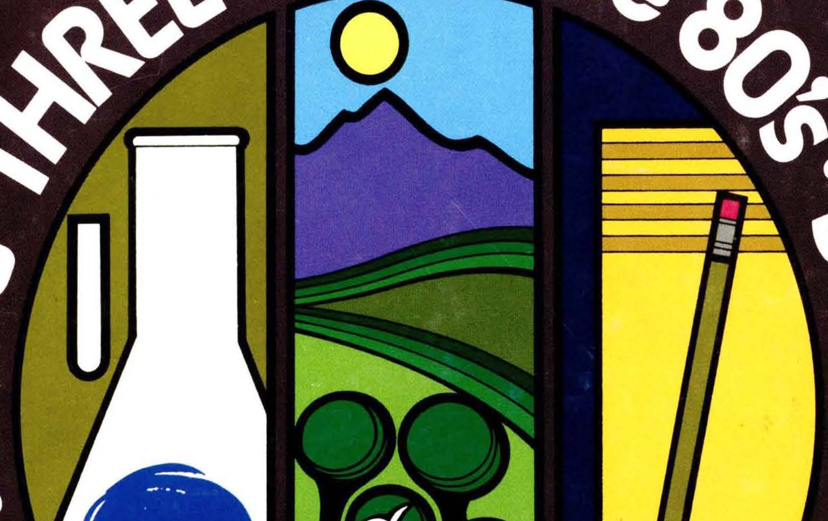
JCTAX 52 (668) 1–130 (1980)

SEPTEMBER 1980

jct JOURNAL OF COATINGS TECHNOLOGY

THREE R's for the 80's

· RESEARCH · RESOURCES · REGULATIONS ·



CONVENTION ISSUE

At Thibaut & Walker, we've always had a reputation for quality resins, consistent formulations, and a broad range of products at a competitive price.

The reputation led to substantial growth, which is why we have recently expanded our facilities dramatically. We enlarged our plant. Increased our laboratory and R & D department. Introduced the latest state-of-the-art production and quality-control equipment and methods, and developed a larger and more efficient delivery system.

Now, we offer one of the widest groups of resins available . . . 100% acrylics, vinyl acrylics, polyurethanes, and a full line of long, medium, and short oil alkyds . . . the exact formulations you require . . . shipment after shipment. In fact, our formulations are so consistent and deliveries so much on schedule you can set your production dates with confidence.

You can also take full advantage of our years of experience producing resins for coatings by calling in one of our representatives or technical advisers, each an expert and each ready and willing to assist you.

Don't delay. Contact us today for the resins that give you quality, consistency, and on-time delivery. And remember, the reputation for quality that made us grow can have the same effect on you.

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SEPTEMBER 1980

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Volume 52 Number 668

Features

Federation Activities

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.

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PAINT CHEMIST
OF THE YEA

I'D LIKE TO THANK MY MOTHER, MY CHEMISTRY PROFESSOR AND, OF COURSE, UCAR ACRYLICS.

I wouldn't be here without you.

In fact, my boss, the paint manufacturer, wouldn't be, either. You see, two years ago we were faced with a terrible choice. Either sacrifice the quality of our paint. Or sacrifice ourselves.

Then I discovered UCAR Acrylics. I was able to formulate paints with the same exterior durability as with conventional acrylics. And the boss was able to save as much as 25¢ on every gallon.

What's more, with UCAR Acrylics I can get other performance characteristics such as gloss retention, pigment binding and resistance to both chalking and dirt pickup. And the boss is still making more than he was with conventional acrylics.

My advice to every paint chemist out there is to call your local Union Carbide Sales Representative and ask for more information about UCAR Acrylics. Or write to Dept. JLS, 270 Park Avenue, New York, N.Y. 10017.

And when your boss offers you a testimonial dinner as a reward, listen to your mother. Mine told me to ask for a raise.

UNION CARBIDE

Coatings Materials

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.

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	U.S. and Canada	Europe (Air Mail)	Other Countries
1 Year	$20.00	$33.00	$28.00
2 Years	$37.00	$63.00	$53.00
3 Years	$52.00	$91.00	$76.00

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

A Guide for Authors is published in each January issue.

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

Comment

The Unheralded Thin Coating

Automobile manufacturers are preparing for another year and the 1981 models will be unveiled soon. Let us hope that the continuing accent toward smaller and more efficient vehicles will spur sales and get the U.S. economy moving again.

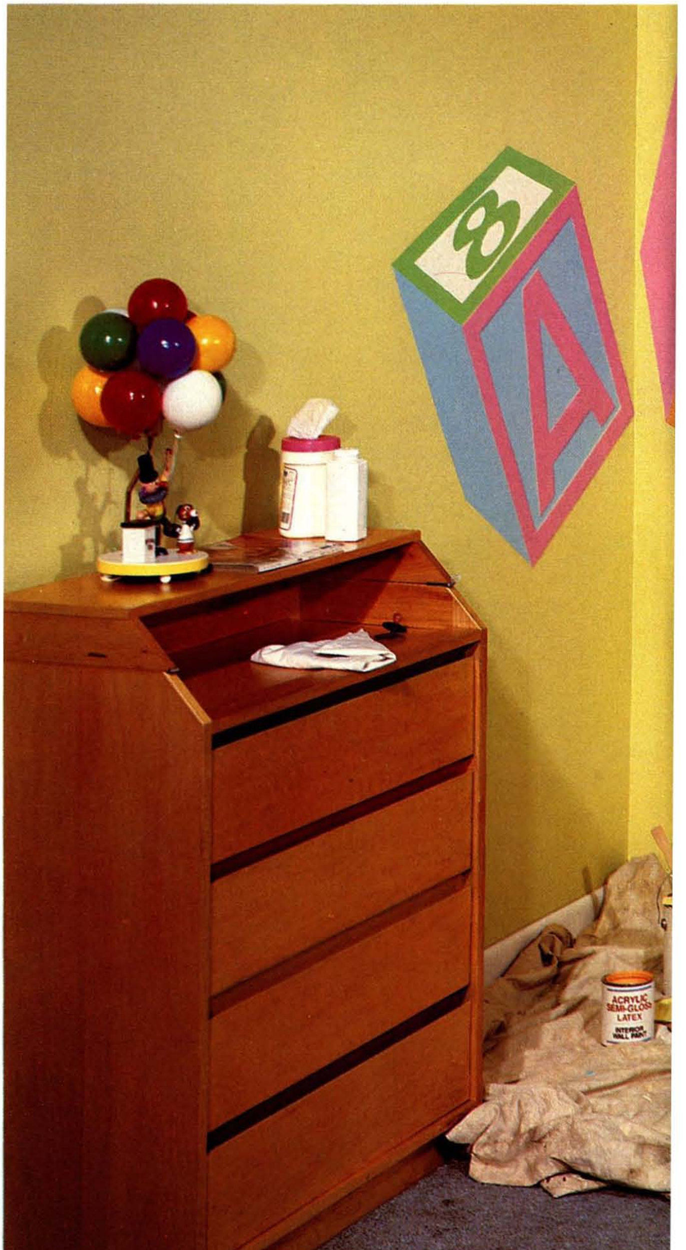
As happens every fall, the auto manufacturers will be touting: better gas mileage, sleeker body designs, improved safety & engineering features, additional options, and more luxurious interior appointments.

One permanent fixture which receives little publicity and which car buyers take for granted is the durable finish which both beautifies and protects. Compared to the price and size of the body it surrounds, and considering the good job it does in resisting the elements, the thin and inexpensive coating is a bargain.

The National Paint and Coatings Association recently announced that its new consumer sales campaign will be entitled, "Picture It Painted."

Let's borrow that for a moment, but reverse it in the case of automobiles: *Picture Them Unpainted!!!!*—FJB.

For semi-gloss and eggshell with performance that inspires... RHOPLEX® AC-417.



Satisfied customers mean repeat business.

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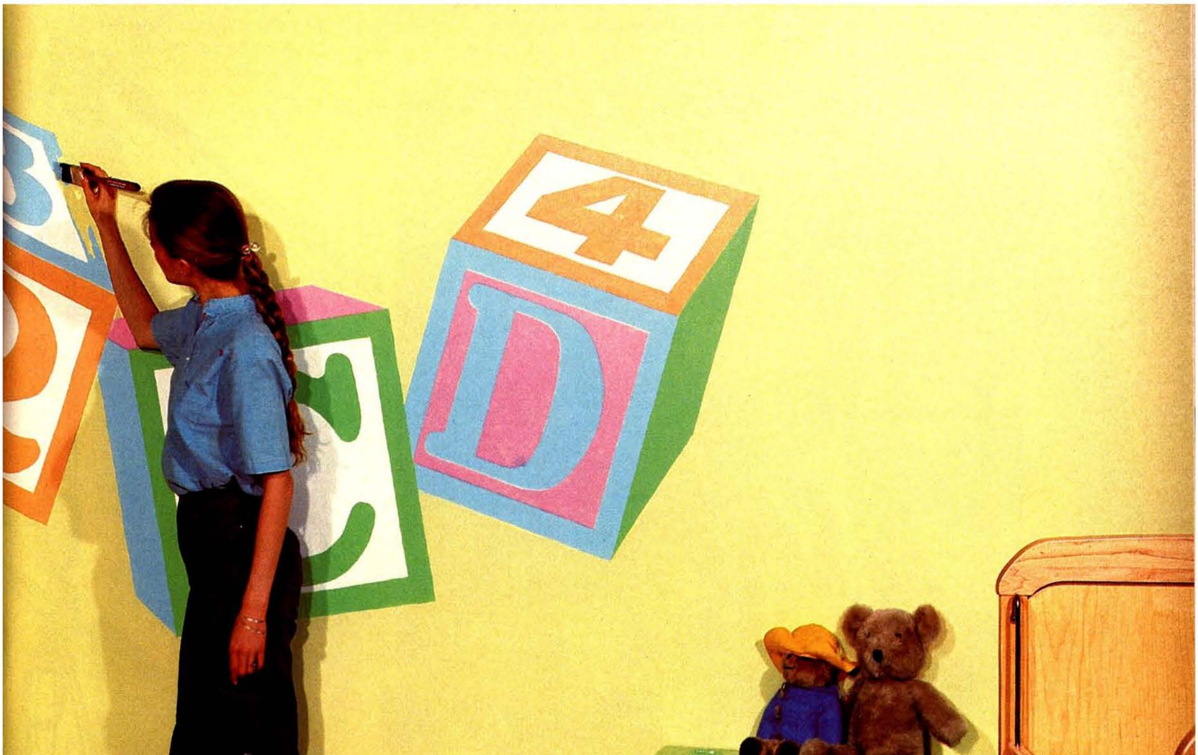
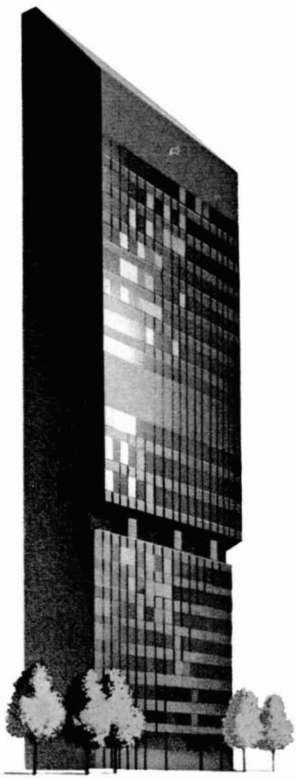

TOYS
ACRYLIC SEMI-GLOSS LATEX
INTERIOR WALL PAINT

high-performance coatings.

These special Ciba-Geigy epoxy resins have been used for years in the electronics and electrical industries. Their outstanding properties make them ideal for new high-performance coatings as well as for upgrading existing coatings systems. We have recently built new, larger manufacturing facilities, and these special epoxies are now available to the coatings industry. We believe the suggested applications illustrated are only a few of many possible uses. Details? Ciba-Geigy, Resins Department, Ardsley, New York 10502. Phone (914) 478-3131.



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Cure in five minutes at 100°C. Promote outstanding adhesion. Allow non-critical mixing ratios.

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Abstracts of Papers in This Issue

A NEW METHOD FOR DETERMINATION OF FORMALDEHYDE EMANATING FROM SUBSTRATES AND COATINGS—M.W. Cox and D.E. Moberly

Journal of Coatings Technology, 52, No. 668,49 (Sept. 1980)

Recent information concerning the toxic effects of chronic exposure to formaldehyde has given impetus to the formulation of industrial coatings and adhesives which evolve less formaldehyde. In order to evaluate the efficiency of formaldehyde-reduction measures, a good laboratory technique for determination of formaldehyde was needed.

This paper describes a new method for the determination of formaldehyde emanating from coatings, coated substrates, and uncoated substrates. Although the method is designed to measure formaldehyde evolved from these products during simulated atmospheric conditions of interior dwellings, the method is not limited to these conditions and can be used to measure formaldehyde generated from other products or conditions, such as curing operations.

The method is reliable, convenient, and it yields data with a precision of six to ten percent. Routine analyses using this method require six hours for completion, which includes only three actual man-hours.

ADHESIVE CHARACTERISTICS OF ULTRAVIOLET RADIATION CURABLE RESINS—K. Nate and T. Kobayashi

Journal of Coatings Technology, 52, No. 668,57 (Sept. 1980)

The adhesive characteristics of ultraviolet radiation curable resins are discussed for the mixtures of 1,2-polybutadiene dimethacrylate and reactive monomers (7:3 by wt). The tensile adhesive strength to an aluminum oxide substrate is significantly affected by the internal stress of the resins. The addition of monomers containing the hydroxyl group gives resins which exhibit excellent adhesion. The large decrease in adhesive strength which appears in the systems with polyfunctional monomers after water absorption, is explained by the increase of internal stress. The effects of the additives and other oligomers are also discussed.

A SIMPLIFIED QUALITY CONTROL METHOD APPLICABLE TO COPPER(I) OXIDE BASED ANTIFOULING PAINTS—F. Marson

Journal of Coatings Technology, 52, No. 668,67 (Sept. 1980)

To reduce the time and expense involved in leaching studies, a simple technique has been developed to continuously monitor the increase in copper concentration during the leaching of antifouling paints in alkaline glycinate accelerated leaching solutions. The copper concentration is measured by direct estimation of the copper glycine complex using a simple immersion absorptiometer. This paper briefly describes the techniques and apparatus used. The absorptiometer head, which consists of an incandescent light source and vacuum photodetector, is treated in more detail. The use of the technique is illustrated by experimentally-determined leaching curves of contact leaching antifouling paints, indicating the effect of changes in pigment volume content, vehicle type, and pigment grade. The use of a simple exponential equation of the form:

$$\exp(x/30) = a + bT$$

where x is the total amount of copper (gm^{-2}) leached after time T (s), a is a constant which ideally should be 1.0, and b is a constant defining the leaching characteristics of the paint, is shown to be applicable to this type of paint. This method and apparatus developed for routine quality assessment appear capable of refinement to yield more detailed information for use in research and development.

