previously, 26 ± 3 years, is based on the exposure of unbacked panels 45° facing south.

The question of how this compares to panels with insulation on the back is interesting since insulation is used under roofs and wall panels and causes the temperature of the coating to rise during the day. *Figure* 23 shows gloss retentions and color changes at different exposure angles with and without insulation.

Figure 24 shows the RHS of panels exposed in the same way. From this figure it can be seen that vertically and horizontally exposed insulated panels and uninsulated panels at 45° facing south have approximately the same RHS, while insulated panels at 45° facing south have a considerably lower RHS. From this, the conclusion can be drawn that the service-life of plastisol coatings used on insulated roofs with 45° inclination will be shorter than what has been stated, about nine years shorter.

Under the most adverse conditions—that is insulated roofs facing south with an inclination of 45°—the life of a plastisol is 17 ± 3 years. Under the best conditions—walls facing north—the life expectancy is at least 30 years, probably 40-50 years.

PLASTICIZER RETENTION: As can be seen in *Figure* 35, the loss of plasticizer is considerably greater in dark colors than in light, due to the higher temperature of darker surfaces subjected to sunlight. A comparison of the diagrams for RHS and plasticizer retention indicates that dark colors reach RHS = 5% and critical low plasticizer content at approximately the same time, while critical low RHS is reached considerably earlier than critical low plasticizer content in light colors.

SUMMARY

After 15 years of outdoor exposure of PVC-plastisol coated HDG-panels, in 28 different colors, at 45° to the south (inland and on the west coast of Sweden), and accelerated tests in the laboratory, the following conclusions were reached:

(1) the color change of a good quality PVC-plastisol, on outdoor exposure, is not very great and is fully acceptable for a building material;

(2) dark colors show greater color changes than light ones;

(3) color change is not a measure for durability of a PVC-plastisol;

(4) a formula has been found to calculate the approximate durability of a PVC-plastisol given gloss retention and/or residual heat stability after a relatively short outdoor exposure time and exposure in a Weather-Ometer;

(5) panels exposed inland age faster than those exposed on the coast;

(6) dirt pick-up, noticeable only on light colors, disappears completely after six to seven years;

(7) a 100μm (4 mils) plastisol film has a shorter durability than a film of 200 μm (8 mils) of the same quality;

(8) the durability of a PVC-plastisol used for insulated claddings with an inclination of less than 20° and more than 70° has been found to be 26 ± 3 years;

(9) for insulated roofs with an inclination of more than 20° but less than 70° the durability is 17 ± 3 years; and

(10) during the time covered by this report approximately 70 million m^2 of PVC-plastisol coated (200 μm) steel has been produced. This corresponds to a 1 m wide coil with a diameter of 250 m or a stack of 1 m^2 large panels with a height of 49 km or a 1 m band close to two times around the equator.

ACKNOWLEDGMENTS

The authors wish to express their thanks to Swedish Steel AB and Nobel Industries Sweden AB for permission to publish this paper.

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APPENDIX

Procedure for Determination of Residual Heat Stability (RHS)

A small glass-vessel (d in *Figure* 36) is almost submerged in silicon oil where the temperature is regulated by a thermostat (c). A slow stream of air [(a) and (b)] of the same temperature as the silicon oil is passed through the glass-vessel and into a beaker (e) containing 0,1 molar $NaNO_3$-solution, so that the air is slowly bubbling through the solution. In the beaker, a chloride-ion sensitive electrode (f) is submerged and the electrode connected to a recorder (g).

A small piece of the material to be tested is placed in the glass-vessel (d) when the oil-bath (c) and the air has reached the predetermined temperature. At the same time the recorder (g) is started.

When the breakdown of the PVC-resin starts, chloride-ions are released and registered via the electrode (f) by the recorder (g). This is seen as a deviation from the straight line drawn by the recorder from the start. The heat-stability is expressed in minutes and represents the time from the start of the test to the time the deviation in the curve occurs. The longer the time, the better the heat-stability.

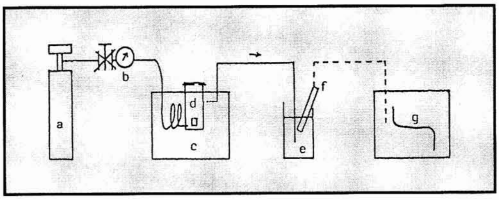

Figure 36

A Multiple-Scattering Model for Opacifying Particles in Polymer Films

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Kerr-McGee Corporation*

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Pennsylvania State University

G.C. Salzman
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A multiple-scattering model is used to define the optimum size and geometry of opacifying particles in polymer films. Application of this theoretical model indicates that 0.22-micrometer diameter rutile spheres are more effective opacifiers than either hollow rutile spheres, rutile spheres encapsulated in air, rutile spheres coated with quartz, or quartz spheres coated with rutile. For a suspension of solid rutile spheres distributed in size, the optimum mode diameter shifts to smaller values the greater the coefficient of variation of the distribution. Moreover, for a given coefficient of variation, opacity decreases more rapidly with diameter for small particles than for particles larger than the optimum size.

These conclusions result from detailed calculations of the luminous reflectance of polymer films in which exact solutions for scattering by coated and uncoated spheres were used. Several parameters not accounted for in previous studies are included in the present model. These parameters are the anisotropy of rutile, the wavelength dependence of its principal refractive indices, the spectral variation of the incident light (tungsten and daylight), and the spectral response of the human eye.

INTRODUCTION

Scattering of light by particles in polymer films has been examined by several investigators to define the most effective opacifier and to establish the theoretical limits of opacity in polymer coatings. The studies presented in references (1)-(6) are good examples of previous investigations based on the physics of light scattering.

Advances in computational facilities over the last decade have increased the degree of sophistication possible for models used to define the optical limits of coating technology. It is now possible to extend these previous efforts substantially by simulating the performance of opacifiers over a wide range of wavelengths. This capability allows development of models that include several terms not considered in previous work,[1-6] such as the wavelength dependence of the refractive index of the opacifying particle, the spectral intensity of the illumination source, and the optical response of the observer or instrumentation used to measure opacity.

In view of the degree of sophistication that is now possible, the present investigation was undertaken to further elucidate the behavior of several types of rutile (TiO_2) spheres in polymer films over the visible spectrum.

PROCEDURE

Anisotropy of Rutile

The rutile phase of titanium dioxide is a uniaxial crystal. Unfortunately, there is not an exact solution to the problem of scattering by spherical particles composed of such a crystalline substance, that is, one with different refractive indices for different states of polarization. Thus, in previous investigations, calculations used a fictitious isotropic substance with a refractive index taken to be the average refractive index of the anisotropic substance. Although there is no theoretical justification for

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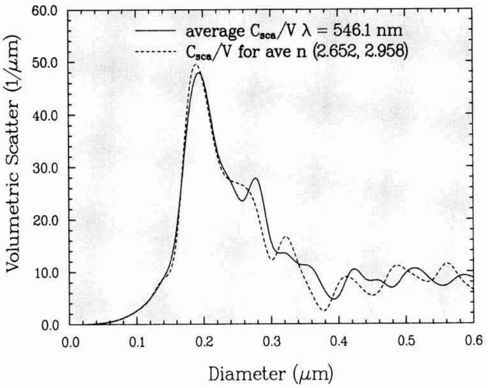

Figure 1—Volumetric scattering cross section of rutile at 546.1 nm as a function of particle diameter. The refractive index of the medium was 1.0. The solid curve shows the average of the volumetric scattering cross sections calculated from the refractive indices of rutile at 546.1 nm. The dashed curve shows the volumetric scattering cross section calculated from the average of the refractive indices at this wavelength

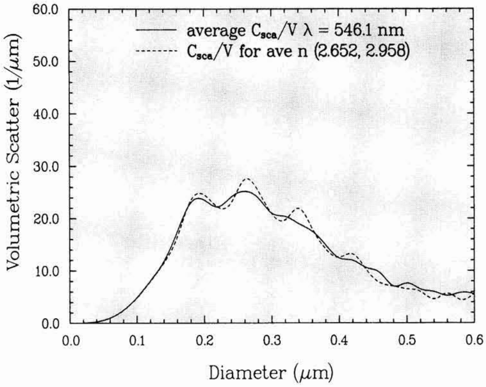

Figure 2—Volumetric scattering cross section of rutile at 546.1 nm as a function of particle diameter. The refractive index of the medium was 1.55. The solid curve shows the average of the volumetric scattering cross sections calculated from the refractive indices of rutile at 546.1 nm. The dashed curve shows the volumetric scattering cross section calculated from the average of the refractive indices at this wavelength

this procedure, it probably does not lead to serious errors if the anisotropy is small. However, rutile is sufficiently anisotropic that using its average refractive index in scattering calculations could lead to unacceptable errors. Therefore, this area was considered in the initial portion of the present investigation.

For sufficiently small (compared with the wavelength of the incident light) anisotropic spheres, there is an exact solution to the scattering problem. As a consequence of this solution, the average scattering cross section of an ensemble of randomly oriented, small, anisotropic spheres is the average of the cross sections for each principal refractive index. That is, instead of determining an average refractive index for use in calculating a single scattering cross section, one calculates a scattering cross section for each principal refractive index and then averages the resulting cross sections.

Therefore, there is some theoretical justification for computing average cross sections. To test the validity of using average refractive indices of rutile in scattering calculations, calculations were performed using the two different procedures.

For this portion of the study, we used the wavelength at which the anisotropy of rutile is greatest, 546.1 nm. The volumetric scattering cross section, C_{sca}/V, (scattering cross section per unit particle volume) was calculated using the computer program presented in *Appendix* A of Bohren and Huffman.[7] Briefly, this program calculates C_{sca}/V from Mie theory as discussed in reference (7) and also described by van de Hulst[8] and Kerker.[9] Verification of these computer programs is also addressed by Bohren and Huffman.

The results of these computations are shown in *Figure* 1. The term λ in this illustration is the wavelength. The refractive index data of Devore[10] were used in this work. The solid curve is the volumetric scattering cross section averaged for the two principal refractive indices. The chain dash curve is C_{sca}/V for the average refractive index.

The refractive index of the medium was 1.0. Note that the two procedures give a noticeable shift in the radius at which volumetric scattering is a maximum. *Figure* 2 shows the same calculations for particles in a medium with a refractive index of 1.55, a typical value for a polymer film. The differences are reduced because the refractive index of the particles relative to that of the surrounding medium is smaller.

However, volumetric scattering is not the only single-particle property that determines the reflectance of a mul-

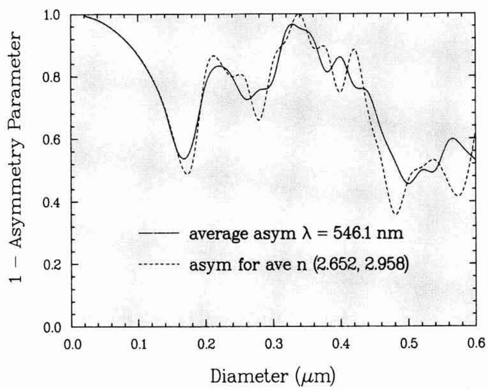

Figure 3—The quantity 1−g for rutile at 546.1 nm as a function of particle diameter. The refractive index of the medium was 1.0. The solid curve shows the average of 1−g calculated from the refractive indices of rutile at 546.1 nm. The dashed curve shows 1−g calculated from the average of the refractive indices at this wavelength

tiple-scattering medium such as a paint film; the asymmetry parameter g (mean cosine of the scattering angle) is also a determinant. *Figure* 3 shows 1–g as a function of particle diameter for the two different ways of treating particle anisotropy. The asymmètry parameter was also calculated using the computer program in reference (7). The refractive index of the medium was 1.0. *Figure* 4 shows the same curves for the case in which the refractive index of the medium was 1.55. Note that again there is a shift, this time in the positions of the first minimum in the curves. The shift of the minimum of the asymmetry parameter is, however, opposite that of the maximum of the volumetric scattering cross section.

Since it is the product of the volumetric scattering and 1–g that determines diffuse reflectance, these two shifts in opposite directions tend to cancel, which is shown in *Figures* 5 and 6 for the cases in which the refractive index of the medium is 1.0 and 1.55, respectively. In these figures s, the scattering coefficient, is the product of volumetric scattering and 1–g. There are certainly differences between results obtained by the two different methods for some diameters, but these differences are small near the most important diameter, that for which s is a maximum. Therefore, we conclude that there is good justification for using average refractive indices in calculating scattering by rutile spheres with diameters around 0.2 micrometer.

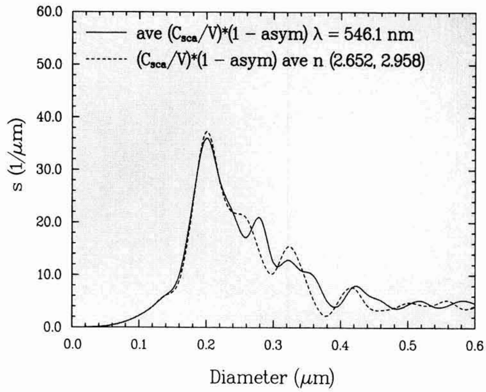

Figure 5—Scattering coefficient for rutile at 546.1 nm as a function of particle diameter. The refractive index of the medium was 1.0. The solid curve shows the average scattering coefficient calculated from the refractive indices of rutile at 546.1 nm. The dashed curve shows scattering coefficient calculated from the average of the refractive indices at this wavelength

Computation of Opacity

After the anisotropy issue was examined, the performance of rutile particles in polymer films was computed for several cases. In so doing, we took into account the wavelength dependence of the refractive indices of rutile, the wavelength variation of the incident light, and the wavelength dependence of the response of the human eye. We did not take into account absorption by rutile since rutile does not absorb appreciably in the visible spectrum.

According to a simple two-stream theory of radiative transfer,[11] the monochromatic reflectance R of a suspension of identical nonabsorbing particles overlying a black surface is,

$$R(r,\lambda,n_p,n_m,fh) = \frac{s(r,\lambda,n_p,n_m)fh}{2+s(r,\lambda,n_p,n_m)fh} \qquad (1)$$

where r is the particle radius, λ is the wavelength in vacuum, n_p is the particle refractive index (no absorption assumed), n_m is the refractive index of the medium, f is the total particle volume per unit volume of film, and h is the film thickness. The scattering coefficient s is (C_{sca}/V) (l–g). The volumetric scattering cross section and asymmetry parameter depend on the particle diameter

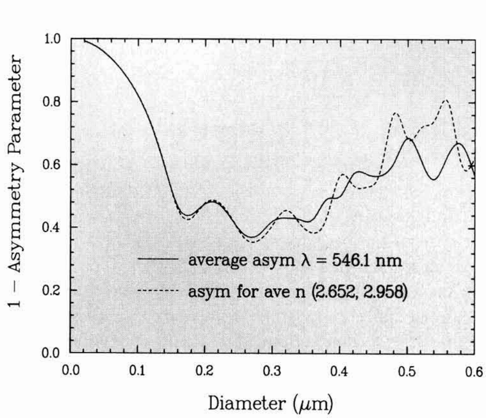

Figure 4—The quantity 1–g for rutile at 546.1 nm as a function of particle diameter. The refractive index of the medium was 1.55. The solid curve shows the average of 1–g calculated from the refractive indices of rutile at 546.1 nm. The dashed curve shows 1–g calculated from the average of the refractive indices at this wavelength

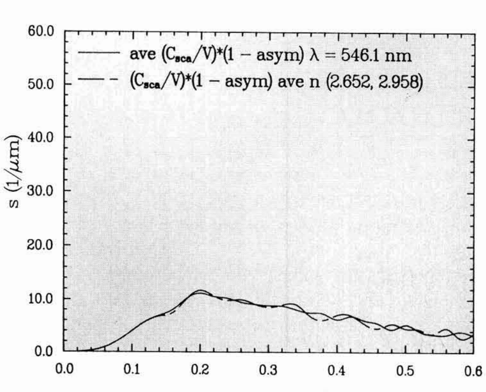

Figure 6—Scattering coefficient for rutile at 546.1 nm as a function of particle diameter. The refractive index of the medium was 1.55. The solid curve shows the average scattering coefficient calculated from the refractive indices of rutile at 546.1 nm. The dashed curve shows scattering coefficient calculated from the average of the refractive indices at this wavelength

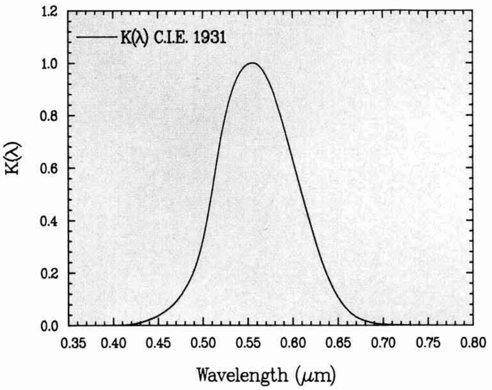

Figure 7—Data for the luminous efficiency of the eye

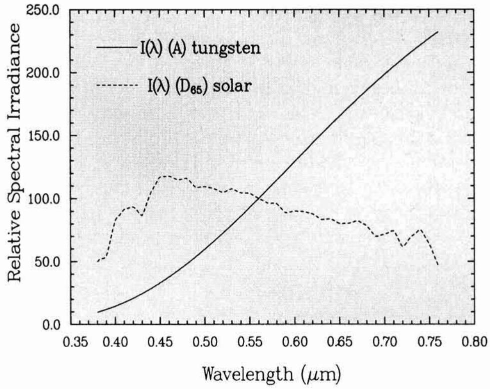

Figure 8—Relative spectral irradiance as a function of wavelength for the two light sources used in this study

relative to the wavelength, the refractive index of the particle, which is itself wavelength dependent, and the refractive index of the surrounding medium.