DETERMINATION OF WATER-MISCIBLE MELAMINE RESINS IN WATER-BASED AND SOLVENT-BASED COATINGS—J.B. Lear

Journal of Coatings Technology, 52, No. 668,73 (Sept. 1980)

A method is presented for the isolation and identification of various water-reducible melamine resins from both water-soluble and high-solids coatings. The use of a hexane extraction from air-dried films yields an extract that can be examined by IR and NMR spectra to provide identification. Knowledge of melamine resin type aids in product formulation.

ZINC OXIDE STABILITY IN EXTERIOR LATEX PAINTS —Zinc Institute, Inc.

Journal of Coatings Technology, 52, No. 668,79 (Sept. 1980)

A stability study of zinc oxide containing exterior latex paints was initiated using eight anionic surfactants at three levels in conjunction with six latex resins.

Independent laboratories prepared 240 paints which were distributed for viscosity testing. Each paint was monitored for viscosity change in four stability tests. The data show the oven-stability test to be the most rigorous.

Results show that the vinyl acrylic and vinyl copolymer resins produce very stable zinc oxide containing exterior latex paints. Data on the acrylic paints, both zinc-free and zinc oxide containing, show that careful selection of the surfactant system is required. Of significant interest is that all paints made with two of the surfactant systems passed all four stability tests.

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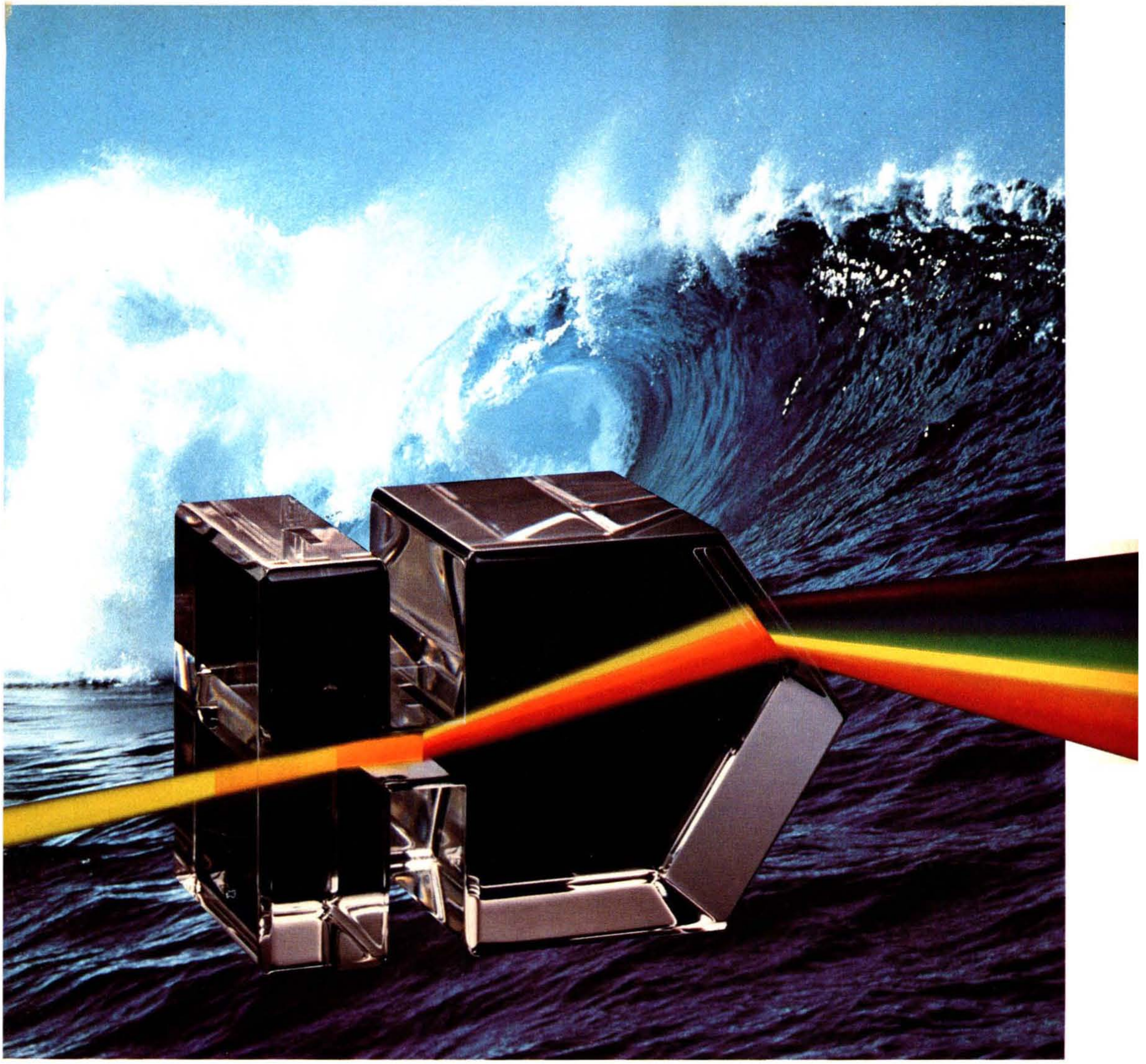
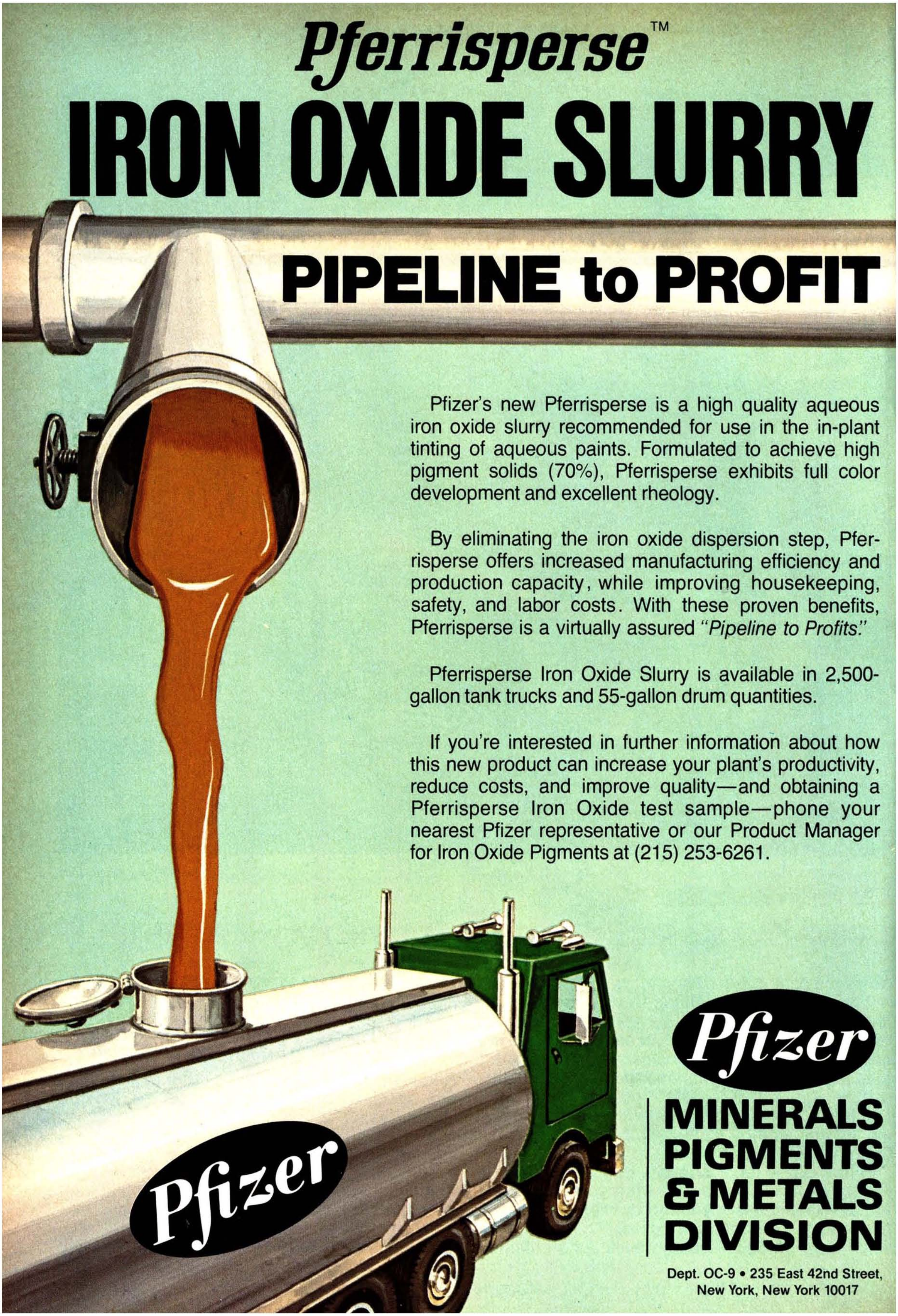


Surf off Maui, Hawaiian Islands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In commemoration of the Birmingham Club's 50th anniversary, John Hitchin, President, presented the above "Presidential Jewel" to Federation President Elder Larson who was in attendance to help celebrate the Club's birthday. The Jewel of Office is to be worn by Federation Presidents at official functions. The certificate (below) describes the Jewel.

Presidential Gift For FSCT

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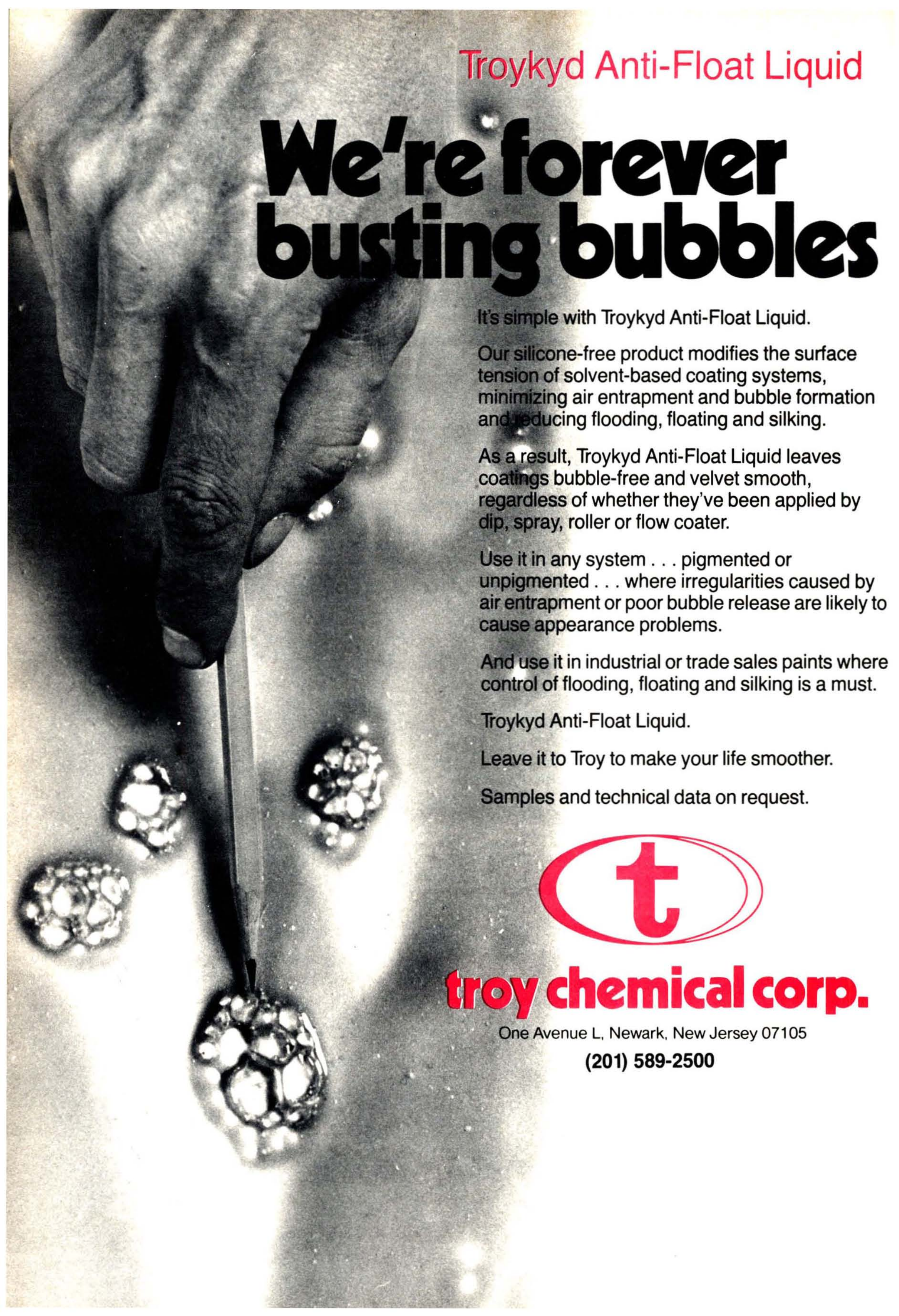
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NUMBER 87 SEPTEMBER 1980

FEDERATION
newsletter

Federation of Societies for Coatings Technology
YE OLDE PAINT STONE 1737

FEDERATION, MCCA AND ISCC WILL SPONSOR SECOND SYMPOSIUM ON "COLOR AND APPEARANCE INSTRUMENTATION," MARCH 24-26

A Symposium on "Color and Appearance Instrumentation" will be sponsored by the Federation, the Manufacturers Council on Color and Appearance, and the Inter-Society Color Council on March 24, 25, 26, 1981, at the Executive West in Louisville, Ky. This is the second symposium to be sponsored by these groups; the first being in 1978 in Cleveland.

The two-and-a-half day program will be divided between general sessions and "hands-on" equipment workshop sessions on instrumentation for measuring color and appearance in the coatings industry. The format is designed to offer a "working meeting" environment, and registrants are invited to bring samples with them.

Manufacturing, production, quality control, and research and development personnel should all benefit from this definitive update on the various aspects of such topics as color measurement, color formulation, gloss and other appearance, and sample preparation.

For complete program details and registration information, please contact Tom Kocis, Director of Field Services, at the Federation office in Philadelphia.