The luminous reflectance over the range of wavelengths λ_1 to λ_2 is given by,

$$R_{lum}(r,fh) = \frac{\int_{\lambda_1}^{\lambda_2} R(r,\lambda,n_p,n_m,fh)\, I(\lambda)\, K(\lambda)\, d\lambda}{\int_{\lambda_1}^{\lambda_2} I(\lambda)\, K(\lambda)\, d\lambda} \tag{2}$$

where $I(\lambda)$ is the special irradiance, $K(\lambda)$ is the luminous efficiency of the eye, and R is the monochromatic reflectance given by equation (1).

The luminous reflectance of an infinitely thick suspension of nonabsorbing particles is one. A good estimate for the contrast threshold of the human eye is two percent. That is, the human eye cannot distinguish between two sources with luminances differing by less than two percent. So a suspension of finite thickness having a luminous reflectance of 0.98 is, to the human eye, indistinguishable from one that is infinitely thick. On this basis, we define opacity O_p as the value of 1/fh such that R_{lum} is 0.98. The values of f and h that give R_{lum} of 0.98 are termed f* and h*. Opacity is related to f* and h* by,

$$O_p = \frac{1}{f^*h^*} \tag{3}$$

Opacity was calculated using the following iterative technique. The initial value of fh was set to 0.1, a value well below the expected solution. For each particle diameter over the range of interest, we computed the scattering coefficient s for 77 wavelengths over the visible spectrum, and R_{lum} was then calculated using equations (1) and (2). Successive new values of fh were established from the bisection technique until R_{lum} was 0.98. By definition, the resulting product fh is equal to f*h*, and opacity was then calculated from f*h* using equation (3).

The opacity of films containing several types of spherical particles was investigated in the present study. In both of these cases, opacity was calculated by the procedure described previously. For spherical particles, scattering coefficient was calculated from Mie theory using the computer program in *Appendix* A of Bohren and Huffman.[7] The scattering coefficient of hollow, air-encapsulated, or coated particles was calculated from the work of Aden and Kerker[12] using the programs presented in *Appendix* B of reference (7).

The luminous efficiency of the eye, $K(\lambda)$, and the spectral irradiance, $I(\lambda)$, of the two illuminants used in this study are shown in *Figures* 7 and 8, respectively. These data were obtained from references (13) and (14). The spectral power distribution of the standard illuminant has been normalized by multiplying this quantity by an appropriate factor so the relative spectral irradiance at 560 nm equals 100. Such normalization is used because only "relative" spectral power distributions are required in colorimetric computations.

Initial opacity calculations indicated that the optimum size of rutile spheres varied only slightly between the two illuminants, so tungsten radiation was used in the present study. The refractive indices of rutile and quartz used in this work were obtained from references (10) and (15), respectively.

DISCUSSION OF RESULTS

Uncoated Spherical Particles

The light scattering model described in the previous section was used to examine the opacity of polymer films containing several types of uncoated particles. The performance of hollow, air-encapsulated, and coated particles is described in a subsequent section.

In the first portion of this study, the opacity of films containing spherical particles was examined as a function of particle size and refractive index to provide a broad overview of the performance of opacifying materials. Following this work, the opacity of log-normally distributed rutile spheres was investigated as a function of particle size and coefficient of variation to establish the performance of polydispersed rutile.

EFFECT OF PARTICLE SIZE AND REFRACTIVE INDEX: The effect of particle size and refractive index on the opacity of monosize spheres is illustrated in *Figure* 9. To our knowledge, this is the only published figure on the subject. A refractive index of 1.55 was selected for the medium to illustrate the scattering of light by particles in a polymer film, and tungsten radiation was used in this work. Opacity is expressed in units of inverse micrometers.

In this instance, opacity was calculated only at 550 nm, the wavelength of maximum sensitivity of the human eye because the material comprising the particles was unspecified. Under these conditions, the wavelength dependence of refractive index was unknown, and opacity could not be evaluated across the visible spectrum. In all subsequent work, opacity was calculated using the entire visible spectrum because the particle composition was known in each case.

The response surface has several important features. For materials with a refractive index close to that of the medium, opacity is nearly independent of particle size. This is especially pronounced for materials with refractive indices in the range of one to two.

For materials with refractive indices greater than approximately 2.2, a pronounced optimum diameter develops, which shifts to smaller values as the refractive index of the particle increases. For example, the optimum particle diameter for a refractive index of 2.2 is about 0.27-micrometer, and the optimum size decreases to about 0.19-micrometer when the refractive index is 3.0.

OPACITY OF POLYDISPERSED RUTILE: In the next portion of the study, opacity was calculated for a log-normal distribution of particles (based on number density) over the visible spectrum. The effects of mean particle size and distribution width on the opacity of films containing rutile were examined. The width of the log-normal distribution was expressed by the coefficient of variation. The spectral irradiance for a tungsten source was used in the opacity calculations.

The results of this work are presented in *Figure* 10. As illustrated, a 0.22-micrometer, monosize, rutile particle exhibits the greatest opacity, which is consistent with the work of previous investigators.[1]

The opacity of a film containing 0.22-micrometer rutile particles is 0.1 inverse-micrometer as shown in this illustration. The opacity can be used to estimate the thickness of a polymer film containing rutile spheres that will opacify a black underlying surface. Solving equation (3) for film thickness h* yields,

$$h^* = \frac{1}{O_p f^*} \tag{4}$$

Substituting 0.1 inverse micrometer for O_p, the value for 0.22-micrometer, monosize, rutile particle and using a film containing 10 vol % rutile yields a value for h* of 100 micrometers (0.004 in.). This calculated film thickness compares well with the thickness of actual paint films, indicating that the results provided by this model are physically realistic.

Figure 10 also shows the opacity of films containing polydispersed rutile spheres. The response surface is dominated by a pronounced ridge that extends from the optimal mode diameter of 0.22-micrometer, on the left side of the illustration, to the lower-right corner of the figure. Points on this ridge describe the mode diameter which gives the greatest opacity for a fixed coefficient of variation. *Figure* 10 shows that as the width of the distribution increases, the mode diameter that yields the highest opacity decreases. Secondly, this figure indicates that, for a constant coefficient of variation, opacity decreases more rapidly with particle diameter for sizes below the optimum on the ridge than for particles larger than the optimum size.

The information in *Figure* 10 can also be used to compare the efficiency of materials produced by different particle generation processes. For instance, in the case of

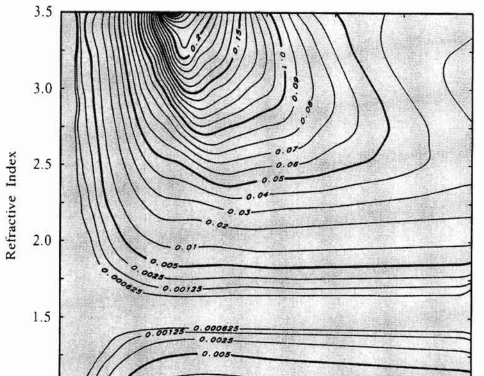

Figure 9—Opacity (inverse micrometers) of a polymer film containing monosize spherical particles as a function of particle diameter and refractive index for a wavelength of 550 nm. The refractive index of the medium was 1.55

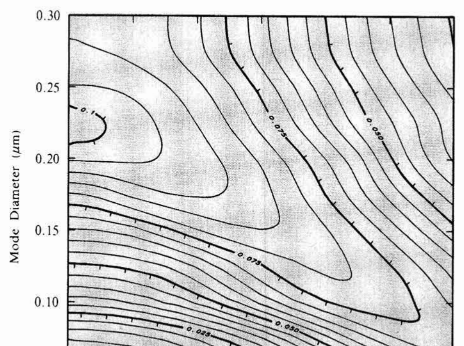

Figure 10—Opacity (inverse micrometers) of a polymer film containing a log-normal distribution of spherical rutile particles as a function of mode diameter and coefficient of variation. A tungsten light source was used in this computation, and the refractive index of the medium was 1.55

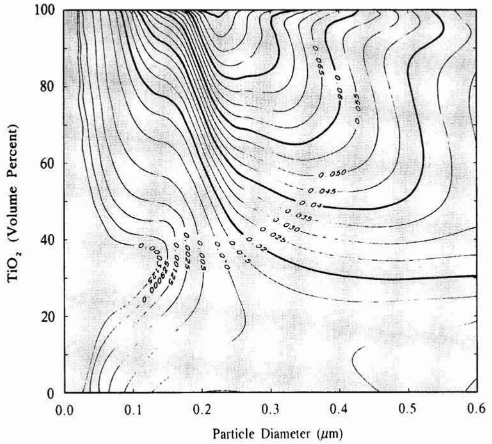

Figure 11—Opacity (inverse micrometers) of a polymer film containing hollow rutile spheres as a function of titanium dioxide content of the particle and external diameter. The refractive index of the medium was 1.55

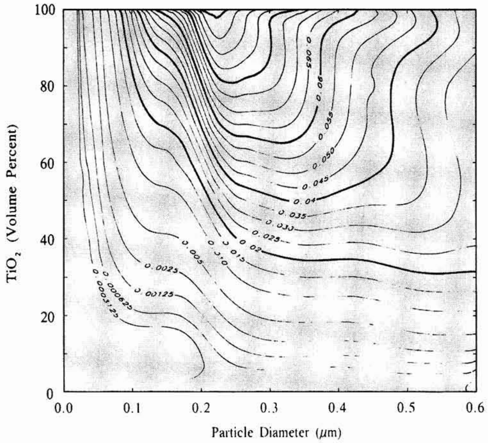

Figure 13—Opacity (inverse micrometers) of a polymer film containing quartz spheres coated with rutile as a function of titanium dioxide content of the particle and external diameter. The refractive index of the medium was 1.55

particles generated by an aerosol process, the coefficient of variation can be determined as a function of particle size using well-established techniques. The opacity of films containing aerosol-generated particulate materials can then be determined from the information in this figure.

By way of example, the coefficient of variation for aerosol-generated materials can be predicted for a self-preserved size distribution of particles using the work of Friedlander.[16] Alternatively, similar information can be obtained from numerical solutions of population balance models, such as those provided by the computer codes of Gelbard et al.[17] Typically, the coefficient of variation obtained by either of these techniques lies in the range of 0.3-0.4, depending on the conditions used to form the particles.

The information in *Figure* 10 indicates that the opacity of films containing such rutile particles is approximately 85% of the value for monosize rutile spheres.

Hollow, Air-Encapsulated, and Coated Spherical Particles

In the final portion of this study, the opacity of films containing either hollow, air-encapsulated, or coated spheres was studied. Several particles were examined in this work to determine if materials might be produced which opacify polymer films more effectively than the uncoated rutile spheres discussed previously. In each

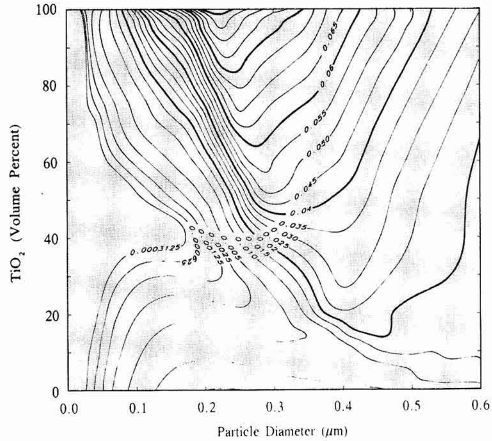

Figure 12—Opacity (inverse micrometers) of a polymer film containing rutile spheres encapsulated in air as a function of titanium dioxide content of the particle and external diameter. The refractive index of the medium was 1.55

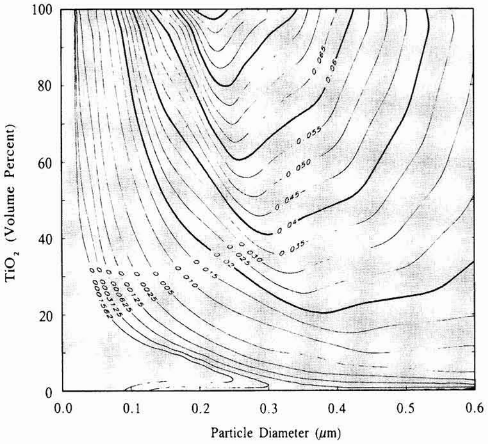

Figure 14—Opacity (inverse micrometers) of a polymer film containing rutile spheres coated with quartz as a function of titanium dioxide content of the particle and external diameter. The refractive index of the medium was 1.55

case, the refractive index of the polymer medium was 1.55, and the film was again illuminated with tungsten radiation.

OPACITY OF HOLLOW RUTILE SPHERES: Initially, the opacity of hollow rutile spheres was investigated as a function of size and the volume fraction of rutile to evaluate the performance of this particle. The results of this work are illustrated in *Figure* 11 which shows the opacity response surface. The data presented in this figure for a solid rutile sphere, that is, one containing 100% titanium dioxide, are consistent with the information shown in *Figure* 10. That is, 0.22-micrometer, solid, rutile particles yield the highest opacity films.

The data in *Figure* 11 show that, for constant external diameter, removing titanium dioxide from the center of the particle significantly reduces its effectiveness as an opacifier. Secondly, the optimum size shifts to larger values as the rutile content of the particle decreases. Finally, for a rutile content less than 50%, opacity is nearly independent of external diameter.

OPACITY OF AIR-ENCAPSULATED RUTILE SPHERES: The opacity of films containing rutile encapsulated in air is presented in *Figure* 12. Again, the illustration shows that 0.22-micrometer rutile spheres provide the greatest opacity for polymer films. As opposed to the data for hollow rutile particles, *Figure* 11, opacity is dependent on size throughout the space investigated.

OPACITY OF COATED PARTICLES: Coated spherical particles were examined next to establish the performance of these opacifiers over the visible spectrum. The results obtained for quartz coated with rutile and rutile coated with quartz are shown in *Figures* 13 and 14, respectively. In each case, the particle is immersed in a medium with a refractive index of 1.55, and the film is again illuminated with radiation from a tungsten source.

The opacity response surface is shown as a function of external particle diameter and rutile content in each case. As in the previous work, opacity decreases as the rutile content decreases, and a 0.22-micrometer, solid, rutile particle provides the greatest opacity. In the case of quartz coated with rutile, opacity shows little dependence on size for titanium dioxide contents less than approximately 50% when particle size is greater than about 0.2-micrometer. For rutile coated with quartz, opacity is size dependent over the entire range of diameters and titanium dioxide contents examined.

CONCLUSIONS

The anisotropy of rutile can be addressed adequately by using the average of the refractive indices of this material in opacity calculations.

The opacity of monosize spheres in a medium with a refractive index of 1.55 is nearly independent of particle size when the refractive index is less than approximately two. A pronounced optimum in particle size develops for refractive indices greater than about 2.2.

In the case of monosize rutile spheres, a 0.22-micrometer diameter particle opacifies polymer films most effectively. For a log-normal distribution of particles, the optimum mode diameter of the distribution shifts to smaller values as the coefficient of variation of the distribution increases.

Monosize, hollow, rutile spheres; rutile spheres encapsulated in air; rutile spheres coated with quartz; and quartz spheres coated with rutile all opacify less effectively than monosize, 0.22-micrometer, rutile particles.

ACKNOWLEDGMENTS

The authors wish to acknowledge the financial support provided by the Kerr-McGee Corporation. Additionally, the assistance of Marie Bufford and Felicia Bennett in typing the manuscript, and the help of Frank Schultz in plotting the response surfaces also is gratefully acknowledged.

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Effect of Hydroxyethylcellulose Molecular Weight and Hydroxyethyl Content On Grafting Reactions of Vinyl Monomers During Latex Manufacture

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The synthesis of hydroxyethylcellulose (HEC)-stabilized vinyl acetate-acrylic and all-acrylic latexes via emulsion polymerization techniques and subsequent analysis of the latex aqueous phase via size exclusion chromatography has shown that both HEC hydroxyethyl content (HEMS) and HEC molecular weight have a net positive effect on monomer-HEC grafting reactions during latex manufacture. Excessive grafting reactions produced dilatancy (shear-thickening) and poor film clarity, apparent only for the all-acrylic system, which required the presence of water-soluble chain transfer agents for practical synthesis. It is concluded that variations in HEC molecular weight and HEMS can profoundly influence the physical properties of latexes prepared in the presence of HEC.