PAINT RESEARCH INSTITUTE WILL PRESENT SYMPOSIUM ON "STABILITY AND STABILIZATION OF COATINGS SYSTEMS"

The Federation's Paint Research Institute will sponsor a Symposium on "Stability and Stabilization of Coatings Systems," on May 4-5, 1981, at the Battelle Institute in Columbus, Ohio.

Sessions will be devoted to these main subjects: Controllable Factors in Making Stable Coatings Systems.....Specific Chemistry of Stabilization.....On-line Stabilization Problems.....Research Ideas for Stabilization.

If you wish further information and the complete program when ready, please contact the Federation office in Philadelphia.

FEDERATION'S TECHNICAL INFORMATION SYSTEMS COMMITTEE PREPARES BIBLIOGRAPHY ON "TECHNICAL USES OF COMPUTERS"

The Federation's Technical Information Systems Committee, under the direction and leadership of Chairperson Helen Skowronska, of the Cleveland Society, has prepared an extensive bibliography on "The Technical Uses of Computers in the Coatings Industry."

This project was undertaken by the Federation in cooperation with the International Coordinating Committee, of which the Federation is a member. Other members of the ICC are: OCCA-UK, OCCA-Australia, FATIPEC (the European Federation), SLF (the Scandinavian Federation), and the Japan Society of Colour Material.

The Federation's bibliography, into which will be incorporated a supplemental one contributed by FATIPEC, will be published in a future issue of the JCT.

NEWS BRIEFS FROM THE SOCIETIES

The names of Society Presidents given below are those elected for 1980-81)

BALTIMORE--Gordon Allison, of McCormick Paint Works, is President.....Society will celebrate 50th anniversary in 1982.

BIRMINGHAM--The President is Roy Ingleston, of McPherson Cruickshank Industrial Finishes Ltd......John Hitchin, President in both 1963 and 1979, was elected to Honorary Membership at June meeting.....At same meeting, Club presented Federation with beautiful medallion (to be worn around the neck) as symbol of Office of Federation President.

CHICAGO--Rick Hille, of United Coatings, is President (until May 1981).

CDIC--The President is Jack Frost, of Ashland Chemical.

CLEVELAND--Jack Malaga, of Body Bros., is President.....Will sponsor Symposium on Pigment Dispersion, October 7, at Cleveland Scientific and Engineering Center. Speakers will be: M. Malaga, of Glidden; J. White, of Hockmeyer; C. Tatman, of Glidden; L. Dombroski, of Chicago Boiler; F. Scheidegger, of Ciba-Geigy; W. Callahan, of Kerr Engineered Sales; and V. Lewis, of Cabot.....1981 Conference on Advances in Coatings Technology at Baldwin Wallace College, March 24-25.....At 1980 Conference, $300 award for the Outstanding Speaker went to Dr. R. A. Dickie, of Ford Motor Co......Matching Funds Campaign, under the direction of Fred Schwab, is doing very well for the Paint Research Institute. In 1977 (the first year) $1,235 was raised for PRI. This year, total will be in excess of $2,000. Thank you, Cleveland!!.....Twenty-five year pins presented to: Bob Taub, Ken Waldo, and John Culler.

DALLAS--The President is Rich Williamson, of Trinity Coatings.

DETROIT--Polymer Institute of Detroit, in cooperation with Society and PCA, will offer following evening courses: 7-week Coatings Laboratory (Mike King); 14-week Fundamentals of Automotive Paint Systems (Don Mordis); 12-week Modern Resin Technology; Principles of Color Technology; and Chemistry of Protective Coatings, a credit course (Taki Anagnostou).

GOLDEN GATE--Sharon Vadnais, of E. T. Horn Co., is President.

HOUSTON--Jim Hunter, of O'Brien Corp., is President (until May 1981).

KANSAS CITY--Dick Warren, of Cook Paint, is President.....Both Society and PCA presented checks of $150 each to Wouter Bosch Surface Coatings Scholarship Fund at University of Missouri-Rolla.

LOS ANGELES--The President is Don Jordan, of Cargill, Inc......25-year pins presented to Arnie Hoffman, Earl Fenstermaker, Tom Nicholson, John Plant, Al Seneker, Wharton Jackson, Bob McNeill, and Bob Koperek.....Plans are going well for 15th Biennial Western Coatings Societies Symposium and Show at Disneyland Hotel and Convention Center in Anaheim, March 4-6. General Chairman is Tony Rumfola, of TCR Industries. Don Jordan is Co-Chairman.....Trev Whittington continues as spearhead and instructor of Paint Course at Los Angeles Tech Trade School.

LOUISVILLE--John Menefee, of Hy-Klas Paint, is President.

MONTREAL--Al Marchetti, of Canadian Paint Mfrs. Assn., is President (until May 1981).....Will celebrate 50th anniversary with dinner-dance on May 9..... Co-sponsoring Symposium on Corrosion with Toronto, September 17 and 18. (See Toronto).

NEW ENGLAND--The President is Dan Toombs, of Lukens Chemical Co.

NEW YORK--Marvin Schnall, of Troy Chemical Corp., is President.....Joint Educational Committee of Society and PCA are offering these courses: Fundamentals of Coatings Technology, a two-semester course taught by Don Brody, at New York Community College; Lab Course for Technicians (including plant visits) coordinated by Jeff Kaye; Simplified Organic Chemistry for Coatings Technologists, instructed by Dr. William Ferren, at Wagner College.....18 completed both parts of Don Brody's Fundamentals Course this year and received engraved certificates.

NORTHWESTERN--Roger Anderson, of the 3M Co., is President.

PACIFIC NORTHWEST--The President is Curt Bailey, of Jarvie Paint Mfg. Co.

PHILADELPHIA--Barry Oppenheim, of McCloskey Varnish Co., is President.

PIEDMONT--The President is Bill Cunane, of Sherwin-Williams Co.

PITTSBURGH--Ray Uhlig, of Technical Coatings Co., is President (until May 1981).

ROCKY MOUNTAIN--Bruce Regenthal, of Komac Paints, is President....Will host Federation's Spring Meetings in May.

ST. LOUIS--The President is Floyd Thomas, Jr., of Thomas & English.

SOUTHERN--Thad Broome, of Precision Paint Corp., is President.....Has organized a new and fifth section in Memphis. Harry Poth, of Burk Hall, is Chairman of new group which attracted 31 members and guests to June meeting.....Pete Decker, of Union Carbide, is Program Chairman for 1981 annual meeting in Birmingham, March 11-13. Program theme is "Coatings Technology - the End Users' Perspective." Working with Pete are Frank Rector, Oliver Cline, Dan Dixon, Bill Early, Len Kusta, Bobby Moore, Ron Nelson, and Pat Perkins.

TORONTO--Jan Grodzinski, of Toronto Coppersmithing International, is President... The September 17 and 18 Symposium of Montreal and Toronto Societies will be devoted to subject of "Corrosion." Speakers will be: Abel Banov, of American Paint Journal; G. M. Sastry, of Union Carbide; Tom Ginsberg, of Union Carbide; Ron Eritano, of Mobay; John Fitzwater, of New England Society Technical

Committee; and Tom Bullet, of Paint Research Association in Teddington, U.K..... In cooperation with Society, George Brown City College is offering a whole host of courses on Coatings Technology: Organic Coatings 901; Resins 902, 903, 904; Polymer Chemistry 905; Non-Polymeric Coatings 906; Coatings Lab 907; Paint Flow and Pigment Dispersion 908. There are also two certificate courses offered as a two-year package: Basic Coatings Technology and Advanced Coatings Technology. P. Rodak, of George Brown, coordinates the entire program.

WESTERN NEW YORK--George Reid, of Spencer Kellogg, is President (until May 1981) .....Will mark 50th anniversary in 1981.

COMING EVENTS

Sept. 17-18...Montreal and Toronto Societies. Joint seminar on "Corrosion."

Oct. 7........Cleveland Society. Symposium on "Formulation for and Utilization of Pigment Dispersion Equipment." Cleveland Engineering and Scientific Center.

Oct. 28.......Federation Board of Directors meeting. Hyatt Regency Hotel, Atlant

Oct. 29-31....Federation Annual Meeting and Paint Show. Civic Center, Atlanta.

Mar. 4-6..... Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim.

Mar. 11-13....Southern Society. Annual meeting. Plaza South Hotel, Birmingham.

Mar. 24-26....Symposium on Color and Appearance Instrumentation. Jointly sponsored by FSCT, ISCC and MCCA. Executive West, Louisville.

Mar. 24-25....Cleveland Society. Conference on Advances in Coatings Technology. Baldwin-Wallace College, Berea, Ohio.

Apr. 30.......Pacific Northwest Society. Annual Symposium. Washington Plaza
May 1-2 Hotel, Seattle.

May 4-5.......PRI Symposium on "Stability and Stabilization of Coatings Systems.' Battelle Institute, Columbus, Ohio.

May 9.........Montreal Society. Fiftieth Anniversary Dinner Dance.

May 14-15.....Federation Spring Meetings. Society Officers on 14th; Board of Directors on 15th. Hilton Hotel, Denver.

Oct. 28-30....Federation Annual Meeting and Paint Show. Cobo Hall, Detroit.

1982

Mar. 10-12....Southern Society. Annual Meeting. Savannah. (tent.)

Apr. 22-24....Southwestern Paint Convention of Dallas and Houston Societies. Shamrock Hilton, Houston.

Apr. 29-30....Federation Spring Meetings. Boston. (tent.)

May 6-8.......Pacific Northwest Society. Annual Symposium. Vancouver.

FEDERATION OF SOCIETIES FOR COATINGS TECHNOLOGY

PROGRAM

1980 ANNUAL MEETING and PAINT INDUSTRIES' SHOW

ATLANTA CIVIC CENTER

OCTOBER 29, 30, 31

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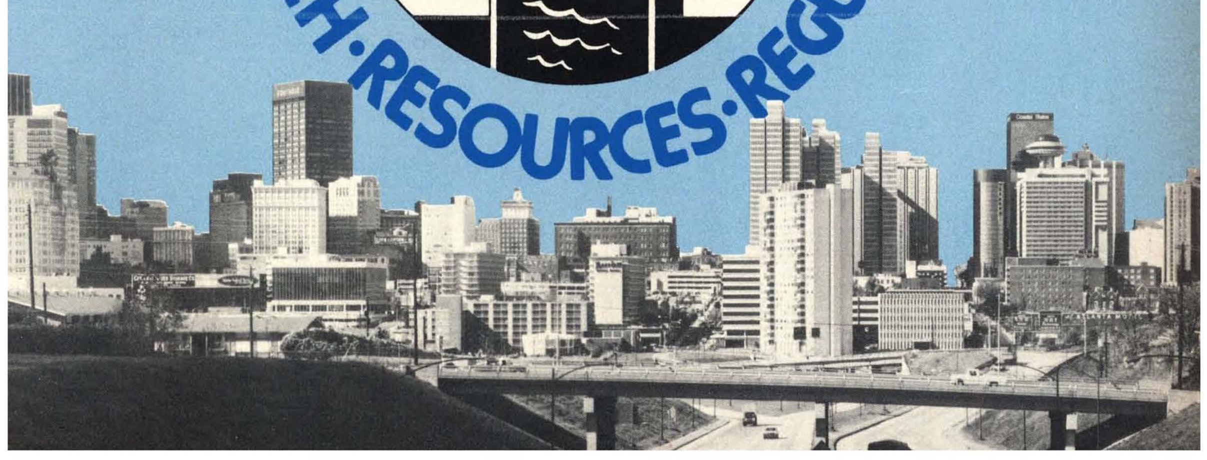


Program

WEDNESDAY, OCTOBER 29

OPENING SESSION
(10:30–11:00)

Fifty-eighth Annual Meeting of the Federation of Societies for Coatings Technology opened by President Elder C. Larson

Invocation and In Memoriam

Welcome: Thad T. Broome, President of Southern Society for Coatings Technology
Hugh Lowrey, Chairman of the Program Committee
Berger Justen, Chairman of the Host Committee
Deryk R. Pawsey, Chairman of the Paint Industries' Show Committee

Introduction of Federation Officers

Introduction of Distinguished Guests

E. W. FASIG KEYNOTE ADDRESS
(11:00–12:00)

THE CHALLENGES OF THE 80's IN COATINGS AND GRAPHIC ARTS—Harvey F. George, Executive Vice-President and Research Director, Gravure Research Institute, Port Washington, NY.

PROTECTION OF RESOURCES THROUGH CORROSION CONTROL
(1:30-4:30)

THE FOUR C's—CALAMITY, CORROSION, COATINGS, AND COMPOSURE—Donald Tuomi, Physics and Electronics Dept., Borg-Warner Corp., Des Plaines, IL.

SALT SPRAY TESTING FOR SHORT-TERM EVALUATION OF COATINGS—Bernard R. Appleman, Federal Highway Administration, Washington, DC, and Paul G. Campbell, National Bureau of Standards, Washington, DC.

SOME SUBSTRATE AND ENVIRONMENTAL INFLUENCES ON THE CATHODIC DELAMINATION OF ORGANIC COATINGS—Henry Leidheiser, Jr. and Wendy Wang, Center for Surface and Coatings Research, Lehigh University, Bethlehem, PA. (A Roon Awards competition paper)

INVESTIGATION AND MONITORING OF THE CORROSION CONTROL PROCESS OF COATINGS—Clive H. Hare, Clive H. Hare, Inc., Stoughton, MA.

MECHANISM OF FILM FORMATION OF ALKYL SILICATE ZINC-RICH COATINGS—Thomas Ginsberg, Chemicals and Plastics Div., Union Carbide Corp., Bound Brook, NJ.

TECHNIQUES OF ELECTROCHEMICAL CORROSION MEASUREMENT—W. M. Peterson, Princeton Applied Research Corp., Princeton, NJ.

EFFICIENT UTILIZATION OF RESOURCES AND RESEARCH
(1:30–4:00)

RENEWABLE RESOURCES FOR THE COATINGS INDUSTRY—Chicago Society for Coatings Technology. Presented by T. Kirk Hay, The Sherwin-Williams Co., Chicago, IL.

RECYCLING WASTE EFFLUENT STREAMS WITH ULTRAFILTRATION—Carl R. Hoffman, Abcor, Inc., Wilmington, MA.