INTRODUCTION

The study of emulsion polymerization of vinyl monomers in the presence of hydroxyethylcellulose (HEC) has achieved widespread interest due to the broad use of this water-soluble polymer as a stabilizer for vinyl acetate homopolymer, vinyl acetate copolymer, and all-acrylic latexes[1-5] used in various applications. Nevertheless, while interest has traditionally remained high, very little has been published regarding the mechanisms by which HEC stabilizes latexes during commercial manufacture. In the few studies which have appeared,[6-8] vinyl acetate has been the only monomer investigated, and only under conditions far from actual semicontinuous processes. A series of studies by the author[9-12] appears to be the first attempt to elucidate the reaction chemistry of HEC in emulsion polymerization utilizing processes resembling those employed by the latex industry. The aqueous size exclusion chromatography (SEC) method employed in studying these latex systems,[13] via monitoring of the latex aqueous phase in contrast to the latex polymer phase, had never before been used to follow the dynamics of HEC during the latex manufacturing process. These studies served to establish that, under typical emulsion polymerization conditions, acrylic and methacrylic monomers unexpectedly have a greater tendency to graft to HEC than vinyl acetate. The present study serves to establish the effects that *a priori* changes in HEC composition (i.e., hydroxyethyl content and molecular weight) have on HEC-monomer grafting reactions during these same processes. This information is important to the fundamental understanding of stabilization of polymer colloids as well as to the practical development of improved water-borne polymer dispersions.

EXPERIMENTAL

Latexes were manufactured according to the recipes in *Tables* 1 and 2. The resulting latices were characterized for pH, Brookfield viscosity, average particle diameter (Coulter nanosizer), grit content (visual assessment), and mechanical stability (10 min in a Waring blender at the highest setting). The samples subjected to high shear were analyzed for both particle size and viscosity. In addition, the latices were centrifuged at 17,000 rpm to remove the polymer solids, and the supernatant liquid

This paper was presented at the Spring and Fall American Chemical Society National Meetings in Miami, FL, and Chicago, IL, respectively.
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Table 1—Acrylic Emulsion Polymerization Recipe

Mixture	Component	Parts by Weight (%)
1	water	50.15
	nonionic surfactant[a]	1.00
	sodium dodecyl benzenesulfonate	0.15
	potassium persulfate (5%)	2.00
	HEC	0.20
	regulator or stabilizer (TEA)[b]	0.50
	monomer	10.00
2	potassium persulfate (5%)	2.00
3	monomer[c]	34.00
	Total	100.00

The procedure used was as follows: (1) add mixture 1 to kettle under an N_2 blanket and heat to 85°C; (2) begin addition of mixture 3 via the metering pump; (3) add mixture 2 after 50% of monomer has been added; and (4) maintain at 85°C for 2 hr beyond addition of monomer.

(a) α-[4-(1,1,3,3-tetramethylbutyl)phenyl]-ω-hydroxypoly (oxy-1,2-ethanediyl).
(b) TEA = triethanolamine.
(c) Monomer mix = butyl acrylate 42.7%, methyl methacrylate 56.8%, methacrylic acid 0.5%.

was analyzed by high-performance size-exclusion chromatography for the concentration of residual HEC (determined by the area under the chromatogram tracing) and HEC molecular weight distribution. Controls were run whereby the latex was produced in the absence of HEC and post-thickened with HEC after cooling to room temperature. The specific aqueous SEC technique used to study the latex aqueous phase is described in reference (13). All HEC samples were obtained from Aqualon Company with molecular weight and HEMS data provided.

Typical latex physical characteristics are provided in *Tables* 3 and 4 versus the effects of HEC molecular weight and HEC HEMS, respectively. *Figures* 1 and 5 provide size exclusion chromatograms of various HEC samples before emulsion polymerization. Latex aqueous phase size exclusion chromatograms are also provided for various HEC samples after emulsion polymerization for vinyl-acrylic latexes (*Figures* 2, 3, and 6) and for all acrylic latexes (*Figures* 4, 7). It should be emphasized that this aqueous technique contrasts with well-known nonaqueous SEC techniques used by latex chemists to study the relative molecular weight distributions of the resulting latex polymer (vinyl acetate or acrylic copolymer) itself.

In size exclusion chromatography, high molecular weight fractions elute first and, thus, molecular weight increases as one moves to the left along the x-axis in a chromatogram. The area under the curve is proportional to the HEC concentration and represents a convenient relative measure of concentration. The broadness of the curves gives a relative indication of HEC molecular weight distribution, whereas peak elution time can represent the average molecular size. In comparison of HEC of similar composition, molecular size can be considered as being nearly equivalent to molecular weight. The difference between the concentration of HEC remaining in the latex aqueous phase and the concentration of HEC originally added is the amount of HEC grafted, as opposed to adsorbed (see the following section).

DISCUSSION

Adsorption of HEC onto latex particles was shown to be negligible via control experiments whereby both vinyl-acrylic and all-acrylic latexes were manufactured in the absence of the HEC, but under the same conditions as the HEC-stabilized latexes, and then post-thickened with HEC to the same concentration. In these instances, SEC showed that 100% of the HEC added remained in the aqueous phase with no changes in molecular weight distribution. Thus, any differences between recovered HEC and added HEC had to be due to HEC-monomer grafting reactions and subsequent covalent incorporation of HEC into the latex polymer particle. Further evidence for this comes from the fact that exhaustive extraction of grafted HEC-containing latex polymer with boiling water yielded no measurable amount of HEC, while tetrahydrofuran solutions of the same latex polymer showed evidence of substantial gel fractions (crosslinked fractions, presumably derived from HEC grafts), which were not found in latexes manufactured in the absence of HEC.

A number of surprising trends are obvious from the data provided in *Tables* 3 and 4 and *Figures* 1-7. For vinyl-acrylic latexes the following observations can be made:

(1) As HEC molecular weight increases, the latex average particle diameter also increases (*Table* 3).

(2) The effect of HEC molecular weight on latex viscosity is not clear-cut. At low HEC concentration, the trend is toward increasing latex viscosity with increasing HEC molecular weight. At higher HEC concentration, latex viscosity decreases with increased HEC molecular weight. At low HEC concentration the observed latex viscosity trends versus HEC molecular weight can not be due to residual aqueous phase HEC since the chromato-

Table 2—Vinyl Acetate-Acrylic Emulsion Polymerization Recipe

Mixture	Component	Parts by Weight (%)
1	water	44.60
	sodium bicarbonate (5%)	1.44
	anionic surfactant[a]	1.40
	nonionic surfactant[b]	0.70
	HEC	0.50
2	monomer[c]	10.00
3	potassium persulfate (5%)	2.48
4	monomer[c]	38.00
5	anionic surfactant[a]	0.88
	Total	100.00

The procedure used was as follows: (1) add mixture 1 to kettle under an N_2 blanket and heat to 85°C; (2) add mixture 2 and 3, and when refluxing subsides, begin addition of step 4 via the metering pump; (3) add mixture 5 after 50% of monomer addition; and (4) maintain at 85°C for 1 hr after completion of monomer addition.

(a) Disodium salt of the sulfosuccinate half-ester of ethoxylated fatty alcohol.
(b) α-[4-(1,1,3,3-tetramethylbutyl)phenyl]-ω-hydroxypoly (oxy-1,2-ethanediyl).
(c) Monomer mix = vinyl acetate 85%, butyl acrylate 15%.

Table 3—Latex Data—Comparison of Resulting Viscosity and Average Particle Diameter for Vinyl-Acrylic and All-Acrylic Latexes Manufactured in the Presence of HEC of Varying Molecular Weights

Example	Monomer	Conc. (wt. %)	HEC △/M.W.	□/HEMS⁻	Latex Viscosity (cps)	Average Particle Diameter (microns)
3-1	.........VA/BA[a]	0.2	80K	2.9	124	0.18
3-2	.........VA/BA	0.2	150K	2.9	220	0.20
3-3	.........VA/BA	0.2	270K	2.9	690	0.28
3-4	.........VA/BA	0.2	650K	2.9	210	0.29
3-5	.........VA/BA	0.5	80K	2.9	1300	0.31
3-6	.........VA/BA	0.5	150K	2.9	1080	0.37
3-7	.........VA/BA	0.5	270K	2.9	920	0.46
3-8	.........VA/BA	0.5	650K	2.9	480	0.56
3-9	.........BA/MMA/MAA[b]	0.2	80K	2.9	265	1.3
3-10	.........BA/MMA/MAA	0.2	150K	2.9	520	1.7
3-11	.........BA/MMA/MAA	0.2	270K	2.9	3880	2.8
3-12	.........BA/MMA/MAA	0.2	650K	2.9	5100	4.0

(a) VA/BA = vinyl acetate/butyl acrylate—85/15.
(b) BA/MMA/MAA = butyl acrylate/methyl methacrylate/methacrylic acid—42.7/56.8/0.5.
△Concentration weight percent based on 100 parts total recipe.
□Molecular weight determined *a priori* via intrinsic viscosity measurements.
⁻HEMS—represents the average number of hydroxyethyl units per anhydroglucose unit, determined experimentally.

grams in *Figure* 2 show little difference in final HEC concentration or molecular weight distribution, despite wide differences in starting molecular weights. This implies that at relatively low HEC concentrations, oxidative degradation of HEC (i.e., molecular weight reduction), long-known to occur in emulsion polymerization systems, is competitive in rate with monomer-HEC grafting reactions.

The chromatograms in *Figure* 3 (latexes manufactured in the presence of higher HEC levels) show that higher concentrations of lower molecular weight HEC remain in the latex aqueous phase (i.e., not grafted) after polymerization when lower molecular weight HEC is used. This contrasts with the lower concentrations of higher molecular weight HEC fractions which remain when higher molecular weight HEC is employed. These observations imply that higher HEC molecular weight fractions preferentially participate in the HEC-monomer graft reactions, accounting for the higher total levels of high molecular weight HEC which grafts versus low molecular weight HEC, on a weight basis. Further evidence for this comes from the fact that at higher HEC concentration, use of the highest molecular weight HEC yields latex particles which are stable agglomerates of smaller particles, resulting from covalent bridging via HEC, as found by transmission electron microscopy performed on selected latex samples.

Thus, final latex viscosity must arise largely from the relative efficiency of packing of the latex particles as determined by latex particle size and particle size distribution, both of which are influenced by monomer-HEC graft reactions.

(3) The effect of HEC HEMS on latex properties is similar to the trends for HEC molecular weight, but not nearly so great in magnitude (higher HEMS results in marginally higher latex viscosity, particle size, and stability). Compare *Figure* 6 curves A and C and *Table* 4 examples 4-1 and 4-2 for HEMS effects independent of HEC molecular weight.

(4) Although relative values remained unchanged (when comparing effects of HEC molecular weight and HEMS), higher absolute values of grafted HEC occurred when higher proportions of butyl acrylate were used in the vinyl acetate-butyl acrylate mix.

(5) 100% recovery of highly degraded HEC occurred when vinyl acetate homopolymer latexes were manufactured according to the same recipes, confirming that it is

Table 4—Latex Data—Comparison of Resulting Latex Viscosity and Average Particle Diameter for Vinyl-Acrylic and All-Acrylic Latexes Manufactured in the Presence of HEC of Varying HEMS and Molecular Weight

Example	Monomer	Conc. (wt. %)	HEC M.W.	HEC 5% Solution Viscosity (cps)	HEMS	Latex Viscosity (cps)	Average Particle Diameter (microns)
4-1	..........VA/BA	0.5	80K	245	2.0	1120	0.28
4-2	..........VA/BA	0.5	80K	93	2.9	1300	0.31
4-3	..........VA/BA	0.5	150K	245	2.9	1400	0.36
4-4	..........BA/MMA/MAA	0.2	80K	245	2.0	395	1.24
4-5	..........BA/MMA/MAA	0.2	80K	93	2.9	400	1.30
4-6	..........BA/MMA/MAA	0.2	150K	245	2.9	610	1.47

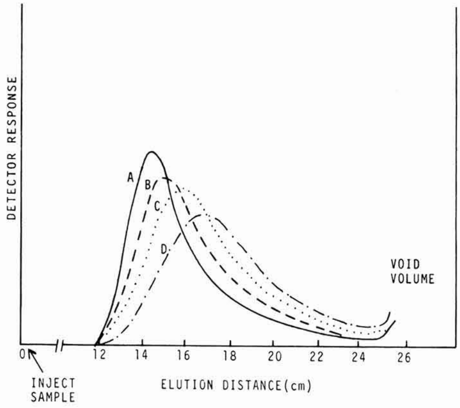

Figure 1—Size exclusion chromatography of HEC standards of varying molecular weights. Legend: A = 650,000; B = 270,000; C = 150,000; and D = 80,000

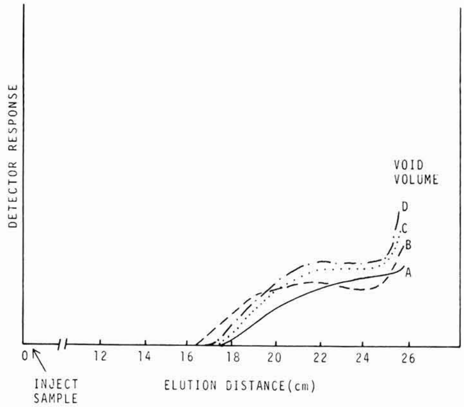

Figure 2—Size exclusion chromatography of residual HEC of varying initial molecular weight in the aqueous phase of vinyl-acrylic latexes. HEC initial concentration = 0.2% by weight of total recipe. Legend: same as *Figure* 1. Corresponds to *Table* 3, examples 3-1 through 3-4

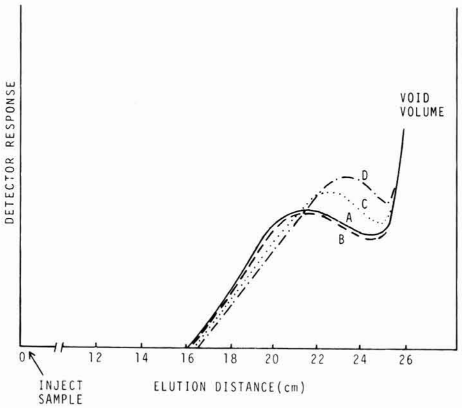

Figure 3—Size exclusion chromatography of residual HEC of varying initial molecular weight in the aqueous phase of vinyl-acrylic latexes. HEC initial concentration = 0.5% by weight of total recipe. Legend: same as *Figure* 1. Corresponds to *Table* 3, examples 3-5 through 3-8

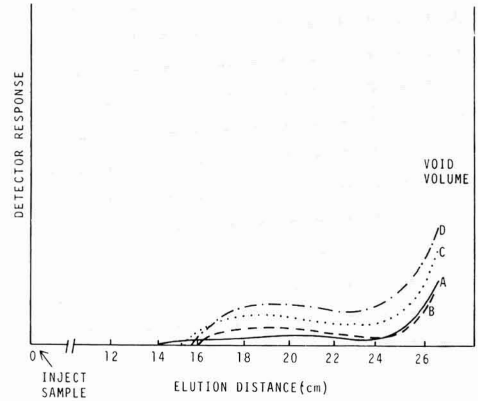

Figure 4—Size exclusion chromatography of residual HEC of varying initial molecular weight in the aqueous phase of all-acrylic latexes. HEC initial concentration = 0.2% by weight of total recipe. Legend: same as *Figure* 1. Corresponds to *Table* 3, examples 3-9 through 3-12

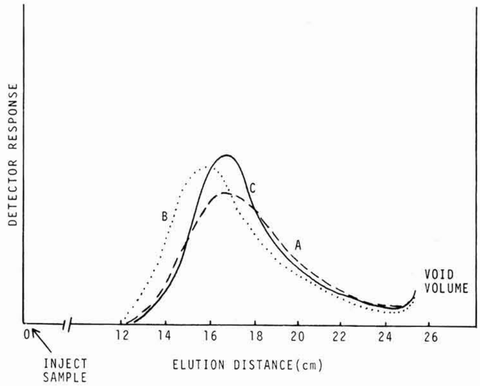

Figure 5—Size exclusion of chromatography of HEC standards of varying viscosity and HEMS. Legend: A, HEMS = 2.9, 5% by weight aqueous solution viscosity = 93 cps; B, HEMS = 2.9, 5% by weight aqueous solution viscosity = 245 cps; C, HEMS = 2.0, 5% by weight aqueous solution viscosity = 245

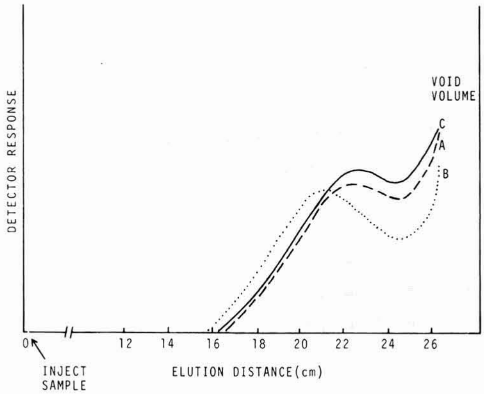

Figure 6—Size exclusion chromatography of residual HEC of varying initial HEMS and viscosity in the aqueous phase of vinyl-acrylic latexes. HEC initial concentration = 0.5% by weight of total recipe. Legend: same as *Figure* 5. Corresponds to *Table* 4, examples 4-1 through 4-3

the acrylic component of the vinyl-acrylic monomer mix which initiates the HEC-monomer graft reactions.

(6) HEC samples of the same viscosity grade are only of the same molecular weight when HEMS values are equivalent. The higher the HEMS, the higher the molecular weight is at a given viscosity (see *Figure* 5). Thus, curves B and C derive from HEC samples of the same viscosity grade, but are clearly not the same molecular weight, the difference being due to HEMS values and the fact that viscosity is measured on a weight basis.