KINETIC PARAMETER CONSIDERATIONS FOR MAXIMIZING STABILITY AND MINIMIZING CURE TEMPERATURE OF THERMOSETTING COATINGS. SULFONIUM SALTS AS LATENT THERMAL INITIATORS FOR CATIONIC POLYMERIZATION—S. Peter Pappas, Polymers and Coatings Dept., North Dakota State University, Fargo, ND, and Loren W. Hill, Monsanto Plastics and Resins Co., Indian Orchard, MA. (A Roon Awards competition paper)

A COMPUTER METHOD FOR PREDICTING EVAPORATION OF MULTICOMPONENT AQUEOUS SOLVENT BLENDS AT ANY HUMIDITY—Albert L. Rocklin, Shell Development Co., Houston, TX, and David C. Bonner, Shell Oil Co., Houston, TX. (A Roon Awards competition paper)

APPLICATION OF SIMPLEX LATTICE DESIGN EXPERIMENTATION TO COATINGS RESEARCH—Kenneth K. Hesler and John R. Lofstrom, DeSoto, Inc., Des Plaines, IL. (A Roon Awards competition paper)

THURSDAY, OCTOBER 30

PRI SEMINAR ON COATINGS RESEARCH PROGRAMS FOR THE 80's
(9:00–12:00)

OVERVIEW OF PRI's NEW DIRECTIONS—Peter V. Robinson, Glidden Coatings and Resins Div., SCM Corp., Strongsville, OH.

MILDEW RESEARCH BY CONSORTIUM—Charles C. Yeager, Registration Consulting Associates, Pacifica, CA., and Program Manager of PRI's Mildew Consortium.

POLYMER-BOUND FUNGICIDES FOR PAINTS SYNTHESIS AND TESTING—Charles U. Pittman, Jr. and Kevin D. Lawyer, University of Alabama, University, AL.

OLIGOMER RESEARCH FOR HIGH SOLIDS COATINGS—Zeno W. Wicks, Jr., Polymers and Coatings Dept., North Dakota State University, Fargo, ND, and Loren W. Hill, Monsanto Plastics and Resins Co., Indian Orchard, MA.

AQUEOUS COATINGS RESEARCH—Raymond R. Myers, PRI Research Director and University Professor, Kent State University, Kent, OH.

THURSDAY, OCTOBER 30
(Continued)

MANUFACTURING COMMITTEE SEMINAR ON SAFETY IN THE PAINT PLANT (9:00–12:00)

Moderator—Gilbert E. Cain, of Hercules, Inc., Wilmington, DE.

PROPERTIES AND HANDLING OF FLAMMABLE MATERIALS—Nelson W. Lamb, Hercules, Inc., Wilmington, DE.

LOSS PREVENTION TECHNIQUES IN MATERIALS HANDLING—Gabriel Malkin, Consulting Engineer, Westfield, NJ.

IN-PLANT SAFETY PRACTICES AND PROCEDURES—Francis C. Gaugush, The Sherwin-Williams Co., Cleveland, OH.

Seminar will also feature 20-minute motion picture on general safety techniques and practices.

Moderator and speakers will assemble as a panel for a 45-minute open-discussion period to conclude seminar.

Presentation of the Morehouse Industries Golden Impeller Award will be made at this session.

SEMINAR ON FORMULATION (9:00–12:00)

FORMULATION STUDIES OF WATER-REDUCIBLE SILICONE ALKYDS—Lynne M. Parr, Resins and Chemicals Div., Dow Corning Corp., Midland, MI.

TITANIUM DIOXIDE: ITS PERFORMANCE IN FLAT LATEX PAINTS—Robert Rauch, Tioxide of Canada Ltd., Sorel, Quebec, Canada.

EXTENDER PIGMENTS IN LATEX WALL PAINTS—Louisville Society for Coatings Technology. Presented by Donald W. Collier, Porter Paint Co., Louisville, KY.

FLASH RUST INHIBITORS: AN EVALUATION OF SOME AMINES AND ORGANIC SALTS IN AN AQUEOUS ACRYLIC COATING—New England Society for Coatings Technology. Presented by N. Bradford Brakke, Lilly Chemical Products, Templeton, MA.

FACTORS INFLUENCING FREEZE-THAW STABILITY IN FLAT LATEX PAINTS—Montreal Society for Coatings Technology. Presented by Robert Kuhnen, Tioxide of Canada Ltd., Sorel, Quebec, Canada.

ORGANO-SILANES AS ADHESION PROMOTERS FOR ORGANIC COATINGS—Peter Walker, Ministry of Defence, Aldermaston, Reading, England (A Roon Awards competition paper).

TOUR OF ATLANTA—10:00 am

(See Spouses' Program)

TESTING AND PERFORMANCE (2:00–5:00)

EXPOSURE PERFORMANCE EVALUATION OF COMMERCIALLY AVAILABLE, NON-TOXIC, WATER-BORNE, CORROSION-INHIBITIVE PRIMERS CONFORMING TO CARB REGULATIONS FOR 1984—Golden Gate Society for Coatings Technology. Presented by Patricia Shaw, Esselte Pendaflex Corp., Emeryville, CA.

OBJECTIVE USE OF SUBJECTIVE COMPARISONS—G. M. Deighton, Laporte Industries Limited, Grimsby, S. Humberside, England. (Presented on behalf of OCCA: Oil and Colour Chemists' Association—UK.)

EVAPORATION AND VAPOR DIFFUSION RESISTANCE IN PERMEATION MEASUREMENTS BY THE CUP METHOD—Erik Nilsson and Charles M. Hansen, Scandinavian Paint and Printing Ink Research Institute, Horsholm, Denmark. (Presented on behalf of SLF: Federation of Scandinavian Paint and Varnish Technologists.)

SHORT-TERM EVALUATION TECHNIQUES FOR LIQUID AND PARTICLE BEHAVIOR IN COATINGS SYSTEMS—Frank Zurlo, Byk-Mallinckrodt, Melville, NY.

ANALYSIS OF WATER-BORNE COATINGS FOR THE QUANTITATIVE DETERMINATION OF WATER AND CO-SOLVENTS—James A. Vance, Vance Laboratories, Indianapolis, IN. (A Roon Awards competition paper)

COLOR MEASUREMENT OF WET PAINT—Don W. Parker, Tromac, Inc., Michigan City, IN.

INFORMATION: A RESOURCE FOR THE 80's (2:00–4:30)

ON-LINE SEARCHING OF DATABASES OF INTEREST TO THE COATINGS INDUSTRY—Richard Caputo, Lockheed Information Systems, Arlington, VA.

COMPUTER-ASSISTED DESIGN OF COATINGS FORMULAS—Edwin J. Lowrey, Precision Paint Corp., Atlanta, GA.

COMPUTERIZED COLOR CONTROL—Robert T. Marcus, Mobay Chemical Corp., Pittsburgh, PA.

COMPUTERIZED PROCESS CONTROL IN THE COATINGS INDUSTRY—Robert W. McFee, Glidden Coatings and Resins Div., SCM Corp., Huron, OH.

TECHNICAL COMPUTER APPLICATIONS IN THE COATINGS INDUSTRY: A BIBLIOGRAPHY, 1967–79—Helen Skowronska, Consultant, Cleveland, OH.

EDUCATIONAL COMMITTEE PRESENTATION ON FSCT-SPONSORED CORRESPONDENCE COURSE FOR COATINGS TECHNOLOGY (2:00–3:00)

CORRESPONDENCE COURSE ON THE SCIENCE AND TECHNOLOGY OF SURFACE COATINGS: AN OVERVIEW—Shelby F. Thames, Gary C. Wildman, Robert E. Burks, Jr., and B. George Bufkin, University of Southern Mississippi, Hattiesburg, MS.

FRIDAY, OCTOBER 31

CONSERVATION IN THE APPLICATION AND CURING OF INDUSTRIAL PRODUCT FINISHES (9:00–10:30)

ENVIRONMENTAL SOLUTIONS FOR THE SPRAY PAINTING INDUSTRY—Arvid C. Walberg, Arvid C. Walberg & Co., Downers Grove, IL.

CURING COATINGS WITH AN INERT-OVEN SOLVENT RECOVERY SYSTEM—Ronald D. Rothchild, Airco Industrial Gases, Murray Hill, NJ.

CURING OF VARNISHES BY MICROWAVES—Henri Valot, National Center for Scientific Research, Thiais, France, (Presented on behalf of FATIPEC: Federation of Associations of Technicians in the Paint, Varnish, Lacquer, and Printing Ink Industries of Continental Europe.)

INNOVATION IN POLYMERS (9:00–10:30)

SYNTHESIS OF BLOCKED MDI ADDUCTS, THEIR DSC EVALUATION AND EFFECT OF PIGMENTATION—Taki J. Anagnostou, Wyandotte Paint Products, Inc., Troy, MI, and Ernest Jaul, Silicones & Urethane Intermediates Div., Union Carbide Corp., South Charleston, WV. (A Roon Awards competition paper)

USE OF THIIRANE-FUNCTIONAL MONOMERS AS A MEANS OF DEVELOPING CROSSLINKABLE EMULSIONS—B. George Bufkin and John R. Grawe, Department of Polymer Science, University of Southern Mississippi, Hattiesburg, MS, Robert M. O'Brien, Mobil Chemical Co., Pittsburgh, PA, and Samuel A. Brown, of Celanese Chemical Co., Summit, NJ. (A Roon Awards competition paper)

PRIMARY AMINE ZWITTERION CO-POLYMERS—Zeno W. Wicks, Jr., and Chiew-Wah Koay, Polymers and Coatings Department, North Dakota State University, Fargo, ND. (A Roon Awards competition paper)

MATTIELLO LECTURE (10:30–11:45)

PHYSICAL CHEMISTRY OF CATHODIC ELECTRODEPOSITION—Percy E. Pierce, Manager of Physical/Analytical Research, PPG Industries, Inc., Allison Park, PA.

FEDERATION LUNCHEON (11:45)

Ballroom West, Atlanta Hilton Hotel

Presentation of the George Baugh Heckel, Paint Show, and Union Carbide Awards.

Winners of other Federation Awards to be announced.

"You CAN Do Something About It"—Address by Dr. Kenneth McFarland, Dean of America's Public Speakers.

ENVIRONMENTAL CONTROL COMMITTEE PANEL DISCUSSION ON WASTE MANAGEMENT BY EPA REGULATIONS—WHAT ANSWERS DO YOU NEED? (2:00–4:00)

Moderator—S. Leonard Davidson, N L Industries, Inc., Hightstown, NJ.

Norman Groves, Reliance Universal, Inc., Louisville, KY.

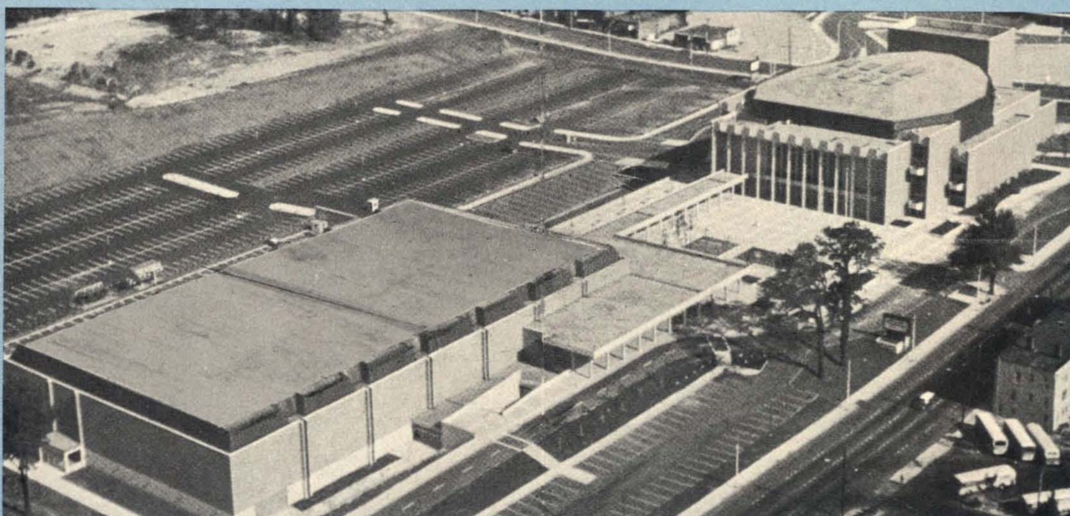
Hugh Williams, Jr., The Sherwin-Williams Co., Cleveland, OH.

ANNUAL BUSINESS MEETING (4:00–5:00)

Annual Business Meeting of the Federation

Presentation of these Awards: American Paint & Coatings Journal/A. F. Voss . . . Materials Marketing Associates . . . Program Committee . . . Roon Foundation . . . Ernest T. Trigg.

Installation of Officers, 1980–81



The Atlanta Civic Center will be site of 1980 Federation Annual Meeting and Paint Industries' Show. Exhibit Hall is in foreground, auditorium at upper right

OTHER CONVENTION INFORMATION

PAINT INDUSTRIES' SHOW

The 45th Annual Paint Industries' Show will run concurrently with the Annual Meeting in the Atlanta Civic Center. The only national exposition of materials and equipment used in the formulation, testing, and manufacture of coatings, the Show will be open from 12:30 pm to 5:30 pm on Wednesday, October 29; 9:30 am to 5:00 pm on Thursday, October 30; and 9:30 am to 4:00 pm on Friday, October 31.

Participating supplier companies will have their top technical representatives on hand to discuss the latest developments with registrants at this year's event, the largest in Paint Show history.

REGISTRATION

Registration fees for the Annual Meeting and Paint Show are on a Federation member and nonmember basis:

	Member	Nonmember	Spouses
Advance*	$40	$55	$25
In Atlanta	$45	$60	$30
One-Day	$25	$35	—

*Special registration for retired members and their spouses only: Advance registration will be $20 each.

Registration form is included in this issue and has also been mailed to all members.

Note: Purchase of luncheon tickets is optional for both advance and on-site registration.

LUNCHEON

The Federation Luncheon will be held on Friday, October 31, at the Atlanta Hilton Hotel.

Presentations will be made to the recipients of the George Baugh Heckel Award (outstanding individual who has contributed to the advancement of the Federation), the Flynn Awards (firms judged to have the best exhibit booths in the 1980 Paint Industries' Show), and the Union Carbide Coatings Technology Award (for extraordinary achievement in coatings technology).

Featured speaker will be Dr. Kenneth McFarland, known as the "Dean of America's Public Speakers," who will address the topic, "You CAN Do Something About It!"

SPOUSES' PROGRAM

A schedule of activities has been planned each day for the spouses attending the Annual Meeting, and a Hospitality Room will be maintained at the Atlanta Hilton Hotel.

A get-acquainted Wine and Cheese Social is scheduled for Wednesday afternoon.

On Thursday, a continental breakfast will precede an all-day tour of Atlanta and an ante-bellum plantation.

Continental breakfast will be available again on Friday morning.

Registration fees for the Spouses Activities are $25 in advance and $30 on-site.

HEADQUARTERS HOTEL

The Atlanta Hilton will be headquarters hotel. Other hotels with blocks of rooms set aside for the Annual Meeting are the Marriott, Hyatt Regency, Holiday Inn Downtown, Atlanta American, Ladha Downtown, Downtowner Motor Inn, and the Inntown Motor Hotel.

Shuttle bus service will be provided between participating hotels and the Civic Center.

ROOM RESERVATIONS

All requests for rooms and suites must be sent to the Federation Housing Bureau on the official form provided by the Federation. These have been mailed to all members and are also included in this issue. Additional forms are available from Federation Headquarters.

BOARD MEETING

The Fall Board Meeting of the Federation will be held on Tuesday, October 28, at the Hyatt Regency Hotel.

SPEAKERS' BREAKFAST

A breakfast and briefing for each day's program participants will be held at the Atlanta Hilton Hotel on Wednesday, Thursday, and Friday.

PUBLICATION OF PAPERS

The JOURNAL OF COATINGS TECHNOLOGY has prior rights to the publication of all papers presented at the Annual Meeting.

NPCA MEETS SAME WEEK

The National Paint and Coatings Association will hold its annual meeting from October 27–29 at the Atlanta Hilton Hotel.

NPCA badges will be honored for admission to the Federation Annual Meeting and Paint Show on Wednesday, October 29.

PROGRAM STEERING COMMITTEE

Chairman—Hugh Lowrey, of Indurall Coatings, Inc., Birmingham, AL; *Vice-Chairman*—Thomas J. Miranda, of Whirlpool Corp., Benton Harbor, MI; Umberto Ancona, of McCloskey Varnish Co., Philadelphia, PA; Fred M. Ball, of Eastman Chemical Products, Inc., Kingsport, TN; Thomas Ginsberg, of Union Carbide Corp., Bound Brook, NJ; Kenneth A. Kieselburg, of Valspar Corp., Rockford, IL; and William Mirick, of Battelle Memorial Institute, Columbus, OH.

MEETINGS COMMITTEE

Members of the Southern Society are serving on the Meetings Committee under General Chairman Berger Justen, of Justen & Associates, Tampa, FL. Chairing the various subcommittees are: Program Operations—Preston D. Smith, of Glidden Coatings & Resins, Atlanta; Information Services—Al Hendry, of A.L. Hendry Co., Tampa; Luncheon—Thad T. Broome, of Precision Paint Corp., Atlanta; Publicity—Peter F. Decker, of Union Carbide Corp., Atlanta; and Spouses' Program—Donald B. Morgan, of Spencer-Kellogg Div., Textron, Inc., Atlanta.

ABSTRACTS OF PAPERS

THE CHALLENGES OF THE 80's IN COATINGS AND GRAPHIC ARTS

Harvey F. George, Gravure Research Institute

The similarities, as well as the basic differences of the closely related technologies of coatings and graphic arts are reviewed as an introduction to a discussion of the challenges faced by coatings and graphic arts in the 80's. These challenges are perceived as the impact of increasingly stringent environmental regulations, constraints imposed by energy and materials availability and cost, as well as increasing labor and capital costs, changing market trends and growth patterns and, finally, rapidly evolving new technology, particularly in electronics and data communications. The challenges, as well as the opportunities they present in inks and coatings research for the 80's, are discussed.

THE FOUR C's—CALAMITY, CORROSION, COATINGS AND COMPOSURE

Donald Tuomi, Borg-Warner Corp.

The four C's—calamity, corrosion, coatings, and composure describe common reactions when we encounter failure phenomena in coatings protected systems. Within the 80's, new materials combinations will be extensively explored throughout society as new technologies are utilized for generating and distributing energy in its varied forms: chemical, electrical, mechanical, nuclear, and thermal. These present new challenges for anticipating corrosion, controlling degradation, preventing failures, and avoiding calamities so we, as well as our society, can retain the necessary composure so that the emerging problems are solved and conflicts resolved.

SALT SPRAY TESTING FOR SHORT-TERM EVALUATION OF COATINGS

Bernard R. Appleman, Federal Highway Administration, and Paul G. Campbell, National Bureau of Standards

This paper examines various aspects of short-term testing of coatings for steel, with particular emphasis on the salt spray test. The salt spray test is the most widely used and the most widely criticized of the accelerated tests. Many of the conclusions and considerations concerning the salt spray test are relevant to other accelerated test methods. The salt spray test is reviewed for the physical and chemical changes induced in different coating mechanisms (barrier, inhibitive, and sacrificial) and in different types of binders. Specific criticisms discussed are reproducibility and repeatability of results, sensitivity to variations in test specimens, sensitivity to rating and interpretation, non-representative conditions, lack of correlation with other measures of performance, and susceptibility to misuse. The paper also describes some lesser known specialized tests and combinations of tests used in short-term testing programs.

SOME SUBSTRATE AND ENVIRONMENTAL INFLUENCES ON THE CATHODIC DELAMINATION OF ORGANIC COATINGS

Henry Leidheiser, Jr. and Wendy Wang, Lehigh University

Polybutadiene coatings, 10–20 μm in thickness, were applied to steel, galvanized steel, aluminum, tin, lead, cobalt, nickel, and silver substrates and the degree of delamination that occurred on cathodic treatment in an electrolyte was determined as a function of the following experimental variables: oxygen in electrolyte, cathode potential, film thickness, pretreatment of substrate, type of electrolyte, electrolyte concentration and temperature. Rates of delamination were determined as a function of the number of coulombs passing through the interface. The rate of delamination was attributed to the relative magnitude of the cathodic reaction, $H_2O + 1/2O_2 + 2e^- = 2OH^-$, that occurs under the coating to the magnitude of the cathodic reaction that occurs on the exposed substrate at a defect. The significance of the findings to the development of an accelerated test for appraising the corrosion protective properties of organic coatings is discussed.

RENEWABLE RESOURCES FOR THE COATINGS INDUSTRY

Chicago Society for Coatings Technology

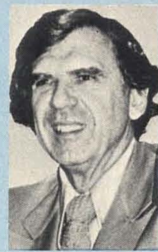
Renewable resources can supply virtually all the raw materials needed for making coatings polymers if petroleum becomes unavailable. In addition to the traditional seed oils, naval stores, and marine products, there is a wealth of materials which can be utilized. Plants grown within our own country can produce hydrocarbons for chemical processing and energy uses, while others can yield specialized oils and chemical feedstocks which currently must be imported. However, commercialization of these plants will require several years of experimental work and economic incentives. Cellulose and starch can provide new polymer types or be converted to basic alcohols for the synthesis of many required chemicals. Waste is one of our largest sources of recoverable or reconstitutable chemicals, and even inorganic materials can be used as sources of chemicals or polymers for coatings.

RECYCLING WASTE EFFLUENT STREAMS WITH ULTRAFILTRATION

Carl R. Hoffman, Abcor, Inc.

Ultrafiltration is gaining acceptance as a viable separation process for concentrating dilute waste effluent streams for recycling of chemicals or to reduce waste disposal problems. This paper discusses ultrafiltration technology with specific emphasis on case histories where ultrafiltration is used to dewater pigment inks, concentrate dilute latex streams and recover electrodeposition paints.

Operating experience and performance of production size ultrafiltration systems for each application are presented, as well as process conditions for selecting appropriate membrane configuration.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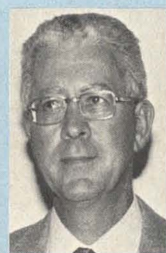

H. Leidheiser, Jr.


W. Wang

A COMPUTER METHOD FOR PREDICTING EVAPORATION OF MULTICOMPONENT AQUEOUS SOLVENT BLENDS AT ANY HUMIDITY

Albert L. Rocklin, Shell Development Co., and David C. Bonner, Shell Oil Co.

Selection of cosolvents for water-reducible coatings is simplified by a computer program which predicts solvent balance and evaporation time of multicomponent water/solvent blends at any humidity. Conventional organic solvent blends are also accommodated, but without humidity correction. The computer method uses an additive equation incorporating activity coefficients calculated by the UNIFAC method. Operation is straightforward, and results are presented promptly at the computer terminal in tabular and graphic form. The method simplifies the problem of selecting blends which comply with air quality control regulations. Examples show how to choose among cosolvents, including those which are only partly miscible with water.


T. Ginsberg


T.K. Hay


C.R. Hoffman

THE APPLICATION OF SIMPLEX LATTICE DESIGN EXPERIMENTATION TO COATINGS RESEARCH

Kenneth K. Hesler and John R. Lofstrom, DeSoto, Inc.

A coating is a complex mixture of pigment, vehicle, solvent, and additives. Variations in the fractions of principal components comprising a coating produce significant changes in properties, performance, and cost. Applying methods for designed experiments with mixtures to coatings research has proven very useful in determining optimum principal component percentages for specific properties, maximum performance, and minimum cost. Simplex lattice design experiments are efficient; only a minimum of sample production is necessary, replication yields information about the experimental error of the test methods, and equation-fitting allows prediction over a broad composition region.


A.L. Rocklin


D.C. Bonner


S.P. Pappas

KINETIC PARAMETER CONSIDERATIONS FOR MAXIMIZING STABILITY AND MINIMIZING CURE TEMPERATURE OF THERMOSETTING COATINGS. SULFONIUM SALTS AS LATENT THERMAL INITIATORS FOR CATIONIC POLYMERIZATION

S. Peter Pappas, North Dakota State University, and Loren W. Hill, Monsanto Plastics and Resins Co.

A general approach, based on kinetic principles and applicable to both one- and two-package coatings, is presented which (1) allows an assessment of the feasibility of any set of desired stability and cure requirements, and (2) provides important insights into the selection of reactive systems which may satisfy the requirements. Kinetic parameter calculations demonstrate that unimolecular rate-controlled reactions, which exhibit relatively large enthalpies and positive entropies of activation, are most suitable for maximizing stability and minimizing cure temperatures.

A companion study of sulfonium salts as latent thermal initiators for cationic polymerization of epoxides is also presented including (1) substituent and anion effects on sulfonium salt reactivity, (2) calculation of activation energies from gel times at cure temperatures, and (3) comparison of observed and extrapolated gel times at storage temperatures. The results provide evidence for rate-controlled generation of active initiator in the polymerization. Furthermore, depending on substituents and temperature, the activation process may be dominated by a unimolecular or bimolecular rate-controlling step. The results illustrate the importance of applying kinetic and mechanistic principles in the selection of reactive systems for coatings and related applications.

MILDEW RESEARCH BY CONSORTIUM

Charles C. Yeager, Registration Consulting Associates Program Manager

Mildew problems have plagued the Paint Industry throughout history. The resolution of these problems has long been an individual matter. Discussed here are the new attempts to resolve these problems by consortium—the gathering together of the country's most knowledgeable microbiologists and paint chemists into a single committee. Their purpose is to direct the exploration of the entire problem and find the best and most economical ways to produce mildew resistant and/or funginert paint systems. The background, present status, initial results, and possible future programs are discussed.

OLIGOMER RESEARCH FOR HIGH SOLIDS COATINGS

Zeno W. Wicks Jr., North Dakota State University, and Loren W. Hill, Monsanto Plastics and Resins Co.

Factors controlling the viscosity of unpigmented and pigmented high solids coatings are not well understood. Variables that have been suggested to affect the viscosity of small molecule liquids and of high molecular weight polymers are summarized. Presumably, oligomers lie in the transition zone and their viscosities depend on a combination of the different variables existing in higher and lower molecular weight materials. The present state of knowledge of factors affecting viscosities of concentrated oligomer solutions will be covered. Also theoretical calculations of the effect of pigmentation on the viscosity of high solids coatings are presented. The research needs for a broader understanding of the factors affecting viscosity of high solids coatings are also identified and preliminary research results are reported.

AQUEOUS COATINGS RESEARCH

Raymond R. Myers, Kent State University

The achievements of the Paint Research Institute program on aqueous coatings systems of the amine-solubilized type will be presented. Improvements in the program's relevance to compliance coatings are discussed, the plans are presented to secure external support of the effort.

FORMULATION STUDIES OF WATER-REDUCIBLE SILICONE ALKYDS

Lynne M. Parr, Dow Corning Corp.

Silicone modification of alkyd coatings imparts excellent exterior durability to the film. Solvent-borne silicone alkyds have been used in exterior maintenance applications for many years. Recently the feasibility of preparing water-reducible silicone alkyds was demonstrated. Early feasibility studies indicated that key properties such as dry time, hydrolytic stability and water resistance were primarily factors of alkyd formulation and not silicone modification. This paper evaluates the impact of variables such as oil length, hydroxyl value, and percent solubilizing acid on key copolymer properties. The results indicate that with proper formulation and processing, a water-reducible silicone alkyd can be prepared that has high performance characteristics similar to a solvent-borne silicone alkyd.

TITANIUM DIOXIDE: ITS PERFORMANCE IN FLAT LATEX PAINTS

R. Rauch, Tioxide Canada, Inc.

This paper addresses a dilemma that has been facing formulators for the last several years. The problem of TiO_2 grade rationalization has been written up in many technical papers in the last three or four years. Most of the papers have offered ways of eliminating flat grade TiO_2 and replacing it with an enamel grade TiO_2, sometimes with fine particle size extenders, but no one has clearly defined the performance of each of these titanium dioxides in flat latex formulations. This work attempts to describe how enamel grade and flat grade TiO_2's perform when the PVC/CPVC ratio of a flat latex formulation is kept constant as well as the cost. In the second part of the work, performance constraints were applied to the formulation as opposed to formulation constraints. That is to say, the film integrity and opacity of flat latex paints were kept constant, using both enamel grade and flat grade TiO_2's. This having been accomplished, a cost determination done, and the relative performance of one grade versus another is shown.

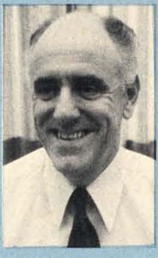
EXTENDER PIGMENTS IN LATEX WALL PAINTS

Louisville Society for Coatings Technology

A study was undertaken with the purpose of cataloging the effect of extender pigments on critical properties of latex wall paints.

A review of available extenders was made and a list of representative materials compiled. These extender pigments were then evaluated in a typical flat latex wall paint at 50 and 60 PVC. Tests were run on each paint to check properties such as scrub resistance, sheen, stain resistance, and hiding power.

Data collected from this work allows correlations to be drawn about the effect of extender pigment type and particle size on specific paint film properties.


P.V. Robinson

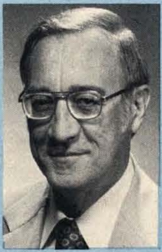

L.W. Hill

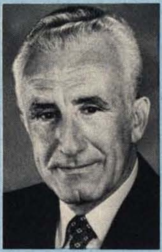

Z.W. Wicks

FLASH RUST INHIBITORS: AN EVALUATION OF SOME AMINES AND ORGANIC SALTS IN AN AQUEOUS ACRYLIC COATING

New England Society for Coatings Technology

Some amines and organic salts were evaluated at different concentration levels in an aqueous acrylic coating for flash rust resistance over bare steel. The coatings on bare steel were also evaluated for humidity resistance and salt spray resistance to evaluate the effects of the additives on the coating's environmental exposure performance.