As expected, extremely high levels of HEC-monomer grafting occurred in the all-acrylic latex system, even in the presence of water-soluble chain transfer agents (triethanolamine),[5] obscuring any differences which may have resulted from altering HEC molecular weight or HEMS. Apparently all acrylic monomer systems "view" even low molecular weight HEC as being very high for grafting purposes. Nevertheless, reproducible, but small differences in latex physical properties were qualitatively correlated with the concentration of grafted HEC, determined indirectly via SEC.

Mechanistically speaking, it is important to realize that grafting of monomers onto HEC occurs as a result of chain transfer of initiator to HEC and subsequent initiation of polymerization by the HEC macro-radical [see scheme in reference (12)]. Nonionic polymeric surface-active species are created *in-situ* which actually perform the function of stabilizing the latex particles. Therefore, sulfate end groups cannot be incorporated into the polymer phase via graft reactions. Further evidence for this comes from a previous study[14] demonstrating the absence of graft reactions in the presence of nonoxidizing azo type initiators.

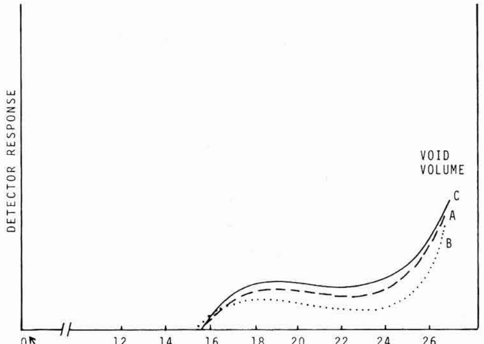

Figure 7—Size exclusion chromatography of residual HEC of varying initial HEMS and viscosity in the aqueous phase of all-acrylic latexes. HEC initial concentration = 0.2% by weight of total recipe. Legend: same as *Figure* 5. Corresponds to *Table* 4, examples 4-4 through 4-6

DANIEL H. CRAIG earned a Bachelor of Science Degree in Chemistry from the State University of New York, College of Environmental Science and Forestry, Syracuse, NY, in 1978 and a Ph.D. in Organic Chemistry from the University of North Carolina, Chapel Hill, NC, in 1982. Since that time he has been employed at the Hercules Incorporated Research Center performing research in such diverse areas as design and synthesis of water-soluble polymers, emulsion polymerization, paper chemicals, and snack food packaging barrier film.

The previous discussion concerns only thermal-persulfate initiated emulsion polymerization as described in the recipes. Emulsion polymerization utilizing redox initiation yields different results insofar as HEC-monomer grafting reactions are concerned, and is the subject of a subsequent study to be published in the near future.

CONCLUSIONS

It can be concluded that monomer grafting reactions undergone by HEC are initiated by the acrylic or methacrylic component of the particular monomer mix and that the extent of grafting of monomers onto HEC can be influenced by both HEC molecular weight and hydroxyethyl content. Furthermore, it can be concluded that monomer-colloid grafting reactions, while promoting latex stability, also favor larger particle size, broad particle size distribution, and lower film clarity. Proper selection of HEC properties prior to polymerization, so as to control HEC-monomer grafting reactions inherent to the emulsion polymerization process, is important for optimizing latex properties.

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Federation of Societies for Coatings Technology

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Numbers 768–779
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Constituent Society Papers

BALTIMORE .... SEPT.

"Paint at Bomb Sites"

A moment of silence was observed in memory of Federation Past-President and 50-Year Member, Howard G. Sholl, who died on July 23. Mr. Sholl, a Federation and Society Honorary Member, was 78 years old.

Ray Keto, a Forensic Chemist with the Bureau of Alcohol, Tobacco, and Firearms, gave a presentation on the Bureau and its functions: to enforce tax laws and the regulation of guns and explosives.

Using slides, the speaker revealed the various types of explosives used and explained the processes which are utilized to trace the origin and originator of the explosives.

Mr. Keto discussed different processes used to analyze paint found at bomb sites. One particular process called for embedding the particle of paint into an epoxy. The particle size is so small that numerous samples are combined, explained the speaker. Each particle is then sanded down and extracted, prior to the analysis.

Q. Is there a problem with bleeding of the paint particle embedded in the epoxy?

A. Yes, that does happen on occasion, but standards and controls are utilized to alleviate this problem

VICTORIA L. KRAM, *Secretary*

CHICAGO .... SEPT.

"Formation of Latex Films"

The meeting's first speaker was Dennis H. Guthrie, of Dow Chemical Co., who spoke on "HUMIDITY AND TEMPERATURE EFFECTS UPON THE FORMATION OF LATEX FILMS COMPENSATED BY COALESCING AGENTS."

Dr. Guthrie discussed studies showing the effect of humidity and temperature on the formation of different latexes modified by various coalescing agents at varied concentrations. He furnished data depicting how the selection of a proper coalescing package could help compensate for atmospheric conditions that could be encountered during the application of latex coatings. The speaker said these effects are most prevalent during film formation of some of the newer high T_g industrial latexes.

The second speaker was Joan Vasil, of Citizens Against Crime (a nationwide organization), whose topic was "HOW TO SAVE YOURSELF FROM HARM WHEN CONFRONTED BY A CRIMINAL."

Ms. Vasil advised attendees on how to stay safe both around the home and when away, what situations to avoid, and how to stay safe when confronted by an attacker.

After her presentation, the speaker distributed helpful pamphlets which give 46 tips for staying safe.

CLIFFORD O. SCHWAHN
Photography/Publicity

CLEVELAND .... SEPT.

"Appliance Coatings"

The Society Officers for 1989-90 were introduced: President—Ilona Nemes-Nemeth, of Sherwin-Williams Co.; Vice-President—Richard J. Ruch, of Kent State University; Secretary—Ben J. Carlozzo, of Tremco Corp.; Treasurer—Roy A. Glover, of Jamestown Paint & Varnish Co.; Assistant Treasurer—Freidun Anwari, of Coatings Research Group, Inc.; and Society Representative—Fred G. Schwab, of Coatings Research Group, Inc.

The Past-President's Pin was presented to the Immediate Past-President Edward R. Bish, of Jamestown Paint & Varnish Co.

Helen Skowronska was presented a certificated in honor of her election to Society Honorary Member. Ms. Skowronska, Chairman of the FSCT Technical Information Systems Committee, is Chairman of the Society Archive Committee and serves as "official" Society Historian.

It was announced that the Society's 75th Anniversary Celebration will be held on December 5, at the Bond Court Hotel, in Cleveland.

The post dinner speaker was Chicago Society member Thomas J. Miranda, of The Whirlpool Corporation. Dr. Miranda's topic was "THE HISTORY OF APPLIANCE COATINGS."

The speaker began his presentation with an early history of the appliance industry. He said the advent of the appliance industry began in the early part of the 20th century. According to Dr. Miranda, coatings used before World War I consisted mainly of natural products and resins. Progression included a series of developments, with varnishes, phenolic modified varnishes, nitrocellulose ester-based coatings, solution vinyls, and urea resins, being used. They were followed by melamines, silicones, and epoxies by the late 1940s. Thermosetting acrylics, first developed in 1939, did not make a major impact on the market until the early 1960s because of several problems.

The speaker detailed the chemistry behind the development of the coatings used today and he explored the latest challenge faced by appliance companies: environmental concerns with the old technologies available to coat appliances. Dr. Miranda said the first suggestions to reformulate and exempt solvents were only stop-gap and other methods, including water reducible resins, electroplating, high solids, and powder coatings were all explored.

Projected sales for major appliances is approximately 53 million units, which represents a considerable volume of coatings, metal preparation chemicals, and metal, stated Dr. Miranda. Today, anionic and cationic electroplating are used for metal cabinets. Powder coatings are being used in freezer liners and storage racks, as well as dryer drums and liners.

Precoating, a coil process employed in several areas, can damage the coating leading to corrosion failures in some applications.

Elimination of halogenated hydrocarbons, formaldehyde as a crosslinker, and waste disposal all have to be addressed for the future, according to Dr. Miranda. He said energy savings in coatings applications also will be a factor driving new products and techniques.

BEN J. CARLOZZO, *Secretary*

KANSAS CITY .... SEPT.

Presentation of President's Gavel

A moment of silence was observed in memory of Howard G. Sholl, Federation Past-President and 50-Year Member, who died on July 23. He was 78 years old.

Dave Kallal, of Hüls, presented President Mark Algaier, of Hillyard Chemical, with the President's Gavel. Immediate Past-President Nick F. Dispensa, of Davis Paint Co., presented Mr. Algaier with the official President's briefcase.

Mr. Algaier awarded Mr. Dispensa with a Past-President's Pin for his dedicated service during his term of office.

H. JEFF LAURANT, *Secretary*

NEW ENGLAND .... SEPT.

"Lead Poisoning"

A moment of silence was observed for Society members Timothy F. Sullivan, of

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Snyder's Restaurant, Linthicum, MD). VICTORIA KRAM, Lenmar, Inc. 150 S. Calverton Rd., Baltimore, MD 21223.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). BERNARD MYATT, Worrall's Powders Ltd., St. Clements Rd., Aston, Birmingham, England B7 5AH.

CDIC (Second Monday—Sept., Dec., Mar. in Columbus; Oct., Jan., Apr. in Cincinnati; Nov., Feb., May in Dayton). JAMES FLANAGAN, Flanagan Associates, Inc., 10999 Reed Hartman Hwy., Cincinnati, OH 45242.

CHICAGO (First Monday—alternate between Sharko's Restaurant, Villa Park, IL and Como Inn, Chicago, IL). THEODORE FUHS, General Paint & Chemical Co., 201 Jandus Rd., Cary, IL 60013.

CLEVELAND (Third Thursday—meeting sites vary). BEN CARLOZZO, Tremco, Inc., 10701 Shaker Blvd., Cleveland, OH 44104.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). HARRY C. SIMMONS, JR., Sherwin-Williams Co., 2802 W. Miller Rd., Garland, TX 75041.

DETROIT (Second Tuesday—meeting sites vary). LIANA C. ROBERTS, A.T. Callas Co., 1985 W. Big Beaver, Troy, MI 48084.

GOLDEN GATE (Monday before third Wednesday—alternate between Francesco's in Oakland, CA and Holiday Inn in S. San Franscisco). MARGARET R. HARTMANN, Midland Div./Dexter Corp., 31500 Hayman St., Hayward, CA 94544.

HOUSTON (Second Wednesday—Sonny Look's Sir-Loin Inn, Houston, TX). JOSEPH CARAVELLO, Guardsman Products, 11502 Charles St., Houston, TX 77041.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). H. JEFF LAURENT, F.R. Hall, Inc., 1920 Swift Ave., N. Kansas City, MO 64116.

LOS ANGELES (Second Wednesday—Steven's Steakhouse, Commerce, CA). SANDRA L. DICKINSON, McWhorter Co., 5501 E. Slauson Ave., Los Angeles, CA 90040.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). LLOYD BROWNING, Kelley Technical Coatings, Inc., 1445 S. 15th St., Louisville, KY 40210.

MEXICO (Fourth Thursday—meeting sites vary). ANTONIO JUAREZ, Amercoat Mexicana, via Gustavo Baz 3999, 54030 Tlalnepantla, edo de Mexico.

MONTREAL (First Wednesday—Bill Wong's Restaurant, Montreal). BRUCE BRIDGES, Reichhold Canada Inc., P.O. Box 120, St. Therese, Que., Canada J7E 4J1.

NEW ENGLAND (Third Thursday—Sheraton Lexington Hotel, Lexington, MA). JOSEPH H. WEINBURG, Permuthane Coatings, P.O. Box 3039, Peabody, MA 01961.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). JEFFREY C. KAYE, MacArthur Petro & Solvents Co., 126 Passaic St., Newark, NJ 07104.

NORTHWESTERN (First Tuesday after first Monday—Jax Cafe, Minneapolis, MN). DANIEL W. DECHAINE, Valspar Corp., P.O. Box 1461, Minneapolis, MN 55440.

PACIFIC NORTHWEST (PORTLAND SECTION—Tuesday before third Wednesday; SEATTLE SECTION—the day after Portland; BRITISH COLUMBIA SECTION— the day after Seattle). STEVE REARDEN, Imperial Paint Co., 2526 N.E. Yeon Ave., Portland, OR 97210.

PHILADELPHIA (Second Thursday—Williamson's Restaurant, GSB Bldg., Bala Cynwyd, PA). PETER KUMZA, VIP Products Corp., 3805 Frankford Ave., Philadelphia, PA 19124.

PIEDMONT (Third Wednesday—Ramada Inn Airport, Greensboro, NC). RUBY JOHANNESEN, Southchem, Inc., P.O. Box 9026, Greensboro, NC 27429.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). JOSEPH POWELL, Union Carbide Corp., P.O. Box 979, Latrobe, PA 15650.

ROCKY MOUNTAIN (Monday following first Wednesday—Holiday Inn North, Denver, CO). GARY SCHINGECK, Diamond Vogal/Komac, 1201 Osage St., Denver, CO 80204.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant, St. Louis, MO). STANLEY SOBOLESKI, U.S. Paint Div., 831 S. 21st St., St. Louis, MO 63103.

SOUTHERN (GULF COAST SECTION—third Thursday; CENTRAL FLORIDA SECTION—third Thursday after first Monday; ATLANTA SECTION—third Thursday; MEMPHIS SECTION—bi-monthly on second Tuesday; and MIAMI SECTION—Tuesday prior to Central Florida Section). VERNON SAULS, McCullough & Benton, P.O. Box 272360, Tampa, FL 33688.

TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). VIK RANA, Ashland Chemicals, 2620 Royal Windsor Dr., Mississauga, Ont., Canada L5J 4E7.

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

Sanncor Industries, and Roger Carlson, who died recently.

The meeting's speaker was Brad Prenney, from the Massachusetts Department of Public Health, who discussed the "CHILDHOOD LEAD POISONING PREVENTION PROGRAM."

Mr. Prenney discussed the causes of lead poisoning, including paint dust (caused by renovation) and house dust which are responsible for 80% of lead poisoning cases, and children biting on cribs and window sills. He said that lead poisoning affects children of all backgrounds.

According to the speaker, the number of lead poisoning cases has decreased in recent years along with the decreased usage of leaded gasoline. The two are indirectly related, stated Mr. Prenney.

The cost of removing lead-based paint and the results of removing the paint are the two main reasons why lead-based paint is still a problem for today's children.

Methods proposed to delead surfaces pose several questions which need to be resolved, including meeting legal and OSHA requirements, the hazard occupants face when lead-based paint is being removed, and where to dispose of the product, said the speaker.

In conclusion, Mr. Prenney stated the Public Health Department is seeking help from the coatings industry in regard to the lead-based paint problem and would welcome any suggestions or recommendations.

JOSEPH H. WEINBURG, *Secretary*

ST. LOUIS .... SEPT.

Ford Plant Tour

The officers for the year 1989-90 were introduced: President—Howard Jerome, of Mozel Equipment Co.; Vice-President—Terry Ponce Gelhot, of Spatz Paints, Inc., Secretary—Stanley Soboleski, Jr., of U.S. Paint Div., Treasurer—Dennis Cahill, of Archway Sales, Inc.; and Assistant Treasurer—Michael Schnurman, of Sinnett-Elpaco Coatings Corp.

John Folkerts, of Futura Coatings, Inc., will continue as the Society Representative to the Federation Board of Directors.

Patrick Gorman, of Hüls, and a member of the Chicago Society, presented the President's Gavel to Mr. Jerome.

Mr. Jerome presented the Past-President's Pin to Robert Wagnon, of Mozel, Inc. Mr. Wagnon was recognized for his dedicated service to the Society.

A tour of the Ford Aerostar Plant in Hazelwood, MO, preceded the meeting. Of particular interest on the tour was the robotic technology used in applying the coating system for the Aerostar.

STANLEY SOBOLESKI, JR., *Secretary*

BIRMINGHAM

Active

Chohan, B.—Carrs Paints Ltd., Birmingham.
Coleman, B.J.—Newtown Industrial Paints Ltd., Tamworth, West Midlands.
McDonna, Frank—MacPherson Paints, Bury, Lancs.

Associate

MacDonald, John P.—Blythe Colours Ltd., Stoke-on-Trent, Staffordshire.
McMillan, Eric—ICI Colours & Fine Chems, Worcester.