R.R. Myers

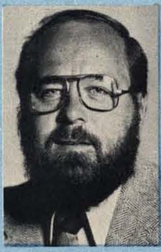

G.E. Cain


L.M. Parr

FACTORS INFLUENCING FREEZE-THAW STABILITY IN FLAT LATEX PAINTS

Montreal Society for Coatings Technology

In recent years the resistance to freezing and thawing of flat latex paints has fluctuated in importance, primarily dictated by the cost and availability of ethylene glycol and the cost of heated transport. The purpose of this paper is to show how formulating parameters, other than ethylene glycol, influence freeze-thaw stability of flat latex paints.


R. Rauch


R. Kuhnen


P. Walker

ORGANO-SILANES AS ADHESION PROMOTORS FOR ORGANIC COATINGS

Peter Walker, Ministry of Defence (England)

Organofunctional silanes of the general formula $R\text{-}Si(OR^1)_3$ have been examined as adhesion promotors for organic surface coatings on metallic substrates. Torque spanner and direct pull-off adhesion measurements clearly show that dramatic improvements in the initial, water soaked, and recovered adhesion of epoxide and polyurethane paints can be obtained on degreased and sandblasted surfaces when silanes are used as pretreatment primers. Investigations also show that similar improvements in adhesion can be obtained when selected silanes are incorporated into a paint in the single package self-bonding concept.

The results of X-ray photoelectric spectroscopy (XPS) examination of the sites of adhesion failure are described, and the existing theories on the role and mechanism of silanes in increasing the adhesion of coatings to the substrate are reviewed in the light of the observations recorded. Finally, the selection of silanes for use with particular formulations is discussed.

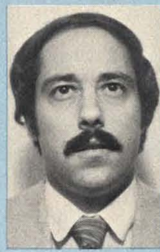

P. Shaw


G.M. Deighton


W.E. Craker


E. Nilsson


C.M. Hansen


F. Zurlo

CORROSION INHIBITIVE PERFORMANCE OF SOME COMMERCIAL WATER-REDUCIBLE, NON-TOXIC PRIMERS

Golden Gate Society for Coatings Technology

Recent laws and regulations limiting the use of various materials in paint are requiring users and manufacturers of corrosion inhibitive coatings to make use of relatively untried formulations. This study is an examination of the corrosion inhibitive performance of five water-reducible, non-toxic primers. The corrosion tests used were salt fog cabinets, blister cabinets, Kesternich cabinet, Cleveland condensation tester, and outdoor exposures.


R.T. Marcus


R.W. McFee


H. Skowronska

OBJECTIVE USE OF SUBJECTIVE COMPARISONS

Dr. W. E. Craker and Mr. G. M. Deighton, Laporte Industries Ltd.

The use of subjective assessments in the paint industry is discussed by reference to the gloss and hiding power of gloss alkyd paints and the "appearance" of semi-gloss latex systems. In addition to comparisons of paint performance, the use of subjective assessments in determining the market significance of particular TiO_2 properties is outlined.

The paper describes two statistical procedures—the trinomial distribution and an extension of paired comparison ranking—which can be applied to subjective comparisons. These enable such comparisons to be handled in an objective manner. Such objective use presupposes that the assessments are impartial and the problems of ensuring this are examined.

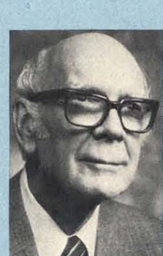
Illustration by reference to the technical problems already outlined leads to comments on the sensitivity of trained personnel to small changes in the distribution of light leaving a paint film. The paired ranking procedure is illustrated by reference to Market Research in the paint industry and the value to both raw material suppliers and the paint maker is discussed.


T.J. Anagnostou


E. Jaul


C-W. Koay


P.E. Pierce


K. McFarland


S.L. Davidson

EVAPORATION AND VAPOR DIFFUSION RESISTANCE IN PERMEATION MEASUREMENTS BY THE CUP METHOD

Erik Nilsson and Charles M. Hansen, Scandinavian Paint and Printing Ink Research Institute

The permeation of water through coatings and other materials is an important factor in their performance. The frequently used cup method to determine permeability coefficients inherently involves certain experimental effects which have not been recognized generally, and which are not mentioned in international standards.

This report describes a simple method to account for inherent cup effects in permeation experiments. This method is necessary to proper interpretation of data for "open coatings" such as acrylic stains, wood, paper, and other relatively permeable materials. Surface resistances to permeation can not be determined without considering these effects.

An improved simple method to determine vapor phase (water/air) permeation of diffusion coefficients is suggested and demonstrated with examples.

SHORT TERM EVALUATION TECHNIQUES FOR LIQUID AND PARTICLE BEHAVIOR IN COATINGS SYSTEMS

Frank Zurlo, Byk-Mallinckrodt

The paper deals with new methods of shortening the evaluation time necessary to determine certain physical properties for both solid and liquid phases in coatings systems. These include: (1) Relative settling characteristics and evaluation of wetting and suspending agents used to control settling; (2) The determination of surface characteristics and the effect of surfactants on these surface characteristics; and (3) To evaluate quantitatively the redispersibility of already settled coated systems.

With new available instrumentation, emphasis will be given to the study of the relative settling characteristics of coatings or settling in progress. The paper shows how the instrumentation can be used for formulating coatings systems as well as quality control.

ANALYSIS OF WATER-BORNE COATINGS FOR THE QUANTITATIVE DETERMINATION OF WATER AND COSOLVENTS

James A. Vance, Vance Laboratories

Porous polymers as gas chromatographic column packing materials can be used to determine both water and cosolvent concentrations in water-borne coatings. Modification of these polymers by deactivation of active cites and coating with a 2% load of Carbowax® 20M-TPA liquid stationary phase sharpens the cosolvent chromatographic peaks and decreases the peak tailing observed with polar compounds such as amines. Through the use of a solid sample syringe and the use of relative response factors, analysis of water-borne coatings for water and cosolvent concentration can be performed with a relative error for water at the 80% level of 1.26%.

ONLINE SEARCHING OF DATABASES OF INTEREST TO THE COATINGS INDUSTRY

Richard Caputo, Lockheed Information Systems

Online searching of bibliographic references in science, technology, and business is now widely available. Over 100 different databases containing about 40 million references can be searched through one service alone (DIALOG) from any timesharing computer terminal. Sample searches will illustrate this retrieval capability in databases of interest to the coatings industry, such as Surface Coatings Abstracts, Chemical Abstracts, Paper and Board Abstracts, Printing Abstracts, etc.

COMPUTER-ASSISTED DESIGN OF COATINGS FORMULAS

Edwin J. Lowrey, Precision Paint Corp.

Potential application areas for computer-assisted design of coatings formulas are limited only by existence of necessary math and input data, but in practice the principal applications are calculations previously done without a computer. Ten years of experience with this tool are described, including benefits, problems, and impact on personnel. A comparative illustration is given, in which formulas for the same product are generated with and without computer assistance; significant differences are apparent in sophistication of design methods, amount of information generated, probability of error, and time required. Illustrations of computer assistance are generalized rather than being taken from a specific computer program. Consideration is given to ways in which computer assistance can be expected to increase the complexity and effectiveness of formula design methods in the future. Other current laboratory computer applications which may interface with or compliment formula design are mentioned.

COMPUTERIZED COLOR CONTROL

Robert T. Marcus, Mobay Chemical Corp.

A computerized color control system represents the merger of a color measuring instrument with a digital computer to simulate a human color matcher. Rather than replace the human currently doing the job, the system becomes an obedient assistant. Coupled with an experienced color matcher, the result should be a noticeable increase in productivity. And coupled with a new employee, the system should help that person become productive more quickly.

In addition to describing the basic components and operation of a computerized color control system, this talk will attempt to realistically describe what the system will and will not do, and what is involved in the start-up of a system.

COMPUTERIZED PROCESS CONTROL IN THE COATINGS INDUSTRY

Robert W. McFee, Glidden Coatings & Resins Div., SCM Corp.

An overview of two process computer systems from the user standpoint—the first which has been in operation since 1973 controlling the thin down portion of trade sales latex paint manufacture; and the second, a system which will be in operation early in 1981 controlling many of the aspects of a resin manufacturing operation. The paper describes each of the systems, their operating procedures, advantages gained, maintenance requirements, and capital investment.

TECHNICAL COMPUTER APPLICATIONS IN THE COATINGS INDUSTRY; A BIBLIOGRAPHY, 1967-79.

Helen Skowronska, Consultant

This bibliography was compiled for the International Committee for Coordinating Activities of Technical Groups in the Coatings Industry, of which the Federation of Societies for Coatings Technology is a member.

This talk will describe the arrangement of the bibliography, number of references within the subject categories, criteria for the exclusion or inclusion of references, etc.

SYNTHESIS OF BLOCKED MDI ADDUCTS, THEIR DSC EVALUATION AND EFFECT OF PIGMENTATION

Taki J. Anagnostou, Wyandotte Paint Products, Inc., and Ernest Jaul, Union Carbide Corp.

Blocked isocyanate compounds have been used in the coatings and related industries for many years. However, there is no convenient technique reported to indicate at which temperature level unblocking will occur. In addition, only with considerable experimentation can it be found what effect additives and pigments have on this unblocking reaction. This study investigates the use of a Differential Scanning Calorimeter (DSC) to designate this temperature range.

Three blocked versions of 4,4′-diphenyl methane diisocyanate (MDI) were synthesized. These were the adducts of methyl ethyl ketoxime, ε-caprolactam, and benzotriazole. They were selected because they represented adducts which were capable of decomposing over a wide temperature range. Confirmation of their de-blocking temperature by infrared spectroscopy techniques on samples baked at temperatures specified by the DSC studies was, in general, successful.

Variations were observed in the temperature range at which unblocking occurs when a polymeric compound containing primary hydroxyl groups (polyoxyethylene glycol) is present. Addition of pigments to this variation had minimal effect on deblocking of the adducts at the lower and medium temperature ranges. However, at high temperature ranges significant changes were observed.

THE USE OF THIIRANE-FUNCTIONAL MONOMERS AS A MEANS OF DEVELOPING CROSSLINKABLE EMULSIONS

B. George Bufkin and John R. Grawe, University of Southern Mississippi, Robert M. O'Brien, Mobil Chemical Co., and Samuel A. Brown, Celanese Chemical Co.

A feasibility study was conducted which investigated the acceptability of using 2,3-epithiopropyl methacrylate (ETPM) as a means of developing crosslinkable emulsions.

To prevent premature reactivity of the thiirane functionality in the emulsion environment, the polymerizations were conducted at low temperatures using nonionic surfactants and a two-step, delayed addition of episulfide monomer. However, in spite of the preventative measures taken, compositions containing in excess of 6 mole percent ETPM possessed inordinately high degrees of premature crosslinking. Therefore, to avoid the baneful effects associated with excessive losses in thiirane functionality and to obtain coatings with an acceptable balance of physical properties, the 54.5/36.4/9.1-EA/MMA/ETPM copolymer emulsion (6 mole percent ETPM) was selected as the most reasonable candidate for further evaluations.

When the model emulsions containing 6 mole percent ETPM were combined with various chemically and structurally different curing agents, the samples containing piperizine displayed a 2.5 fold increase in tensile strenth, a 2.3 fold increase in solvent resistance, a 2.7 fold decrease in elongation, decreased impact resistance, and increased film hardness (2H versus 2B) after thermal curing (30 minutes at 65°C) as compared to samples of the same emulsion evaluated without a curing agent.

Coatings of the ETPM-containing emulsion were also found to crosslink at room temperature when piperizine was used as a curing agent.

PRIMARY AMINE ZWITTERION COPOLYMERS

Zeno W. Wicks Jr. and Chiew-Wah Koay, North Dakota State University

A copolymer of the vinyl ester of trimellitic acid anhydride and butyl acrylate was reacted with 2-amino-2-methyl-1-propanol to give a zwitterion copolymer with pendant half esters of 2-amino-2-methyl-1-propanol. The copolymer is soluble in 2-butoxyethanol. When diluted with water it behaves in a generally similar manner to that resulting when amine salts of "water-soluble" acrylic resins in cosolvent are diluted with water. Films of the copolymer with pTSA catalyst crosslink when cured for 30 min. at 150–175°C to give solvent rub resistance and hardness comparable to a water soluble acrylic resin with hexamethoxymethylmelamine. Thus, a primary amine zwitterion system offers the potential of a water soluble system which could cure without emission of formaldehyde or amine into the atmosphere.

THE PHYSICAL CHEMISTRY OF CATHODIC ELECTRODEPOSITION

Percy E. Pierce, PPG Industries, Inc.

Electrodeposition has gained worldwide acceptance as a coating process for automotive, appliance, and general industrial coating. The advantages of the process are high levels of coating utilization, automation, low levels of pollution, and high throwpower, i.e., the ability to coat the recessed portions of complex shaped metal parts.

In the original electrodeposition process the parts to be coated were made the anode. Recently, a new process in which the parts to be coated are made the cathode has gained increasing acceptance because higher levels of corrosion protection can be obtained with cathodically deposited coatings.

The cathodic process is an electrochemical process. The physical chemistry of the process and the understanding of the process depends on a knowledge of electrochemistry. The electrochemical investigation of the process has involved researchers in all the major industrial countries but especially those in Germany, the United States, and Japan.

In order for film deposition to begin, a suitable boundary layer around the part must be formed. Once the boundary layer is established the rate of film growth depends on the number of electrochemical equivalents required to neutralize the solubilizing salt groups, voltage, and the conduction characteristics of the deposited layer. If the film redissolves in the bath the process of film growth will stop at some point giving rise to a limiting film thickness.

The throwpower is also related to the electrochemistry of the deposition process as well as the geometry of the throwpower cell. Thus, throwpower can be calculated and the results of various throwpower tests such as the GM and Ford tests compared.

Among the factors which contribute to improved corrosion protection in the cathodic process is the development of improved polymers which are more resistant to cathodic disbonding and the reduction in metal and pretreatment dissolution during cathodic film deposition. It is expected that the cathodic electrodeposition process will continue to gain acceptance especially in those areas in which superior levels of corrosion resistance are required.