CHICAGO

Active

Barnard, Neal R.—O'Brien Corp., South Bend, IN.
Billstrand, Charles A.—Sherwin-Williams, Chicago, IL.
Cahir, Thomas H.—The O'Brien Corp., South Bend.
Clow, Kent J.—Rust-Oleum Corp., Evanston, IL.
Dare, William A.—Valspar Corp., Wheeling, IL.
Desai, Snehal S.—Videojet Systems, Elk Grove Village, IL.
Dudek, Stephen J.—Rust-Oleum Corp., River Forest, IL.
Flament-Garcia, Mary Jane—Dexter Packaging Prods., Waukegan, IL.
Francioli, Susan L.—J.M. Huber Corp., Evanston.
Girard, Andrew—Rust-Oleum Corp., Evanston.
Henriksen, Richard A.—Galesburg Manufacturing, Galesburg, IL.
James, Edward W.—Benjamin Moore & Co., Melrose Park, IL.
Johnson, Dale S.—Ace Paint Division, Matteson, IL.
Johnson, Bruce A.—McWhorter, Carpentersville, IL.
Jordan, Orlando D.—Rust-Oleum Corp., Evanston.
Libey, Eugene D.—DeSoto, Inc., Chicago Heights, IL.
Lippuci, Norman F.—Jordan Paint Mfg. Co., Forest Park, IL.
Martin, Robert E.—Seymour of Sycamore, Sycamore, IL.
Max, Richard E.—Zarco Industrial Fin., Chicago.
McNulty, Michael J.—Lindsay Finishes Inc., Madison, WI.
Meyers, Victoria M.—DeSoto, Inc., Chicago Heights.
Mitchell, Jay R.—Moline Paint Mfg. Co., Moline, IL.
Morrill, Gary A.—Aqualon Co., Palatine, IL.
Ochitwa, Ginette—Valspar Corp., Wheeling.
Osterman, Richard D.—Rust-Oleum Corp., Evanston.
Polido, Ferdinand—Benjamin Moore & Co., Melrose Park.
Poma, Timothy J.—DeSoto, Chicago Heights.
Richards, William T.—W.C. Richards Co., Blue Island, IL.
Robison, Russell D.—The O'Brien Corp., South Bend, IN.
Salvesen, Roger A.—DeSoto, Inc., Des Plaines, IL.
Shteynberg, Vladimir—Spraylat Corp., Chicago.
Stewart, David H.—Ace Paint Div., Matteson.
Thyne, Jacqueline A.—Dexter Packaging, Waukegan.
Ulven, Darrell E.—Gordon Bartels Co., Rockford, IL.
VanBoxtel, Paul J.—DeSoto, Inc., Chicago Heights.
Whitson, Steven C.—Dexter Specialty Ctg., Waukegan.
Wiza, Thomas E.—Valspar Corp., Wheeling.

Associate

Burkhard, D. Richard—Midstates Resins, Forest Park, IL.
Campbell, Chris A.—Cargill Inc., Carpentersville, IL.
Ciez, Margaret—McWhorter, Carpentersville.
Crist, Joseph T.—Daicolor-Pope, Naperville, IL.
Fischer, Rick—Eiger Machinery Inc., Bensenville, IL.
Geho, Keryn N.—J.M. Huber Corp., Quincy, IL.
Gogek, Jack L.—A.E. Staley Mfg. Co., Glenview, IL.
Kallal, David A.—Hüls America Inc., Chicago, IL.
Ladow, William R.—U.S. Silica Co., Cedar Lake, IN.
Martz, William D.—ECC America Inc., Chicago.
Matera, Michael V.—Hüls America Inc., Chicago.
Quan, James D.—C.J. Osborn, Arlington, Heights, IL.
Rowe, Richard—McWhorter, Carpentersville, IL.
Scoville, Terry D.—Valspar Corp., Kankakee, IL.
Waltenspiel, Herb—Kraft Chemical Co., Melrose Park, IL.

CLEVELAND

Active

Cammarato, Michael A.—The Glidden Co., Strongsville, OH.
Delgado, Michael A.—Master Builders Inc., Berea, OH.
Emmett, Duane D.—The Euclid Chemical Co., Cleveland, OH.
Figoli, Andrew N.—Cansto Paint & Varnish Co., Cleveland.
Hardy, Richard D.—X-I-M Products Inc., Westlake, OH.
Hosbach, Marilyn J.—Engelhard Corp., Beachwood, OH.
Howard, Jerald D.—Plasti-Kote Co., Inc., Medina, OH.
Konieczynski, Ronald D.—Nordson Corp., Amherst, OH.
MacDonald, Gene W.—CAM Chemical Corp., Tallmadge, OH.
Mallisk, Julie R.—Sherwin-Williams Co., Cleveland.
Mecca, Sam V.—Universal Cooperatives, Alliance, OH.
Micha, Melanie A.—The Glidden Co., Strongsville.
Okin, Susan J.—PPG Industries, Inc., North Olmsted, OH.
Sandorf, Victor G.—Coatings Development Co., Painesville, OH.
Thompson, Glenn H.—The Glidden Co., Westlake.
West, John E.—The National Latex Products Co., Ashland, OH.
Whitlam, Mark A.—J.C. Whitlam Mfg. Co., Wadsworth, OH.

Associate

Misiti, Vincent S.—ICI Americas Inc., Olmsted Township, OH.
Volkens, Oavio J.—Silberline Mfg. Co., Inc., Shaker Heights, OH.

GOLDEN GATE

Active

Davis, John J.—DeSoto, Inc., Berkeley, CA.
Dulava, Dan—Frank W. Dunne Co., Oakland, CA.
Hohl, Ronald J.—Pratt & Lambert, Marysville, CA.
Ilmberger, Michael J.—Hüls America, Pleasanton, CA.
Kalfayan, Ed J.—Jasco, Mountain View, CA.
Kleber, Edward J.—Connell Bros. Co., Ltd., San Francisco, CA.
Marganti, Rex F.—Dexter Corp., Hayward, CA.
Michal, Gene—O'Brien Corp., S. San Francisco, CA.
Sakanashi, Kelly K.—Hüls America, Pleasanton.
Sayre, Larry G.—O'Brien Corp., S. San Francisco.
Shah, Ashok A.—Dexter Corp., Hayward.
Stromquist, Eve C.—Flecto Co., Inc., Oakland.

Associate

Flynn, Kevin A.—Univ. of California — WBRC, Richmond, CA.
Nicolas, Alfred B.—Connell Bros. Co., Ltd., San Francisco, CA.

HOUSTON

Active

Ignatow, James—The Rectorseal Corp., Houston, TX.

Educator/Student

Baker, Alice P.—Alvin, TX.
Jacobson, Brett A.—Tomball, TX.
Seiter, Jeanne L.—Borger, TX.

KANSAS CITY

Active

Kincheloe, Richard Dean—Cook Paint & Varnish Co., Kansas City, MO.

MACK, J. STUART—Pratt & Lambert, Inc., Wichita, KS.
SCHINNER, JOSEPH R.—Pratt & Lambert, Inc., Wichita.

Associate

JANISH, RENEE M.—Dow Chemical Co., St. Louis, MO.
LUDLOW, JOHN A. JR.—George C. Brandt, Inc., N. Kansas City, MO.
MILLAR, JOE M.—Dow Chemical Co., Overland Park, KS.

Retired

HANSEN, LEE C.—Bella Vista, AK.

NEW ENGLAND

Active

BREWER, SCOTT A.—Cabot Corp., Billerica, MA.
DA SILVA, MARIA F.—Cabot Corp., Billerica.
DELLI COLLI, DENNIS A.—Cabot Corp., Billerica.
GOSS, HARRY—Kyanize Paints, Inc., Everett, MA.
GRAHAM, DAVID W.—Lilly Industrial Coatings, Inc., Templeton, MA.
GREEN, RICHARD E.—Sanncor Industies, Leominster, MA.
KAMDAR, KIRTI P.—USCI Div., C.R. Bard Inc., Billerica.
LEONARD, LAWRENCE R.—Senergy Inc., Cranston, RI.
MYERS, PATRICK D.—Cabot Corp., Billerica.
SINKOWSKI, JAMES A.—US Silica Co., Groton, CT.
SOLOMON, HAYDEN S.—Hydro-Environmental, Acton, MA.
STENSON, PAUL H.—ICI Resins U.S., Wilmington, MA.

Associate

SALMON; JOHN T.—Eagle Can Co., Peabody, MA.
WHITTAKER, JAMES E.—Thor Chemical Inc., Norwalk, CT.
YATCZYN, JOSEPH F.—Henkel Chemical Corp., Ambler, PA.

Educator/Student

PERRONE, THOMAS F.—East Hartford, CT.

NORTHWEST

Active

SUBACH, DANIEL J.—H.B. Fuller Co., Vadnais Heights, MN.

PITTSBURGH

Active

MANNAY, MICHAEL S.—The Valspar Corp., Pittsburgh, PA.

Associate

SABATINE, RICHARD P.—Mobay Corp., Pittsburgh, PA.

ST. LOUIS

Active

BOEMER, JULIA E.—Kop-Coat, Inc., St. Louis, MO.
EVANS, TERRENCE P.—U.S. Paint Corp., St. Louis.
LUCZAK, MICHAEL J.—U.S. Paint Corp., St. Louis.
MAAS, KAY W.—Akzo-Lanchem Corp., E. St. Louis, MO.
PYSZ, JOHN F.—Monsanto, St. Louis.
ROBINSON, RANDELL R.—P.D. George Co., St. Louis.

Associate

CIEZ, MARGARET A.—McWhorter, Carpentersville, IL.
MITCHELL, JIM—Cook Paint, Florissant, MO.
WIETIES, DAVID L.—Superior Solvents and Chem., Inc., St. Louis, MO.
YOUNCE, GARY L.—Akzo-Lanchem Corp., E. St. Louis, MO.

WESTERN NEW YORK

Active

KHOURY, MARK P.—Pratt & Lambert, Buffalo, NY.

Chicago

(Jan. 8)—"A SECOND GENERATION MODIFIER FOR LOW VOC POLYURETHANE AND MELAMINE COATINGS"—Cheryl Blomquist, CasChem, and "CORROSION REDUCTION IN SOLVENT AND WATER-BORNE COATINGS USING ZIRCO ALUMINATES"—Lawrence B. Cohen, Manchem.

(Feb. 5)—"OPTIMAL DISPERSION DESIGN"—George Goodwin, Daniel Products, and "ORGANOCLAYS—PAST, PRESENT, AND FUTURE"—Dwaine Siptak, ECC America.

(Mar. 5)—"EVALUATION OF NEW GENERATION COALESCING AGENTS FOR INDUSTRIAL ACRYLICS LATICES"—Daniel King, Exxon Chemical Co., and "RECYCLING SOLVENT WASTE & NEW TECHNOLOGY FOR IN-HOUSE WASTE MANAGEMENT"—Daniel Storrer, Oak Recovery.

(Apr. 2)—"TITANIUM DIOXIDE'S CONTRIBUTION TO THE DURABILITY OF PAINT FILMS"—J.H. Braun, E.I. du Pont de Nemours & Co., Inc., and "SILICONE RESIN, INTERMEDIATES AND ADDITIVES FOR LOW VOC COATING APPLICATIONS"—William A. Fenzel, Dow Corning.

(May 11)—AWARDS NIGHT.

Golden Gate

(Jan. 15)—"WAX EMULSIONS IN WATER-BORNE COATINGS"—Marshall Wiseman, Michelman Inc.

(Mar. 19)—"COUPLING SOLVENT EFFECTS ON WATER-REDUCIBLE ALKYD RESINS"—Rhonda Vance, Dow Chemical.

(Apr. 16)—"THE TRUTH ABOUT ACCELERATED WEATHERING—IT'S SIMPLER THAN YOU THINK"—Douglas M. Grossman, The Q-Panel Co.

(May 14)—"NEW DEVELOPMENTS IN HIGH SOLIDS RESINS AND RHEOLOGY ADDITIVES"—Robert Van Doren, NL Chemicals.

Kansas City

(Jan. 11)—"NEW SAFETY AND ENVIRONMENTAL REGULATIONS AND HOW THEY AFFECT THE COATINGS INDUSTRY"—Maude Taylor, Buckman Laboratories.

(Feb. 8)—"DEFOAMING AND DE-AIRING"—Jay Adams, Tego Chemie Service USA.

(Mar. 8)—"TANK CLEANING"—Fred Poulos, WashTec. ALSO TOUR OF SINCLAIR & VALENTINE INK.

(Apr. 13)—LADIES' NIGHT.

(May 10)—EDUCATION NIGHT.

(June 8-10)—JOINT MEETING OF ST. LOUIS AND KANSAS CITY SOCIETIES. Holiday Inn, Lake of the Ozarks, Missouri.

Los Angeles

(Jan. 10)—"WAX EMULSIONS IN WATER-BORNE COATINGS"—Marshall Wiseman, Michelman Inc.

(Mar. 14)—"COUPLING SOLVENT EFFECTS ON WATER-REDUCIBLE ALKYD RESINS"—Rhonda Vance, Dow Chemical.

(Apr. 11)—"THE TRUTH ABOUT ACCELERATED WEATHERING—IT'S SIMPLER THAN YOU THINK"—Douglas M. Grossman, The Q-Panel Co.

(May 9)—"NEW DEVELOPMENTS IN HIGH SOLIDS RESINS AND RHEOLOGY ADDITIVES"—Robert Van Doren, NL Chemicals.

New York

(Jan. 9)—"POLYSILOXANES: CHEMISTRY AND APPLICATION IN COATINGS"—Gene Franklin, Byk Chemical.

(Feb. 8)—JOINT MEETING WITH MNYPCA.

Plan Now to Attend
The Joint Meeting of the
Kansas City and St. Louis Societies
June 8-10
Holiday Inn, Lake of the Ozarks, Missouri

(Mar. 13)—"SEMIBULK SYSTEMS—POWDERS"—C. Alack, Semibulk Systems.
(Apr. 3)—"CALCULATION APPROACH TO EFFICIENT TITANIUM DIOXIDE FORMULATION IN COATINGS"—Rebecca Craft, E.I. du Pont de Nemours & Co., Inc.
(May 8)—"A SOLVENT PROPERTY AND SOLUBILITY PARAMETER CALCULATOR"—Mark Dante, Exxon Chemical Co.

Pacific Northwest Portland, Seattle & Vancouver Sections

(Jan. 16-18)—"WAX EMULSIONS IN WATER-BORNE COATINGS"—Marshall Wiseman, Michelman Inc.
(Mar. 20-22)—"COUPLING SOLVENT EFFECTS ON WATER-REDUCIBLE ALKYD RESINS"—Rhonda Vance, Dow Chemical.
(Apr. 17-19)—"THE TRUTH ABOUT ACCELERATED WEATHERING—IT'S SIMPLER THAN YOU THINK"—Douglas M. Grossman, The Q-Panel Co.
(May 15-17)—"NEW DEVELOPMENTS IN HIGH SOLIDS RESINS AND RHEOLOGY ADDITIVES"—Robert Van Doren, NL Chemicals.

Philadelphia

(Jan. 11)—JOINT MEETING WITH PHILADELPHIA PCA. "ECONOMIC FORECAST FOR 1990"—Frederick Dickson, ICI.
(Feb. 8)—"TRENDS IN THE COATINGS INDUSTRY"—Chuck Reitter, *American Paint & Coatings Journal.*
(Mar. 8)—"EPOXY RESINS FOR LOW VOC COATINGS"—William Collins, CIBA-GEIGY Corp.
(Apr. 28)—AWARDS BANQUET.
(MAY)—MANUFACTURING SEMINAR.

Technical Committee Meetings

(Jan. 4)—"SILICONES FOR TODAY'S PAINT INDUSTRY"—Edward Orr, Byk-Chemie, U.S.A.
(Feb. 1)—"REGULATORY UPDATE OF FORMALDEHYDE"—Jeffrey D. Felder, Monsanto Chemical Co.
(Mar. 1)—"NOVEL ISOCYANATE FREE CHEMISTRY"—Kenneth Van Dyke, Hüls.
(Apr. 5)—"PIGMENT SYNERGISM"—John Baiker, NYCO.

Rocky Mountain

(Jan. 8)—"WAX EMULSIONS IN WATER-BORNE COATINGS"—Marshall Wiseman, Michelman Inc.
(Mar. 12)—"COUPLING SOLVENT EFFECTS ON WATER-REDUCIBLE ALKYD RESINS"—Rhonda Vance, Dow Chemical.
(Apr. 10)—"THE TRUTH ABOUT ACCELERATED WEATHERING—IT'S SIMPLER THAN YOU THINK"—Douglas M. Grossman, The Q-Panel Co.
(May 7)—"NEW DEVELOPMENTS IN HIGH SOLIDS RESINS AND RHEOLOGY ADDITIVES"—Robert Van Doren, NL Chemicals.

St. Louis

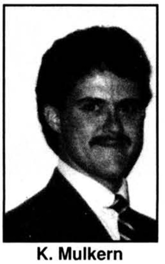
(Jan. 16)—Special Education Night. "TRENDS IN THE COATINGS INDUSTRY"—Chuck Reitter, *American Paint & Coatings Journal.*
(Mar. 20)—"THE TRUTH ABOUT ACCELERATED WEATHERING—IT'S SIMPLER THAN YOU THINK"—Douglas M. Grossman, The Q-Panel Co.
(Apr. 17)—MANUFACTURING MEETING.
(May 15)—Past-Presidents' Night. "TiO_2 UPDATE—DOMESTIC AND WORLD"—Louis Griffis, Kerr McGee.
(June 8-10)—JOINT MEETING OF ST. LOUIS AND KANSAS CITY SOCIETIES. Holiday Inn, Lake of the Ozarks, Missouri.

Western New York

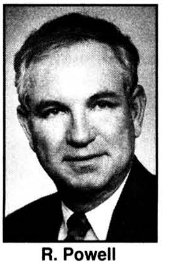
(Dec. 19)—"POLYFUNCTIONAL ISOCYANATE OXAZOLIDONE RESINS"—Bernie Taub, Spencer Kellogg/Reichhold Chemicals, Inc. Fanny's, Amherst, NY.
(Jan. 16)—JOINT MEETING WITH BUFFALO PCA. Buffalo Raceway, Hamburg, NY.
(Feb. 20)—Subject to be announced. Protocol, Williamsville, NY.
(Apr. 17)—"FACTORS OF INFLUENCE IN MATERIAL WEATHERABILITY"—Mike Crewdson, SubTropical Testing Service. Cambria's, Of Course!, Nepew, NY.
(May 15)—"WATER-BORNE COATINGS FOR WOOD"—Theodore DelDonno, Rohm and Haas Co. Shooters Restaurant, Buffalo, NY.

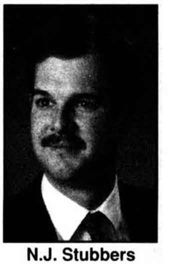
People

The promotions of **John J. Walsh** to Vice President/General Manager and **Kevin Mulkern** to Vice President/Sales, have been announced by The Truesdale Company, Brighton, MA. A member of the New England Society, Mr. Walsh joined the company in 1986 as Sales Manager. Prior to that he was with Monsanto for over 20 years. Mr. Mulkern began working with Truesdale as Technical Specialist also in 1986. Before that, he held a Technical Management position at Samuel Cabot, Inc. He is a Past-President of the New England Society.


K. Mulkern


W. Ryan


R. Powell


N.J. Stubbers

The appointment of **William Ryan** as Haloflex® and Alloprene® Product Manager for ICI Resins US, Wilmington, MA, has been announced. Mr. Ryan will manage all commercial aspects of ICI Resins' Haloflex vinylidene chloride terpolymers and Alloprene chlorinated rubber.

Du Pont Company, Wilmington, DE, has announced the following appointments within its Chemical & Pigments Department: **Gerald Campbell**—Senior Account Manager/Coatings and Plastics, Midwest/Cleveland; **R. David Brackins**—Account Representative/Pulp and Paper, Midwest/Kalamazoo; **Patricia A. Nichols**—Planning Specialist, Wilmington (Southern Society member); **William J. Stenger, Jr.**—Account Manager/Coatings and Plastics, East/Florida (Baltimore Society member); **Colette M. Daney**—Account Manager/Coatings and Plastics, East/Baltimore (Los Angeles Society member); and **Keith J. Smith**—Senior Account Manager/ Coatings and Plastics, West/Bay Area.

Also, **Edward J. Donnelly, Jr.** has been named Director of Marketing for Automotive Finishes, and **Robert L. Turner** has been appointed Director of Automotive OEM Finishes Technology for Du Pont's Automotive Products, Troy, MI.

In addition, **T.W. Boaz** was named Industry Manager for the White Pigments & Mineral Products Division of the Chemical and Pigments Department of Du Pont in Wilmington, DE. Formerly Market Manager for Coatings and Plastics, Mr. Boaz was Sales Manager for the western U.S.

S.P. Morell & Company, Scarsdale, NY, has appointed **Jim Goldsmith** as Technical Representative covering the mid-Atlantic territory. Mr. Goldsmith brings 21 years of chemicals experience to this position.

Rich Powell has been elected Vice President and Manager of Raw Material Sales to the Coatings and Allied Industries by the Board of Directors of The Argus Company, Louisville, KY. Bringing over 22 years experience to this post, Mr. Powell has held technical sales positions with Reichhold and NL Industries. He is a member of the Louisville Society.

Stan Haduch has been appointed General Sales Manager with Ball Chemical Company, Glenshaw, PA. Mr. Haduch joined Ball in 1985 as Senior Sales Representative. He is a Past-President of the National Association of Corrosion Engineers.

The appointment of **Charles L. Wolven** as Director/Business Planning for SCM Chemicals, Baltimore, MD, has been announced. In this position, Mr. Wolven will be responsible for the direction and coordination of all strategic business planning and analysis activities for SCM Chemicals Worldwide operations, including long-range plans, potential acquisitions, expansions, and joint ventures.

In addition, **Timothy F. Hely** has been named Director/Materials for SCM. Among his responsibilities, Mr. Hely will control the purchasing activities of all raw materials, energy, and other services and supplies.

The Specialty Chemicals Group of Morton International, Chicago, IL, has announced the promotion of **John D. Harigan** to Vice President/Automotive and Industrial Finishes. Prior to joining Morton, Mr. Harigan held various positions in the coatings for plastics and substrates industry including the title of Group Manager for PPG Industries.

The appointment of **Neil J. Stubbers** as Technical Sales Representative with Deeks and Company, Cincinnati, OH, has been announced. Mr. Stubbers will work out of the Cincinnati sales office and cover the Ohio region. He is a member of the CDIC Society.

The Additives Division of CIBA-GEIGY Corporation, Hawthorne, NY, has announced the following appointments: **Leslie R. Gatechair**—Specialist/Diversification Products; **Bruno Salle**—Senior Technical Representative; and **Laura Geer**—Sales Service Coordinator/Coatings, Radiation, and Photography.

In addition, **Eric Tucker** has joined the Pigments Division as Manager/Materials Management. Prior to joining CIBA-GEIGY, Mr. Tucker held the position of Materials Manager at Cobe American Scale in Elmsford, NY.

Walter W. Banker, Vice President of Finance and Administration of Croda Inks Corporation, Niles, IL, has announced his retirement. Replacing Mr. Banker will be **Larry Rokosz**, who will be appointed Financial Director for the company.

Howard W. Jacobson has been named Departmental Fellow in Du Pont's Chemicals and Pigments Department. Mr. Jacobson joined Du Pont as a Research Chemist in 1955. He holds 30 U.S. patents covering inventions related to improved titanium dioxide pigments, advanced ceramics, and refractory metals. Mr. Jacobson works out of the Jackson Laboratory of Du Pont in Deepwater, NJ.

Dean Stanley Tarbell was presented with the 1989 Dexter Award for Outstanding Contributions to the History of Chemistry during the fall meeting of the American Chemical Society (ACS).

The Award was inaugurated in 1956 by Dexter Chemical Corporation of New York and is administered by the History of Chemistry Division of the ACS.

Dr. Tarbell's work in the history of chemistry was done in collaboration with his wife, Dr. Ann Tracy Tarbell. Their work has largely centered on the development of organic chemistry in the United States and has resulted in numerous articles and two books: a biography "Roger Adams; Scientist and Statesman," and "Essays on the History on Organic Chemistry in the United States."

The Powder Coatings Division of the O'Brien Corporation, S. San Francisco, CA, has announced the promotion of **Buddy Miller** to the position of Business Development Manager for Functional Powder Coatings. In his new position, Mr. Miller will concentrate selling efforts in the pipe coatings line, as well as develop business for functional coatings applied to rebar, riser pipe, valves and fittings, and any other thick film applications.

Past-President of the Detroit Society, **Charles L. Collinson**, has joined the staff of BYK-Chemie USA, Wallingford, CT, as Senior Technical Representative/Automotive, in the Detroit area. Mr. Collinson is also a member of the Technical Association of the Pulp & Paper Industry.

Guiseppe Dossi has been named General Manager of CMS S.p.A.—Crown Metro Aerospace Coatings, Italy. He will be headquartered in San Zenone degli Ezzelini, TV, Italy. Mr. Dossi was promoted after two years as Production Manager at Crown Metro and will be responsible for all internal aspects of the company.

In addition, **Mike Shaffer** has joined the staff of Crown Metro as Senior Chemist/Technical Service. He will work out of the Los Angeles, CA, office.

Joseph C. Michalski has joined the staff of Seegott Inc., Parsippany, NJ, as Sales Representative. Before coming to Seegott, Mr. Michalski was employed by CIBA-GEIGY Corp., UNOCAL Chemicals, AZS Corp., and Trimont Chemicals Corp.

The D.H. Litter Company, Inc., New York, NY, has announced the appointment of **Stanley Wojnicki** as a Sales Representative for the New York and New Jersey territories. Mr. Wojnicki most recently served as Sales Representative with Johnson & Johnson.

Brian Shuma has been named General Supervisor of Whitestone for Genstar Stone Products Company, Hunt Valley, MD. In his new capacity, Mr. Shuma will oversee the mining, primary crushing, and hauling of all whitestone at the firm's calcium carbonate plant in Texas, MD.

Texaco Chemical Company, Houston, TX, has announced the appointment of **Eric T. Keefer** as Technical Sales Development Representative/Specialty Coatings. His territory will be Ohio and the southeastern United States.

Larry J. Baldwin has been named Senior Research Chemist at Ferro Corporation, Cleveland, OH. In fulfilling his new duties, Mr. Baldwin will be involved in research and development of specialty organic materials.

The Specialty Chemicals Group of Georgia-Pacific Corporation, Atlanta, GA, has appointed **Charles W. Morris** its Business Manager. Previously, Mr. Morris was President of Purification Engineering Inc., and Vice President and General Manager of Sylvachem Corporation.

Michael J. Doherty has been promoted to Area Manager in the Steel Valley District of Betz MetChem, Horsham, PA. In his new position, Mr. Doherty will be responsible for all sales and service activities in central and western Kentucky. He has been with Betz since 1986.

J. David Wolf and **Lee N. Fiedler** will take on new executive assignments for Goodyear, Akron, OH. Mr. Wolf was elected a Corporate Vice President of Purchasing to succeed Mr. Fiedler, who becomes Vice President and General Manager of the Chemical Division with broadened responsibility to establish that division as the first autonomous business within the General Products Division.

Also, Goodyear's Polyester Division has named **Jim Ranomer** Manager of Recycling Programs, and **Tom Peterson** Marketing Manager for Bottle Resins.

The following appointments have been announced by by Arizona Chemical Company, Panama City, FL: **Randy N. Waldman**—District Manager, St. Paul, MN; **Don C. Grubbs**—Senior Sales Representative, Cleveland, OH; **Michael J. Lally**—Sales Representative, Cincinnati, OH; **Richard E. Judd**—Senior Sales Representative, Stockholm, NJ; and **Sam D. Belcher**, National Accounts Manager/Ink Resins, Panama City.

Roland Valin has been promoted to Sales Manager for Sandoz Chemicals Corporation's Charlotte, NC, Pigments and Additives Industry Line. Mr. Valin joined Sandoz in 1983 as a Laboratory Supervisor. He was promoted to his most recent position, Manager of Technical Services, in 1988. Mr. Valin is a member of the Detroit Society.

Gary W. Miller has been appointed Vice President and General Manager of Devoe & Raynolds Company, Louisville, KY. In his new position, Mr. Miller will direct the operations of Devoe Paint's stores around the country. In addition, he will be responsible for the technical and marketing functions of the company and will oversee Devoe's Dealer marketing activities through its outlets nationwide.

Obituary

Dean A. McGee, Chairman Emeritus and Chairman of the Executive Committee of the Board of Directors of Kerr-McGee Corporation, died September 15. He was 85.

Mr. McGee graduated from the University of Kansas in 1926 with a Bachelor of Science Degree in mining engineering. He joined Phillips Petroleum Company as a Petroleum Geologist, and was later promoted to Chief Geologist. In 1937, Mr. McGee joined A & K Petroleum Company, predecessor of Kerr-McGee Corporation, as Chief Geologist. Over the following years, Mr. McGee served in a number of capacities within the company, culminating with the position of Chairman and Chief Executive Officer.

Mr. McGee has received numerous awards, citations, and honorary degrees in recognition of his professional contributions and humanitarian service. Among these are the highest awards of the American Association of Petroleum Geologist; the American Pretroleum Institute; the American Institute of Mining, Metallurgical, and Petroleum Engineers; and the National Petroleum Hall of Fame.

State University of New York Short Course April 18-20, to Focus on Polymer Blends

The Institute of Materials Science, State University of New York, New Paltz, NY, will present a short course on "Polymer Blends and Alloys: Phase Behavior, Characterization, Morphology, Alloying Technology," in Orlando, FL, April 18-20.

The course emphasizes the fundamental theories and the practical consequences of miscibility, phase behavior, morphology and characterization techniques. Also included are a comprehensive review of the science and technology of polymer blends, new applications, and case histories that led to successful commercial products.

Topics to be discussed include: miscibility in polymer blends; high temperature miscible blends; processing effects on morphology and mechanical properties; compatibilizers for polymer blends; chemistry for compatibilization of polymer blends/alloys; mechanical properties of high impact polymers; review and recent advances of applications of polymer blends and alloys; interfacial aspects of polymer blends; relationship to material properties; control of morphology and mechanical properties through reactive compounding; effects of chemical interactions in polymer blends; blends of block copolymers with other polymers and resins; physical and mechanical properties of impact modified PC/PET blends; and polymer blends containing acrylonitrile-butadiene-styrene (ABS polymer).

The series of lectures is designed for scientists and engineers who are, or will be, involved in the research and development, the manufacturing, or the applications of polymer blends and alloys.

For more information, write Institute of Materials Science, CSB 209, State University of New York, New Paltz, NY 12561.

ASTM to Sponsor Symposium On Analysis of Paints, May 14-15

The application of current analytical techniques to the solution of coatings problems will be the focus of a seminar sponsored by ASTM, on May 14-15, at the Pittsburgh Hilton in Pittsburgh, PA.

During the two-day seminar, top national and international analytical authorities will present and discuss the latest techniques and instruments used to analyze paints, coatings, and related materials.

A Special Technical Publication based on the symposium proceedings will be published following the symposium.

For a free program booklet, with fees, enrollment, and hotel information, contact David Bradley, ASTM, 1916 Race St., Philadelphia, PA 19103-1187. Program details are available from Symposium Chairman William C. Golton, E.I. du Pont de Nemours & Co., Inc., Marshall Laboratory, P.O. Box 3886, Philadelphia, PA 19146.

Coatings Technology Course at DePaul University To Be Sponsored by Chicago Society and PCA

The Joint Education Committee of the Chicago Society for Coatings Technology and the Chicago Paint and Coatings Association will sponsor a "Course in Coatings Technology," from January 9-May 15 at DePaul University, Schmidt Academic Center, in Chicago.

The program, designed to focus on the fundamental tools needed in the coatings industry, is intended as an introduction to the important concepts of coatings technology for chemists, technicians, sales people, and those seeking a basic understanding of the field. Topics to be covered include formulating techniques, raw materials, quality assurance, application methods, problem solving, and environmental considerations.

Each of the 16 weekly meetings will feature lectures by acknowledged professionals in their respective fields.

For more information, contact Joe Polak, Henkel Corp at (312) 579-6198 or Kevin Murray at DeSoto, Inc., (312) 391-9000.

RadTech '90 North America Conference and Exposition To Explore "Radiation Curing: A World of Opportunities"

The Radiation Curing Conference and Exposition, RadTech '90 North America, will be held at the Hyatt Regency in Chicago, IL, on March 25-29. Focusing on the theme of "Radiation Curing: A World of Opportunities," the conference will cover the full spectrum of radiation curing topics to be presented by the industry's leading experts. Three distinct program tracts have been planned: Technical, Business/Marketing, and Users. Areas to be covered include applications, safety and handling, advances in chemistry, testing and measurement, advances in equipment, and markets and economics.

In addition, several preconference seminars have been scheduled. "Introduction to Radiation Curing" will provide a comprehensive overview of radiation curing with specialized discussions on current issues in the graphic arts, adhesives, and coatings fields. A "Chemistry Tutorial" is designed for scientists who are new to radiation curing and need a class in the chemistry and technology to better understand the papers to be presented in the technical track. A "Business Primer" preconference seminar will cover a brief history of the commercial development of UV/EB technology, showing the impact of environmental, government, international and economic factors on the past and projected growth curves.

Exhibits featuring such products as UV/EB equipment, coatings, inks, adhesives, monomers, oligomers, and photoinitiators will be presented.

For additional information, contact RadTech '90 North America, 60 Revere Dr., Suite 500, Northbrook, IL 60062.

Nonmetallic Materials Applications in Oilfield Service To Be Topic of NACE Symposium, April 23-27

A symposium on nonmetallic materials applications in severe oilfield service will be conducted during CORROSION/90, an international corrosion forum devoted to the protection and performance of materials. Sponsored by the National Association of Corrosion Engineers (NACE), CORROSION/90 will be held at Bally's Hotel in Las Vegas, NV, April 23-27.

CORROSION/90 will feature numerous symposia related to the coatings industry that deal with the following technical topics: pipeline coatings, coatings and linings in the 90s, railcar corrosion, and protective systems for military and aircraft material.

In addition, presentations will be given on fiberglass tubular goods for oilfield use; chemical resistance and curing agents in fiberglass reinforced tubulars; plant-applied plastic liners and field coupling systems for line pipe; sucker rod lubricants; and the use of polyethylene for oilfield service equipment. The pitfalls of severe environment testing; HSN for oilfield applications; practical evaluation of o-ring seal explosive decompression resistance; and fiberglass-epoxy lined steel tubulars for CO_2 and H_2S corrosion protection also will be covered.

More than 450 technical presentations on applied and research-oriented issues will be conducted in 35 technical symposia and numerous research presentations during the two-day Research in Progress Symposium which is planned.

An advance program, including symposia details, conference paper abstracts, technical meetings, registration and hotel information may be obtained from the NACE Conference Manager, P.O. Box 218340, Houston, TX 77218.