1980 PAINT INDUSTRIES' SHOW

EXHIBITORS

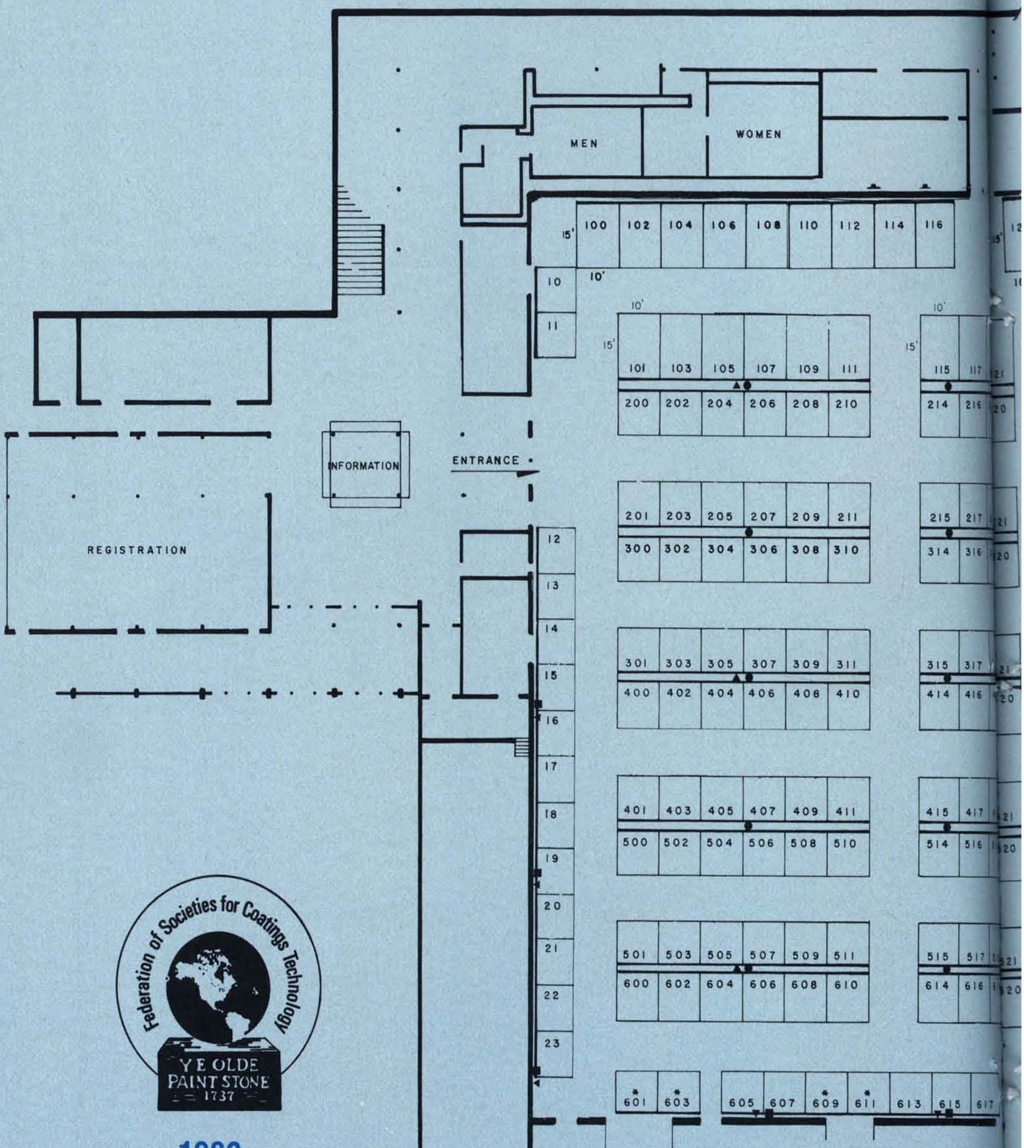
Atlanta Civic Center
Atlanta, Georgia
October, 29, 30, 31

PAINT SHOW HOURS

Wednesday, October 29	**12:30 to 5:30 pm**
Thursday, October 30	**9:30 am to 5:00 pm**
Friday, October 31	**9:30 am to 4:00 pm**

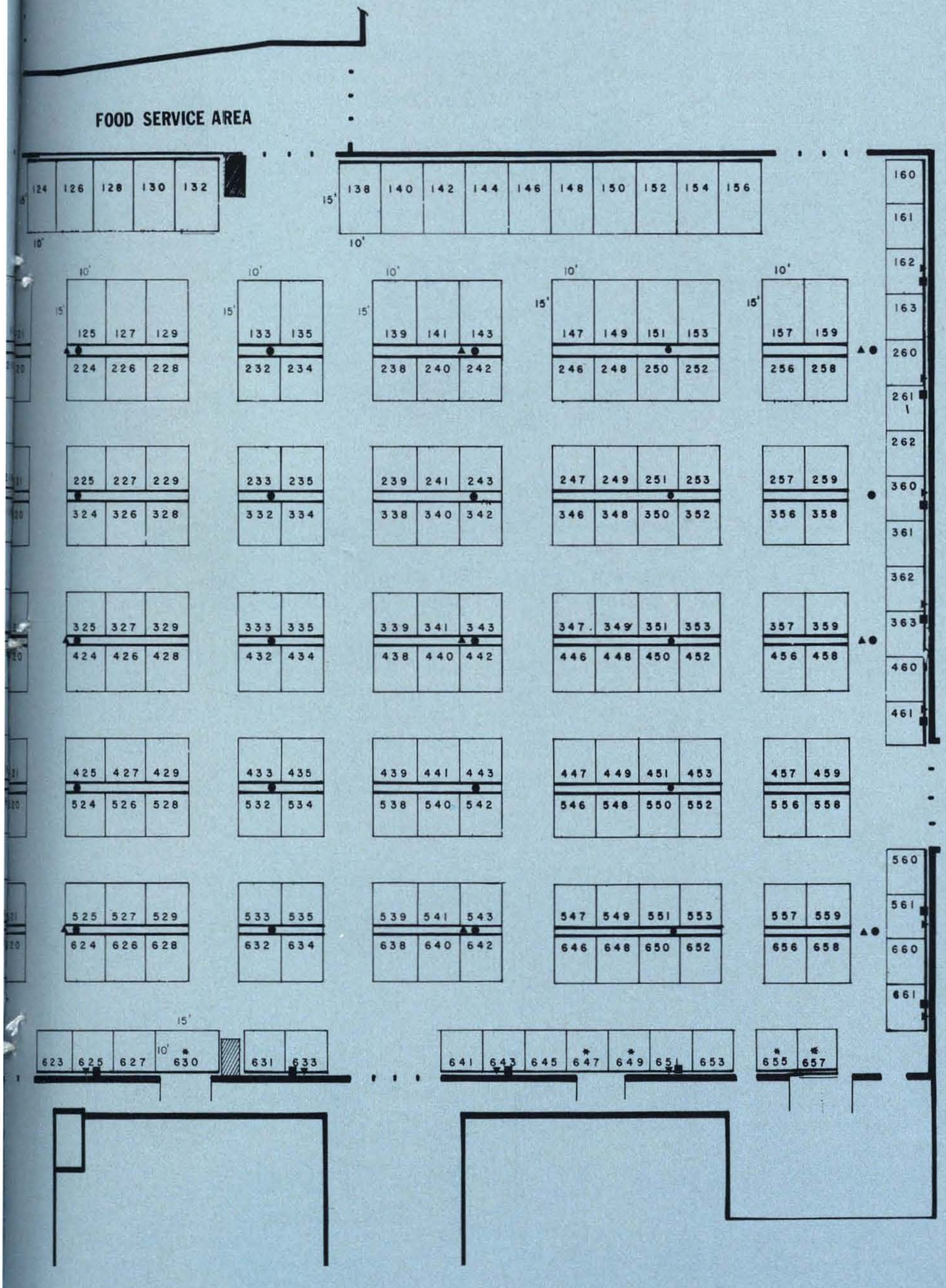
Exhibitors	Booth(s)
Aceto Chemical Co., Inc.	620
Air Products & Chemicals, Inc.	415-417
Alcan Ingot & Powders	433-435-532-534
Alpine American Corp.	153
Aluminum Co. of America	638-640-642
C.M. Ambrose Co.	108-110
American Hoechst Corp.	357-359-456-458
American Nepheline Corp.	307
Applied Color Systems, Inc.	225-227-229
Armstrong Containers, Inc.	611
Ashland Chemical Co.	315-317-319-321 414-416-418-420
Atlas Electric Devices Co.	238-240
B.A.G. Corp.	661
BASF Wyandotte Corp.	614-616-618
Beltron Corp.	613
Bennett's Colorant Div.	252
Blackmer Pump Div., Dover Corp.	451-453
Brinkmann Instruments, Div. Sybron	151
Brookfield Engineering Labs.	18
Buckman Laboratories, Inc.	346-348
Burgess Pigment Co.	529
Byk-Mallinckrodt Chem. Prod. GmbH	257-259-356-358

Exhibitors	Booth(s)
Cabot Corp.	447-449
Carborundum Co.	656-658
Cargill, Inc.	339-341-343 438-440-442
CDI Dispersions, Inc.	308
Celanese Chemical Co.	514-516-518-520
Celanese Polymers & Specialties Co.	515-517-519-521
Chicago Boiler Co.	124-126-128
Color Corp. of America	406
Columbian Chemicals Co.	233-235-332-334
Cordova Chemical Co.	558
Cosan Chemical Corp.	10-11
Custom Chemical Co.	251
Daniel Products Co.	247-249
Degussa Corp.	350-352
Desert Minerals Prods. Corp.	646-648
Diamond Shamrock Corp., Proc. Chems.	501-503-505
Diano Corp.	606-608-610
D/L Laboratories	328
Dow Chemical USA	605-607
Draiswerke, Inc.	550-552
Dresser Minerals, Inc.	660



1980
PAINT INDUSTRIES' SHOW

Atlanta Civic Center   Atlanta, Georgia
October 29, 30, 31, 1980


FOOD SERVICE AREA

Exhibitors	Booth(s)
Eastman Chemical Products, Inc.	239-241-243 338-340-342
Ebonex Corp.	556
Elcometer, Inc.	457-459
Elektro-Physik, Inc.	363
Encapsulair, Inc.	152
Engelhard Minerals & Chems. Div.	546-548
Epworth Manufacturing Co., Inc.	333-335
Fawcett Co., Inc.	351
Federated Metals Corp., Sub. ASARCO	446
Fed. of Societies for Coatings Tech.	Lobby
Filter Specialists, Inc.	304-306
Fricke Enterprises Co.	150
GAF Corp.	655
Gardner Laboratory, Div. Pacific Sci.	525-527
Georgia Kaolin Co.	154-156
W.R. Grace & Co., Davison Chem. Div.	15-16-17
Graco, Inc.	641-643
Halox Pigments	19-20
Harshaw Chemical Co.	425-427-429 524-526-528
Henkel Corp.	624-626-628
Hercules Incorporated	125-127-129 224-226-228
Hilton-Davis Chemical Co. Div.	533-535-632-634
Hockmeyer Equipment Corp.	232-234
Hooker Chemical Corp.	160
J.M. Huber Corp.	133
Hunter Associates Lab., Inc.	261-262
Ideal Mfg. & Sales Corp.	362
International Minerals & Chems. Corp.	401-403-405 407-409-411
Interstab Chemicals, Inc.	139-141
IWI Industries, Itasco Div.	560
Jaygo, Inc.	651-653
Johns-Manville	347-349
Kenrich Petrochemicals, Inc.	547-549
KTA-Tator Associates, Inc.	561
Labelette Co.	135
Liquid Controls Corp.	617
Lorcon Resins	450
3M/Chemical Resources Div.	112
Macbeth Div., Kollmorgen Corp.	506-508-510
Manchem Limited	539-541
Meadowbrook Corp.	604
Merck & Co., Chemical Div.	419-421
Miller Paint Equipment, Inc.	650-652
MiniFibers, Inc.	460-461
Modern Paint and Coatings	106
Morehouse Industries, Inc.	100-102-104
Myers Engineering, Inc.	600-602
MGI International, Inc.	260
Netzsch Brothers, Inc.	256-258
Neville Chemical Co.	324-326
NL Chemicals, NL Industries	209-211
NYCO Div., Processed Minerals, Inc.	147-149

Exhibitors	Booth(s)
O'Brien Industrial Equipment Co.	543
Omya, Inc.	551-553
Paint Research Institute (with FSCT)	Lobby
Penn Color, Inc.	21-22-23
Pennsylvania Glass Sand Corp.	250
Pfaudler Co., Div. Sybron Corp.	452
Pfizer, Inc., MPM Div.	12-13-14
Photomarker Corp.	645
Polychrome Corp.	157-159
Polyvinyl Chemical Industries	500-502-504
PPG Industries, Inc.	631-633
Premier Mill Corp.	205-207
Q-Panel Co.	310
Quackenbush Co.	148
Reichard-Coulston, Inc.	601-603
Reichhold Chemicals, Inc.	325-327-329 424-426-428
Rohm and Haas Co.	215-217-219-221 314-316-318-320
Schold Machine Co.	615
Semi-Bulk Systems, Inc.	360-361
Shamrock Chemicals Corp.	627
Shell Chemical Co.	439-441-443 538-540-542
Silberline Manufacturing Co., Inc.	309-311
Solem Industries, Inc.	162-163
South Florida Test Service, Inc.	242
Southern Clay Products, Inc.	609
Spencer Kellogg Textron	301-303-305 400-402-404
Sun Chemical Corp.	115-117-119-121 214-216-218-220
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Thibault-Walker Co.	647-649
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Troy Chemical Corp.	408-410
Union Camp Corp.	507-509-511
Union Carbide Corp.	101-103-105-107-109-111 200-202-204-206-208-210
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Union Process, Inc.	138-140-142
Uniroyal Chemical	130
United Catalysts, Inc.	448
Universal Color Dispersions	114-116
R.T. Vanderbilt Co., Inc.	144-146
Viking Pump Div., Houdaille, Inc.	557-559
Vorti-Siv Div., M&M Machine	143
Wacker Chemical Co.	630
Warren Rupp Co.	132
Wilden Pump & Engineering Co.	623-625
Zorelco Limited	161

Government / Industry

Battelle Suggests Potential Methods For Energy Conservation

Improved separation technology, chemical conversions, and reduction of inert materials are some of the ways the chemical industry can conserve energy.

That's the conclusion of researchers at Battelle's Columbus Laboratories in a study recently conducted for the U.S. Department of Energy. The study, prepared for DOE's Office of Industrial Conservation Programs, identified potential candidate areas in which the DOE can develop research and development programs in energy conservation for the chemical industry.

Other conservation techniques include use of supplemental energy sources and low-temperature heat, as well as fluidized-bed quenching, dry pelletizing, and improved electrolytic efficiency.