CALL FOR PAPERS

Inter-Society Color Council Annual Meeting

"Art and Science of Appearance"

April 22-24, 1990 • Marriott Hotel, Cleveland, OH

On April 22-24, the Inter-Society Color Council will hold its annual meeting at the Cleveland Airport Marriott, in Cleveland, OH. The theme of the meeting will be "The Art and Science of Appearance." Among the presentations planned are two open sessions of contributed papers and a poster papers session.

The first session (Interest Group I) will focus on "Spectrophotometry and Colorimetry." The session will run for about three hours and papers of varying lengths will be presented. Those authors with a special or unique measurement technique that can be shared with others may contact the Interest Group co-Chairmen by February 15: Dr. Danny C. Rich, Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543 or Dr. Roy Berns, The Munsell Color Science Laboratory, RIT, P.O. Box 9887, Rochester, NY 14623-0887.

Interest Group II will sponsor an opportunity for practitioners in areas of color science to share insights and results of their work through an additional open session. The focus will be on "Appearance, Modeling, and Vision." This group is particularly interested in work which relates to the focus of the last ISCC meeting on Color Appearance Models. However, any papers relating to the broad scope of appearance, modeling and vision would be welcome. The papers should not exceed 20 minutes in length. Titles and abstracts should be submitted to the following Chairmen: Dr. Norman Burningham, 357 True Hickory Dr., Rochester, NY 14615 or Ms. Paula Alessi, Eastman Kodak Co., 1700 Dewey Ave., Rochester, NY 14650-1925.

The intent of the poster papers session is to provide a forum for individual members to share state-of-the art color information. Poster presentations should promote color communication. Topics are open. To qualify, the work must be original, noncommercial, and suitable for exhibition with or without the author present. Deadline is February 15. Papers will be reviewed and selected by the Papers Committee. Entries should be submitted, in the form of a title and abstract, to the Committee Chairwoman, Ms. Alessi, at the same address listed previously.

ELECTROCOAT/90 to Be Held March 13-15 in Cincinnati

An introductory session, over 25 technical presentations, and an operator's clinic will be featured at ELECTROCOAT/90, scheduled for March 13-15 at the Drawbridge Inn, in the Greater Cincinnati Airport Area, Cincinnati, OH. The event will be sponsored by *Products Finishing* magazine.

The introductory session will provide basic information on electrocoating for those new to the technology or those who desire a refresher course. Technical sessions will address new technological developments, electrocoating system design and operation, pretreatment, regulatory considerations, and end-user experiences. In addition, a special clinic for operators of electrocoating lines has been planned.

Direct inquiries to ELECTROCOAT/90, c/o *Products Finishing*, 6600 Clough Pike, Cincinnati, OH 45244-4090.

CIM Catalog

The availability of a 66-page catalog describing information/educational products covering computer-integrated manufacturing (CIM) has been announced. The bulletin details 113 different products including books, videotapes, courses, clinics, seminars, conferences, and expositions. To obtain a copy of the catalog, contact Market Planning & Communications, Society of Manufacturing Engineers, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930.

SARA Data

EPA Superfund Amendments and Reauthorization Act (SARA) data are available on diskettes. The data file is contained on six 5¹/4 in. double-sided, double density diskettes (360K). Also, Chemicals Subject to Reporting Under the Emergency Planning and Community Right-to-Know Act (Title III of SARA) are available on a data file containing one 5¹/4 in. double-sided, double density diskette. Both systems are compatible with the IBM PC. For more information, contact the United States Department of Commerce, National Technical Information Service, 5285 Port Royal Rd., Springfield, VA 22161.

Color Measurement

A video that explains the concept of color measurement starting with a definition of the sensation of color in terms of hue, chroma, and lightness, with an explanation of tristimulus values, the chromaticity diagram and its uses, has been made available. The video is obtainable in VHS and BETA formats, and running time is 34 minutes. Write to Applied Color Systems, Inc., P.O. Box 5800, Princeton, NJ 08543, for more information on the video "Color Difference Calculations."

Acrylated Melamine Chemistry

Technical data has been published on two new products based on acrylated melamine chemistry. The products are designed to assist in meeting durability performance needs and complying with increased government regulations for paint and coating formulators. Information on these products, designated AM 1129 and AM 1142, can be obtained by writing Monsanto Chemical Co., Monsanto Co., 800 N. Lindbergh Blvd., St. Louis, MO 63167.

Chromatographic System

A chromatographic system for the selective determination of individual oxygenates in gasolines, fuels, and other complex organic mixtures is detailed in literature. The analyzer is a single capillary column based system selective toward oxygen. Further information on the Carlo Erba O-FID Analyzer is available from Fisons Instruments, 24911 Avenue Stanford, Valencia, CA 91355.

Shipping and Storage Drum

An extended fork tube design bulk liquid shipping and storage drum, developed to provide stability for handling and stacking has been introduced in literature. The container is available with carbon steel or stainless steel construction to handle a wide range of liquids. Additional information on the Extended Fork Tube Jumbo™ Drum is available from Clawson Tank Co., 4701 White Lake Rd., Clarkston, MI 48016-0350.

Cyclodextrins

Technical data on cyclodextrins, a class of ring shaped compounds that reportedly have the ability to form molecular inclusion complexes that result in: stabilization, volatility control, solubility, micronizing, contact effect, and masking of odors, has been released. Further information can be obtained by contacting American Maize-Products Co., 1100 Indianapolis Blvd., Hammond, IN 46320-1094.

Spectrometer Series

A full-color brochure that describes the capabilities of a company's spectrometer series and accessories has been issued. Topics covered throughout the pamphlet include software and data systems extensions, spectrometer layout, accessories, and NMR probeheads. Copies of this 16-page brochure are available from Bruker Instruments, Inc., Manning Park, Billerica, MA 01821.

NACE and SSPC to Issue Joint Standards

The National Association of Corrosion Engineers (NACE) and the Steel Structures Painting Council (SSPC) agreed to jointly develop and publish voluntary consensus standards.

The initial joint standard activity focuses on surface preparation of steel using abrasive blast techniques; much of this information is detailed in SSPC Specifications SP5, SP6, SP7, and NACE Standards TM0170 and TM0175. The surface preparation outlined in these documents include: white metal blast cleaning, near-white blast cleaning, commercial blasting cleaning, and brush-off blast cleaning.

The governing bodies of NACE and SSPC agreed to form joint task groups to sponsor joint individual standards or groups of common standards. The task groups will oversee the development and/or revision of the proposed joint document assuring equal opportunity for NACE and SSPC members' input to be considered.

For more information, contact the NACE Technical Service Division, P.O. Box 218340, Houston, TX 77218.

Density Device

Technical data is available on an automatic density device for solids. The system is designed to measure the density of solids having volumes of 0.5-100 mL. English, French, Spanish, or German reporting can be displayed following one keystroke. Information on AccuPyc 1330 density device can be obtained from Micromeritics, One Micromeritics Dr., Norcross, GA 30093-1877.

Liquid Flame Retardant

A technical data sheet describing a high performance liquid flame retardant for homopolymer and copolymer polypropylene has been released. The product is comprised of flame retardants, a stabilizer system, and liquid vehicle carrier. Because the system is aliphatic, dioxins are not produced upon burning, and light stability is improved over conventional aromatic flame retardant polypropylene systems. For further information on the product designated No. 86-00751, contact Tom Loschiavo, PDI: A Business Unit of ICI Americas Inc., 54 Kellogg Court, Edison, NJ 08817.

Aliphatic Isocyanate

An unsaturated aliphatic isocyanate (meta-isopropenyl dimethylbenzyl isocyanate) which reportedly can be copolymerized with many common monomers to prepare functionalized and/or reactive polymers, is the topic of a technical data sheet. The product also can be reacted with diols, triols, and polyols to yield oligomers and polymers with vinyl (isopropenyl) functionality. For more details on TMI® unsaturated aliphatic isocyanate, contact American Cyanamid Co., One Cyanamid Plaza, Wayne, NJ 07470.

Prepainted Metal

To increase industry awareness of the wide range of manufacturing applications for prepainted metal, the National Coil Coaters Association (NCCA) has published two promotional pieces: the Office Products Information Kit and "The Lasting Look of Metal Roofing" brochure created by the Building Products Task Force. Both pieces, plus a variety of literature supporting the use of prepainted metal, is available by contacting NCCA, 1900 Arch St., Philadelphia, PA 19103.

Chlorine Dioxide Generator

Technical information on a mini chlorine dioxide generator system has been released. The mini generator system is a prepackaged design for low flow output of chlorine dioxide. The unit consists of a triplex metering pump; one head for feeding a chlorine dioxide precursor, one head for feeding hydrochloric acid (pH control), and one head for feeding sodium hypochlorite. Contact Marketing Services Dept., Drew Industrial Div., One Drew Plaza, Boonton, NJ 07005, for more details on the Drewchlor® mini generator system.

Concrete Floor Coating

The development of a high-performance coating system for concrete floors is described in literature. Based on aerospace technology, these coatings reportedly display chemical and abrasion resistance and are VOC compliant to most county, state, and federal regulations. The system consists of two coats of Uralox (primer) and one coat of Uramet (topcoat). For more information, contact Stan Haske, Crown Metro Aerospace Coatings, Inc., 4343 Temple City Blvd., Temple City, CA 91780.

Viscometer

Technical data has been released on a flexible, expandable rotational viscometer which includes a built-in electronic speed control and speed setting for the measuring system, as well as a digital display for easy reading of test results. Safety circuits check for system overload, incorrect speed setting, and switch positions. For further information on the Rotovisco RV20 system, contact Fisons Instruments, 24911 Avenue Stanford, Valencia, CA 91355.

Heat Pumps

Information is available on two heat pump control coolers which use an air-to-air heat exchanger to cool electronic and electrical control enclosures. The products eliminate fan-induced contamination of enclosures, enabling the user to seal the cabinet and cool/recirculate interior air. For addition information on models 1115 and 1140 heat pumps, contact Karen Thee, Application Engineer, Vortec Corp., 10125 Carver Rd., Cincinnati, OH 45242-9976.

NMR Spectrometers

A full-color, 20-page guide describes a company's multi-purpose solids and liquids NMR spectrometer product line. The brochure contains details of the instruments' digital and RF architecture, plus a comprehensive summary of available software. For a copy of this brochure, write Bruker Instruments, Inc., Manning Park, Billerica, MA 01821.

Chromatography

American Standards Testing and Materials (ASTM) has introduced its revised second edition of its Standards on Chromatography. Included is this edition are 137 ASTM tests and practices, including: ion chromatography; gas, liquid, thin-layer, and steric exclusion; infrared spectroscopy; and electron impact mass spectrometry. Other related publications on the topic include: "Progress in Analytical Luminescence"; "Chemical Analysis of Metals"; Power Plant Instrumentation for Measurement of High-Purity Water Quality"; Bibliography on Size Exclusion Chromatography (Gel Permeation Chromatography) 1979-1982"; and "Liquid Chromatographic Data Compilation." For ordering information, contact Customer Service Dept., ASTM, 1916 Race St., Philadelphia, PA 19103.

Wet Adhesion Monomer

A recently released technical brochure contains recommended formulations for producing emulsion polymers based on a proprietary wet adhesion monomer. Data includes procedures, properties, and tests for use of the product. Contact Alan Peterkofsky, Commercial Development, Performance Chemicals Div., Alcolac, 1099 Winterson Rd., Linthicum, MD 21090 for more information on Sipomer® WAM wet adhesion monomer.

Mercury Porosimeter

A mercury porosimeter which combines extended measurement techniques with high resolution data has been introduced. The operator reportedly can set up an analysis in either the scanning or equilibration mode and then select pressure points or a maximum intrusion increment (or both) to acquire the data. Contact Micromeritics, One Micromeritics Dr., Norcross, GA 30093-1877, for more information on the Pore-Sizer 9320.

High-Resolution Weighing

An eight page "how to" booklet on high-resolution weighing has been printed. The piece is written in an easy-to-read fashion, and includes a review of the two basic weighing technologies, a glossary of terms, and a brief question and answer section with graphic illustrations and reference charts. For a free copy, contact Ilene Pfifferling, Sartorius Corp., Weighing Systems Div., 140 Wilbur Place, Bohemia, Long Island, NY 11716.

Concrete Coatings

Technical data has been released on a full line of high quality products for preparing and coating concrete floors. The system's preparation materials include stripping agents, cleaners, degreasers, and etching solutions. For more information on the full line of Chemglaze® concrete coating products, write Lord Corp., Industrial Coatings Div., 2000 West Grandview Blvd., P.O. Box 10038, Erie, PA 16514-0038.

Plastoflex Primer

Data has been released on a low-temperature plastoflex primer. The product meets all OEM specifications for hardness, adhesion, ambient and cold flexibility, water resistance, thermal shock, water and soap spotting, and gas, oil, and heat resistance. The primer can be used with either hand spraying systems or with higher production mixing systems for maximum usage. For more information, contact Akzo Coatings, Inc., P.O. Box 7062, Troy, MI 48007-7062.

Color Formulation System

A color formulation system which utilizes high speed measurement capabilities with a 10-nanometer measurement interval to measure high chroma colors is the topic of recently released literature. The system features an IBM compatible processor and a 20-megabyte hard disk drive. Technical details on the Color Mate Formulation System are available from Milton Roy, 820 Linden Ave., Rochester, NY 14625.

Fiber Optic Sensors

A reference handbook on a fiber optic sensors test has been released. Contents include discussions on fundamentals and intensity-modulated, phase modulated, displacement, temperature, flow, level, magnetic and electrical field, and rotation rate (gyroscopes) sensors. In addition, distributed sensing systems, chemical analysis, and digital switches and counters are described. The 240-page book "Fiber Optic Sensors—Fundamentals and Applications," lists at $44.95, and may be obtained by writing to Instrument Society of America, 67 Alexander Dr., P.O. Box 12277, Research Triangle Park, NC 27709.

Visual Standard

The Steel Structures Painting Council has announced a revised visual standard for the abrasive blast cleaning of steel surfaces. This series of photographs illustrates the proper degree of cleanliness of various steel surfaces when cleaned according to written SSPC surface preparation specifications. The new standard, SSPC-VIS 1-89, replaces the SSPC visual standard that had been used by the U.S. coatings industry since 1967. To order SSPC-VIS 1-89, or to receive more information, contact SSPC, 4400 Fifth Ave., Pittsburgh, PA 15213.

SARA Title III Reports

The availability of MSDS Software/ SARA Title III Reports which run on IBM-compatible PCs has been announced. These reports calculate and summarize the inventory quantities including maximum amount, average amount, and number of days on site for the SARA Hazard Information and summarize specific SARA Title III information for each hazardous ingredient. For further information on the BatchMaster PLUS+ MSDS Subsystem, contact Pacific Micro Software Engineering, 35-59th Place, Long Beach, CA 90803.

"WATER-BASED TRADE PAINT FORMULATIONS" and "INDUSTRIAL WATER BASED PAINT FORMULATIONS"

By
Ernest W. Flick

Published by
Noyes Data Corp.
Mill Rd. & Grand Ave.
Park Ridge, NJ 07656 (1988)

Reviewed by
Joseph A. Vona
Westfield, NJ

The books authored by Ernest W. Flick exist in two volumes.

The first volume, "Water Based Trade Paint Formulations," is a collection of 562 water-based trade paint formulations. They are environmentally safer formulations and any solvent used is minimal.

The data consists of manufacturers' suggested formulations and they are divided into three major sections which cover exterior and interior water-based paints, enamels, and coatings. The exterior paints include formulas based on alkyd modified latex paints, all acrylic flat and semi-gloss latex paints. Formulations which meet Federal specifications are also discussed. Latices supplied by different manufacturers are used in formulating paints. Exterior tint base paints formulated with various latices are also discussed. Exterior white paints, exterior trim tint base enamels and semi-gloss paints and enamels are also described.

The interior paint formulations include interior flats, flat tints bases, interior flat white paints, semi-gloss paints and enamels. All are formulated with vinyl, acrylic and/or vinyl-acrylic copolymer latices.

For many formulations, some properties are listed. These include viscosity, solids content, pigment volume concentrations, leveling, sag resistance, scrub cycles, freeze-thaw stability, gloss, water spotting, and adhesion.

This volume also contains a section for chemical trade names and the suppliers name. Addresses of suppliers are also included which is important in requesting technical assistance.

The second volume, "Industrial Water-Based Paint Formulations" consists of 220 water-based industrial paint formulations which provides a basis for paint manufacturers to formulate with modifications, many different types of coatings. These include air dry coatings, bake dry coatings, coil coatings, lacquers, primers, spray enamels, topcoats and traffic paints.

These formulations are for the most part less hazardous and environmentally safer systems. Again, the use of solvents has been minimal. The author has obtained the most recent data available from suppliers.

In many cases, important properties are listed for each formulation. These include: type of paints, application techniques, ingredients by weight and/or volume, mixing suggestions, and properties such as viscosity, gloss, pencil hardness, pigment/binder ratio, etc. More important, the formulations' source is provided. Therefore, the user can consult the supplier to obtain technical assistance.

The book also lists chemical trade names and a chemical description. Also the suppliers' name and address is given.

Although this volume is a compendium of many suppliers' formulations, it is an excellent source of water-based industrial paints.

"SELECTED PAPERS OF TURNER ALFREY"

Edited by
Raymond F. Boyer and
Herman F. Mark

Published by
Marcel Dekker, Inc.
270 Madison Ave.
New York, NY 10016 (1986)
v + 579 Pages, $99.75

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

Here is a book which fits the category of required reading! It is the story of a giant who walked among other great chemists and left his mark on the academic and industrial world.

In this volume, a number of Turner Alfrey's significant contributions to polymer chemistry is laid out for the reader by those who had the good fortune to work with him.

The book begins with Alfrey's academic career at Brooklyn Polytechnical Institute where Herman Mark started him on a study of shellac and from which he became an excellent teacher at the Institute. He was later called to the Dow Chemical Co., where his work from 1948-1981 is cited. A chapter lists his publications and patents; his doctoral thesis then a section devoted to selected papers on statistical order of polymers, viscosity, reactivity ratios, chain transfer, and physical properties of multi-layered polymeric films.

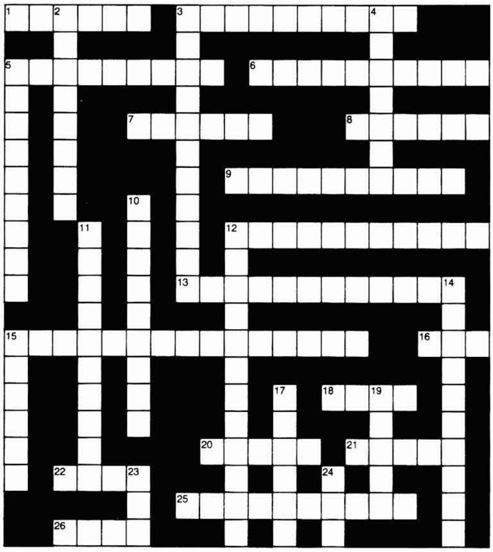
In addition to being delightful reading, this book should be on the shelf of all polymer chemists for the treasures contained between its covers and as a tribute to one of the great polymer chemists of our time.

CrossLinks

by Earl Hill

Earl Hill is a retired Coatings Chemist with an interest in mathematics, statistical quality control, and his home computers. He is a resident of Erie, PA, and has been a member of the Federation for 25 years.

Mr. Hill's puzzles are prepared using an Atari ST computer. The words are selected mainly from the Federation's Paint/Coatings Dictionary and Webster's 9th New Collegiate Dictionary.



Solution to be Published in January Issue

No. 33

ACROSS

1. Lacquer synonym (Japanese)
3. Water-soluble, mid-East gum, T________
5. Something that goes under an enamel
6. Something that goes round 'n round
7. Lithographic drawing
8. Through which we view the outside
9. Military paint
12. Three additive mixture components
13. Consisting of three colors
15. Metal salts for toner pigments
16. Where we may store our vehicles
18. Iron corrosion product
20. A part of a bridge
21. Lightness (color theory)
22. A keyboard mistake
25. Lab instrument to find sp. gr.
26. Goes with 8 Across

DOWN

2. A process of cutting underneath
3. Generally an attribute of 8 and 26 Across
4. Popular chase game played at lunchtime
5. Partial film curing
10. Cast; underhue, e.g.
11. To make an impression on
12. Constituent used to make alkyds (Chem.)
14. Green (Syn.)
15. Opposite of 3 Down
17. Desirable attribute of paint company CEO
19. When 18 Across goes to h____l with the joke
23. Source of TiO_2
24. A type of coater

Coming Events

FEDERATION MEETINGS

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

1990

(Apr. 25-26)—Symposium on Color and Appearance Instrumentation (SCAI). Sponsored by the FSCT and the Inter-Society Color Council. Cleveland Airport Marriott, Cleveland, OH.

(May 16-19)—Federation "Spring Week." Seminar on the 16th and 17th; Society Officers Meeting on the 18th; Board of Directors Meeting on the 19th. Galt House, Louisville, KY.

(Oct. 29-31)—68th Annual Meeting and 55th Paint Industries' Show. Convention Center, Washington, D.C.

1991

(Nov. 4-6)—69th Annual Meeting and 56th Paint Industries' Show. Convention Center, Toronto, Ontario, Canada.

SPECIAL SOCIETY MEETINGS

1989

(Dec. 5)—Cleveland Society 75th Anniversary Dinner Party. Bond Court Hotel, Cleveland, OH. (Charles K. Beck, 75th Anniversary Chairman, 8369 Paddock Court, Mentor, OH 44060).

1990

(Feb. 21-23)—Southern Society. 17th Annual Water-Borne and Higher-Solids Coatings Symposium. New Orleans, LA. (Dr. Robson F. Storey, Department of Polymer Science, University of Southern Mississippi, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Mar. 14-16)—Southwestern Paint Convention. Houston and Dallas Societies. Doubletree at Post Oak, Houston, TX. (Neil McBride, P.O. Box 841156, Houston, TX 77284-1156).

(Apr. 4-7)—Southern Society. Annual Meeting. Sandestin Beach Hilton, Destin, FL. (James R. Salisbury, Union Carbide Corp., 2043 Steel Dr., Tucker, GA 30084).

(May 3-5)—Pacific Northwest Society. Annual Symposium. Red Lion Hotel, Bellevue, WA.

(June 8-10)—Joint Meeting of the St. Louis and Kansas City Societies. Holiday Inn, Lake of Ozarks, MO.

1991

(Feb. 18-20)—Western Coatings Societies' 20th Biennial Symposium and Show. San Francisco Hilton, San Francisco, CA.

(May 2-4)—Pacific Northwest Society. Annual Symposium. Meridien Hotel, Vancouver, British Columbia, Canada. (John P. Berghuis, NL Chemicals Canada, Inc., 3450 Wellington Ave., Vancouver, B.C., Canada, V5R 4Y4).

OTHER ORGANIZATIONS

1989

(Dec. 12-15)—"Getting Into Compliance with Environmental Regulations for Paint and Coatings Facilities." Short course sponsored by UC Berkeley Extension, University of New Orleans, New Orleans, LA. (Continuing Education in Engineering, UC Berkeley Extension, 2223 Fulton St., Berkeley, CA 94720).

1990

(Jan. 21-24)—ASTM Committee D-1 Meeting on Paint and Related Coatings and Materials. Embassy Suites Hotel, Ft. Lauderdale, FL. (ASTM, 1916 Race St., Philadelphia, PA 19103).

(Jan. 22-24)—ASTM Committee E-12 Meeting on Appearance of Materials. Embassy Suites Hotel, Ft. Lauderdale, FL. (Sharon Kauffman, ASTM, 1916 Race St., Philadelphia, PA 19103).

(Feb. 18-21)—Adhesion Society Annual Meeting. Sheraton Savannah Resort and Hotel, Savannah, GA. (Adhesion Society President Jim Wightman, Dept. of Chemistry, VPI & SU, Blacksburg, VA 20461).

(Mar. 13-15)—Electrocoat/90. Drawbridge Inn and Convention Center, Ft. Mitchell, KY. (Cindy Puthoff or Anne Goyer, Gardner Management Services, 6600 Clough Pike, Cincinnati, OH 45244).

(Mar. 25-29)—RadTech '90—North America. Radiation Curing Conference and Exposition. Hyatt Regency Chicago, Chicago, IL.

(RadTech International North America, 60 Revere Dr., Suite 500, Northbrook, IL 60062).

(Apr. 2-6)—11th International Corrosion Congress. Florence, Italy. (AIM—Associazione Italiana di Metallurgia, Piazzale Rodolfo Morandi, 2, I-20121 Milano, Italy).

(Apr. 16-21)—Materials Research Society Spring Meeting. San Francisco Marriott Hotel, San Francisco, CA. (Materials Research Society, 9800 McKnight Rd., Suite 327, Pittsburgh, PA 15237).

(Apr. 22-24)—Inter-Society Color Council Annual Meeting. Cleveland Airport Marriott, Cleveland, OH. (Program Chairman, James E. Grady, Pigments Dept., CIBA-GEIGY Corp., 7187 White Pine Dr., Birmingham, MI 48010).

(Apr. 23-27)—Corrosion/90 sponsored by the National Association of Corrosion Engineers. Bally's Hotel, Las Vegas, NV. (NACE, Conference Manager, P.O. Box 218340, Houston, TX 77218).

(Apr. 30-May 2)—Surface Coating '90. Sponsored by the National Chemical Coaters Association, The Sheraton Sturbridge Resort and Conference Center, Sturbridge, MA. (Shirley Spears, NCCA, P.O. Box 44275, Cincinnati, OH 45244).

(May 2-9)—Surface Treatment '90. Hannover Fairgrounds, Hannover, West Germany. (Hannover Fairs USA Inc., 103 Carnegie Center, Princeton, NJ 08540).

(May 8-10)—Haztech International Conference and Exhibition. Sponsored by the Institute for International Research. George R. Brown Convention Center, Houston, TX. (Rachelle Scheinbach, Executive Director, Institute for International Research—Bellevue, 13555 Bel-Red Rd., Bellevue, WA 98009).

(May 14-15)—"Analysis of Paints and Related Materials." Symposium sponsored by ASTM Committee D-1. Pittsburgh, PA. (Marsha Firman, ASTM, 1916 Race St., Philadelphia, PA 19103).

(May 14-19)—"Interpretation of IR and Raman Spectroscopy." Course and Workshop. Vanderbilt University, Nashville, TN. (Clara Craver, Director, Fisk Infrared Institute, Box 15, Fisk University, Nashville, TN 37203).

(May 21-23)—12th International Conference on "Advances in the Stabilization and Controlled Degradation of Polymers." Luzern, Switzerland. (A.V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(May 30-June 1)—4th International Conference on "Crosslinked Polymers." Luzern, Switzerland. (A.V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(June 13-15)—Solid Waste and Recycling Technology Conference and Exhibition. Sponsored by the Institute for International Research. Cobo Conference/Exhibition Center, Detroit, MI. (Rachelle Scheinbach, Executive Director, Institute for International Research—Bellevue, 13555 Bel-Red Rd., Bellevue, WA 98009).

(June 18-20)—64th American Chemical Society (ACS) "Colloid and Surface Science" Symposium. Sponsored by ACS Division of Colloid and Surface Chemistry, Lehigh University, Bethlehem, PA. (M.S. El-Aasser, Emulsion Polymers Institute, Lehigh Univ., 111 Research Dr., Bethlehem, PA 18015).

(July 9-13)—16th International Conference on "Organic Coatings Science & Technology." Athens, Greece. (A.V. Patsis, Institute of Materials Science, State University of New York, New Paltz, NY 12561).

(July 23-25)—"Polymer Analysis and Characterization." International symposium sponsored by Du Pont Company and the Czechoslovak Academy of Sciences, Brno, Czechoslovakia. (Howard G. Barth, ISPAC Chairman, Du Pont Co., Experimental Station E228/238, P.O. Box 80228, Wilmington, DE 19880-0228 or Josef Janca, Inst. Analytical Chem., Czechoslovak Acad. Sci., Leninova 82, 611 42 Brno, Czechoslovakia).

(Sept. 10-14)—NACE Fall Committee Week/90 sponsored by the National Association of Corrosion Engineers. (NACE, P.O. Box 218340, Houston, TX 77218).

(Sept. 16-22)—20th FATIPEC Congress. Acropolis, Nice, France. (Jacques Roire, A.F.T.P.V., 5 rue Etex, 75018 Paris, France).

(Sept. 26-28)—Haztech International Conference and Exhibition. Sponsored by the Institute for International Research. Brooks Hall, San Francisco, CA. (Rachelle Scheinbach, Executive Director, Institute for International Research—Bellevue, 13555 Bel-Red Rd., Bellevue, WA 98009).

(Oct. 2-4)—Haztech International Conference and Exhibition. Sponsored by the Institute for International Research. David L. Lawrence Convention Center, Pittsburgh, PA. (Rachelle Scheinbach, Executive Director, Institute for International Research—Bellevue, 13555 Bel-Red Rd., Bellevue, WA 98009).

(Oct. 25-26)—"Water in Exterior Building Walls: Problems and Solutions." Symposium sponsored by ASTM, Dearborn, MI. (Symposium Chairman, Thomas A. Schwartz, Simpson Gumpertz & Heger Inc., 297 Broadway, Arlington, MA 02174).

(Oct. 31-Nov. 2)—103rd Annual Meeting of the National Paint and Coatings Association. Washington, D.C. (National Paint and Coatings Association, 1500 Rhode Island Ave., N.W., Washington, D.C. 20005).

(Nov. 9-11)—National Decorating Products Show. Sponsored by the National Decorating Products Association (NDPA). Indiana Convention Center and Hoosier Dome, Indianapolis, IN. (NDPA, 1050 N. Lindbergh Blvd., St. Louis, MO 63132-2994).

1991

(Feb.)—Inter-Society Color Council Williamsburg Conference. Williamsburg, VA. (Louis A. Graham, Lou Graham & Associates, Inc., 1207 Colonial Ave., Greensboro, NC 27408).

(Mar. 4-8)—Corrosion/91 sponsored by the National Association of Corrosion Engineers. Cincinnati, OH. (NACE, Conference Manager, P.O. Box 218340, Houston, TX 77218).

(Apr. 22-25)—The Euro-Asian Interfinish Israel 1991. Conference sponsored by the Metal Finishing Society of Israel. Herzlia, Israel. (Secretariat, Ortra, Ltd., 2 Kaufman St., Tel-Aviv 61500, Israel).

(July 7-12)—Seventh International Conference on Surface and Colloid Science (ICSCS). Sponsored by the International Association of Colloid and Interface Scientists, Université de Technologie de Compiègne, France. (M. Clausse, Secretariat of the 7th ICSCS, c/o Wagons-Lits Tourisme, B.P. 244, 92307 Levallois-Perret Cedex, France).

Advertisers Index

NOTE: The Advertisers' Index is published for the convenience of our readers and as an additional service to our advertisers. The publisher assumes no liability for errors or omissions.

'Humbug' from Hillman

Here it is October and snow is in the air amid the glorious foliage of Vermont. As I put together yet another December column it is difficult to realize that as you are reading this, it will soon be the season "to be jolly," for "peace on earth, good will to men" (and women!), and for "joy to the world." All of which, I wish for every one of my readers.

In looking back over the past year, I remember, with sadness, the passing of my good friend and faithful contributor, Roy Tasse. Roy always searched for the "belly laff" because, as he wrote in a letter to me just a week before his sudden death, "laffs keep the facial muscles from sagging." So—have a few "belly laffs" on Roy from the July 1973 *Farmers Almanac*:

Verbal Burbles

Overjoyed father .... Happy pappy
Weak bird .... Frail quail
Criminal shellfish .... Mobster lobster
Frank Perdue .... Rooster booster
Listless bird .... Dull gull
Amiable bird .... Pleasant pheasant
Arrogant horseman .... Cocky jockey
Dancing nun .... Sister twister
Happy bird .... Perky turkey
Typo error .... Proof goof

A man rushed into a drugstore and asked the druggist how to stop hiccups. The answer was a slap in the face. Amazed and angry, the man demanded the reason for such behavior.

"Well," the druggist said, "you don't have hiccups any more, do you?"

"No," shouted the customer, "but my wife, out in the car, still has!"

The Second Class Seaman was describing his war adventures to his aunt. She listened with bulging eyes as he recounted them.

"One day," he went on, "I looked over the side and two points off the starboard bow, I saw a torpedo only 40 feet away and headed right toward us."

"My goodness," interrupted the aunt, "I hope it was one of ours!"

During the first day of school, the teacher informed all the students that if they had to go to the restroom, they were to raise two fingers. Puzzled, one kid asked, "How's that going to help?"

During a lull in the doings at the discotheque, the girl impulsively declared "Let's get married now, George. I don't want to wait around until I'm 35 and have wrinkles, bags under my eyes, and a pot belly."

"Well," George replied, "If that's the way you're going to look. Let's forget it!"

—Sign at a perfume counter—Don't use this brand if you're bluffing!

—Sign in finance company window—"For the man who has everything but hasn't paid for it."

Son—"Dad, I'll never solve this problem."

Dad—"Don't give up, son. Robert Fulton didn't give up, Thomas Edison didn't give up and then, look at Irving McPringle."

Son—"Who's Irving McPringle?"

Dad—"See! You never heard of him. He gave up!"

As he paid the hotel bill, the departing guest turned and called to the bellhop—"Quick, run up to room 454 and see if I left my pajamas and razor there. Please hurry because I have six minutes to catch a train." Four minutes later the bellhop was back and out of breath. "Yes sir," he reported, "they're up there!"

Meeting at lunch, two businessmen were talking about world problems, high taxes, and, finally, about their families. "I have six boys," one of them said, proudly.

"That's a nice family. I wish I had six children," sighed the other.

"Why, don't you have any children?" the proud father asked with a touch of sympathy in his voice.

"Oh yes—twelve!" sighed the second man.

Air pollution is getting so bad that if you shoot an arrow in the air it will get struck there.

And—from the *American Legion Magazine*, Roy marked for our attention—

—One publisher to a colleague, "The trouble with being in the publishing business is that too many people who have half a mind to write a book, do so!"

—Two women were talking on a bus. One said, "Tomorrow is my husband's birthday."

"What are you getting for him?" her friend asked.

"Make me an offer!"

—Children are a great help in your old age. They help you get there faster.

—The government defines a citizen as one who has what it takes.

—Herb Hillman
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