During the study, Battelle examined four energy-intensive chemical processes used to produce ammonia and carbon dioxide, chlorine and caustic soda, carbon black, and ethylbenzene and styrene. Successful energy-conservation research for these processes could apply to other processes not included in the study.

Battelle estimated that the use of different separation technologies might produce a reduction of as much as 10 trillion Btu annually for the ammonia industry and a similar reduction for the chlor-alkali industry.

The Battelle report concluded that an increase of 10% in conversion efficiency applied to 50% of existing capacity could result in annual energy savings of 10 trillion Btu for ammonia production, 5 trillion Btu for concentrating caustic soda, 4.5 trillion Btu for carbon black, and 1 trillion Btu for ethylbenzene-styrene.

As to reduction of inert materials, Battelle estimated improvements in the carbon black process could result in savings of 2 to 5 trillion Btu per year while improvements in the ammonia process might save about 9 trillion Btu each year.

Another energy-conservation technique identified by Battelle was to use supplemental energy sources produced in the various processes. As one example, the hydrogen by-product of the chlor-alkali process could be used in a fuel cell to generate electricity.

As to better use of low-temperature heat, Battelle said the chemical industry may be able to take advantage of new technology in this area. A considerable amount of energy, for example, is lost from many processes in the form of cooling water heated to relatively low temperatures; there are, however, known thermodynamic cycles by which energy may be recovered from such low-energy sources. For instance, the temperature of a fluid may be increased by pumping it to higher pressures.

As part of the study, Battelle also identified three technologies that could be studied for energy-conservation in specific applications: fluidized-bed quenching—to be used in the final quenching of carbon black formations; dry pelletizing—to be used in preparing carbon black pellets; and improved electrolytic efficiency—to be used in reducing energy consumption in chlor-alkali processes during electrolysis of the brine solution.

Copies of the report, "Pilot Study to Select Candidates for Energy Conservation Research for the Chemical Industry" (publication number DOE-TIC-11118), are available for $9.00 each in paperback ($3.50 microfiche) from the National Technical Information Service, Springfield, VA 22161.

INTRODUCING

BYK

VP-155

POLYMERIC DISPERSANT

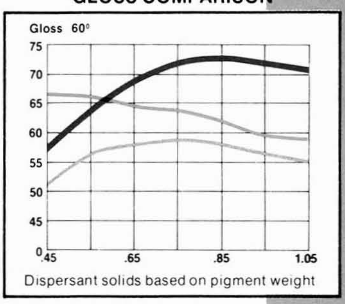
A Non-Foaming Anionic Dispersant for Latex Systems

BYK VP-155, the latest development from Byk-Mallinckrodt, represents a remarkable breakthrough in dispersants for latex systems.

BYK VP-155 affords stable pigment dispersion which ultimately provides substantial gloss improvement, increased shelf life and minimum foaming. Due to its polymeric structure, it does not detract from film properties.

BYK VP 155 was designed especially for use in high and semigloss latex systems as a primary dispersant. When compared to present surfactants, it provides much improved gloss properties and stability on heat aging.

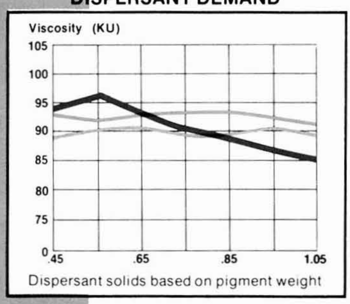
GLOSS COMPARISON



- BYK VP-155
- Competitor A
- Competitor B

- ***Substantial gloss improvement.***
- ***No foam produced during production or application.***
- ***Considerably improved stability on heat aging.***
- ***Effective with many prime pigments as well as most extenders and reactive pigments using a minimum dispersant level.***

DISPERSANT DEMAND



- BYK VP-155
- Competitor A
- Competitor B

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A New Method for Determination Of Formaldehyde Emanating From Substrates and Coatings

Michael W. Cox and David E. Moberly
Reliance Universal, Incorporated*

Recent information concerning the toxic effects of chronic exposure to formaldehyde has given impetus to the formulation of industrial coatings and adhesives which evolve less formaldehyde. In order to evaluate the efficiency of formaldehyde-reduction measures, a good laboratory technique for determination of formaldehyde was needed.

This paper describes a new method for the determination of formaldehyde emanating from coatings, coated substrates, and uncoated substrates. Although the method is designed to measure formaldehyde evolved from these products during simulated atmospheric conditions of interior dwellings, the method is not limited to these conditions and can be used to measure formaldehyde generated from other products or conditions, such as curing operations.

The method is reliable, convenient, and it yields data with a precision of six to ten percent. Routine analyses using this method require six hours for completion, which includes only three actual man-hours.

INTRODUCTION

Formaldehyde-based products have been used extensively for at least 40 years. The high reactivity of formaldehyde has made it almost indispensible in the formation of crosslinkable polymers which are used in the fields of industrial coatings and adhesives. Unfortunately, the reactions of formaldehyde in the formation of polymeric materials are often reversible to some degree, giving rise to the release of free formaldehyde under the proper conditions of temperature, presence of water, and other chemical agents.[1]

Formaldehyde release from polymeric materials, in particular urea-formaldehyde adhesives, has been studied as early as 1942, but even more rigorously since the late 1950's. Many of the studies were initiated because of the irritating effect of formaldehyde on human mucous membranes, and the desire to reduce the levels of formaldehyde release. Consequently, many methods of testing for formaldehyde and reducing its release have been documented.[2] Recently, increased concern has been raised about formaldehyde in the atmosphere of homes, particularly in light of efforts to seal homes for energy conservation. As homes are sealed against heat loss, they are also sealed against ventilation and indoor pollutants such as formaldehyde.[3] The problem of formaldehyde in well-sealed homes has also been aggravated in some cases where urea-formaldehyde foam has been used as insulation. In order to develop products which evolve less formaldehyde during end use, a laboratory procedure for determination of evolved formaldehyde was needed.

As previously stated, many techniques for this determination exist, but all these methods suffer from one or more of the following problems: They do not stimulate end use of the products; they do not control relative humidity (RH), temperature, or flow-rate of sampling air; they do not use commercially available equipment; or they fail to provide for recovering formaldehyde lost by polymerization on any surface it contacts.

The new procedure described in this paper does not share these drawbacks and it provides meaningful data concerning formaldehyde evolution during end use situations.

EXPERIMENTAL

The equipment needed to construct and use one test chamber is detailed in *Table* 1. The sampling train should be assembled in accordance with *Figure* 1. An item by item description of the system is given in *Table* 2.

Sampling Technique and Sample Preparation

SAMPLE PREPARATION FOR TESTING OF COATINGS: Experience has shown that the evolution of formaldehyde

*Robertson Research and Development Center, 4730 Crittenden Dr., Louisville, KY 40221.

Table 1—Equipment for One Test Chamber

Quantity	Item Description
2	10 ml Bubble flowmeters
2	SS-400-1-OR O-Seal stainless steel fittings, straight thread connection
1	Multiple outlet, Markson
1	Intermatic Model T 101, 24 hr, dial time switch
3	25 ml midget impingers
1	500 ml filtering flask
1	125 ml filtering flask
3	Powerstat variable transformers, 3PN 116B
1	Lab-Line 1475, alumaloy desiccator
1	Nupro B-4SG, fine metering needle valve
2	Bandit, ⅜" box clamps
1	Western Model 2281 dial thermometer, 0–250° F (0–120° C)
1	Hot plate, Corning Model PC-35
1	Diaphragm pump, Neptune Dyna-pump Model 2
1	Thermometer, 76 mm Immersion, 305 mm length, 0–250° F (0–120° C)
1	By-the-yard heat tape, 1.5′ (46 cm) length
1	500 ml flask heating mantle
1	Silicone rubber flat stock, 1/16″ (0.16 cm) thick
	Glass wool
	Other Equipment Needed for Analysis
	UV-Vis Spectrophotometer, Portable Spectronic 20 (Bausch-Lomb) or equivalent)
	Other Miscellaneous Laboratory Equipment
	Pipettes, Volumetric Flasks, Tygon Tubing, Ring Stands
	Reagents
	Formaldehyde, sodium bisulfite salt; deionized water; chromatropic acid; sulfuric acid; indicating drierite

from a coating during end use is dependent upon the type and condition of the substrate. Also, in the case of plywood or particle board, the amount of formaldehyde evolved from the board itself can be an order of magnitude higher than the amount of formaldehyde evolved from the coating. Meaningful data about the coating can best be obtained when the coating is applied to a substrate which does not evolve formaldehyde. Furthermore, the coating should be applied in a manner simulating commercial application. Therefore, in the case of wood coatings, thick veneers or dimension stocks were selected as substrates.

To prepare the sample, select a piece of thick veneer or dimension stock, ¼ to ½ in. (0.6 – 1.3 cm) thick, preferably using the same type of wood to which the testing coating would be applied. Coat the substrate in a manner simulating commercial manufacturing. If a topcoat is being evaluated, for example, the substrate should also be prepared in a manner similar to commercial manufacturing. If there will be other coatings present in addition to the coating under study, enough test samples should be prepared to permit testing of completely finished substrate and, as a control, substrate with only the coating of interest omitted.

After preparation, cut the prepared substrate into 4 × 4 in. (10.2 × 10.2 cm) pieces, and condition the panels at room temperature (25° C) for one week in a humidity controlled chamber. It was found that a sulfuric acid-water mixture was a convenient means of controlling RH. Care must be taken to avoid any actual contact of the test pieces with the acid-water mixture. By selecting different acid-water mixtures, atmosphere conditions can be controlled so that board moisture contents between 7 and 11% moisture content can be obtained. Use of a solution which yields a 9% board moisture content is suggested for most work. Actual moisture content

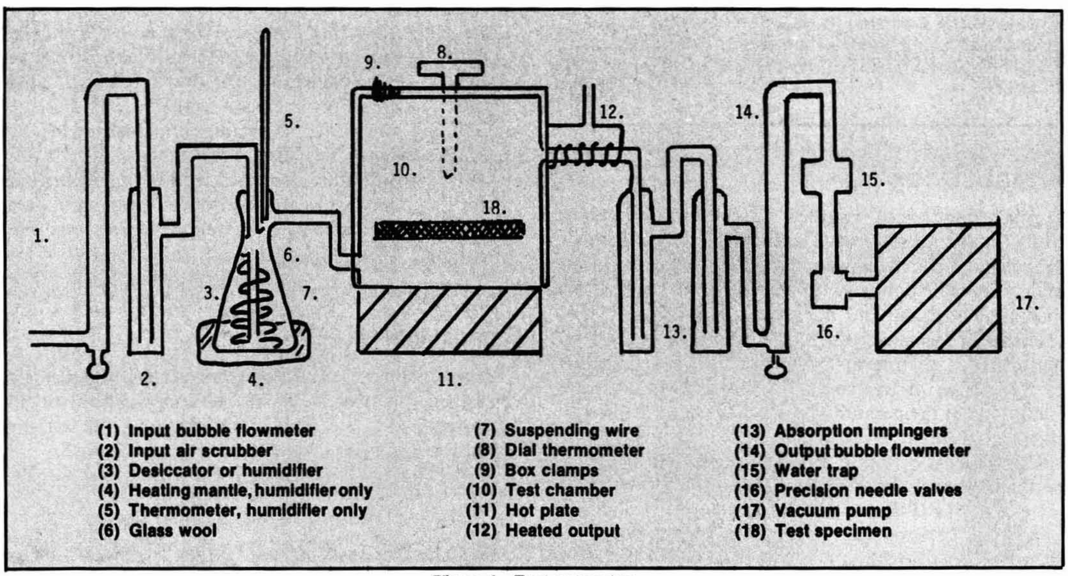

Figure 1—Test apparatus

values were confirmed by use of a moisture meter, supplied by the Moisture Register Company (*Figure* 2).

SAMPLE PREPARATION FOR TESTING OF SUBSTRATE: From the interior of a large piece of substrate, cut 4 × 4 in. (10.2 × 10.2 cm) test pieces. Avoid use of material from the edge of the large piece. Experience has shown that selection of interior sections yield more consistent values. Next, seal an edge of the board which is perpendicular to the grain of the front surface by dipping the test piece to a depth of ⅛ in. (0.3 cm) in molten polyethylene. This will provide the same ratio of "with the grain" and "against the grain" edge length to surface area as is found on a 4 × 8 ft. standard plywood panel.

Condition the test pieces at room temperature (25° C) for one week in a sealed container which contains a sulfuric acid-water mixture to control RH. As previously described, use of a solution which yields a 9% board moisture content is suggested for most work (*Figure* 2).

Formaldehyde Collection

To begin this procedure, fill all impingers with 15 ml of deionized water. If test is to be run at 0% RH, install the desiccator in the system. For all other values of RH, install the humidifier. Turn on the pump and, by use of the needle valve and output bubble flowmeter, set the output flow-rate at 60 ml per min. To continue, check the input flow-rate by use of the input bubble flowmeter. If the input and output flows do not match within 5%, the system must be checked for leaks.

After setting the voltage on the output heat tape to yield a temperature on the output tube of about 220° F (105° C), set the hot plate to yield that desired temperature for the test chamber. A temperature of 120° F (49° C) was selected as the standard, which represents an extreme temperature found in an unoccupied mobile home in warm climate.

If the humidifier is being used, set its temperature according to *Figure* 3 to yield the desired test RH. After equilibrium is attained, put fresh deionized water in the absorption impingers, place the test panel in the chamber, and reseal the chamber. Recheck input and output flow-rates for evidence of leaks.

After two hours of exposure at 49° C, turn off the hot plate and permit the test chamber to cool to room temperature for one hour. Open the cooled test chamber, remove the test specimen, and then reseal within one minute. Recheck input and output flow-rates. Next, turn the hot plate back on and set it to yield a chamber temperature of 230° F (110° C) and maintain this temperature for one hour. All systems should then be turned off and absorption impingers removed from the system. Cooling is not necessary at this point.

Wash the absorption impinger solutions into a 100 ml volumetric flask and dilute to the mark. In accordance with the analytical procedure which follows, analyze this solution for formaldehyde content.

Use of Chromatropic Acid For the Determination of Formaldehyde

PRINCIPLE OF THE METHOD: Formaldehyde reacts with a chromatropic acid-sulfuric acid solution to form a

Table 2—Construction of Sampling Train

Item No.[a]	Description
1	Input Bubble Flowmeter: 10 ml Bubble Flowmeter
2	Input Air Scrubber: 25 ml Midget Impinger containing 15 ml of deionized water
3–7	Desiccator or Humidifier 500 ml, Side arm filtering flask (a) When used as a desiccator the flask contains non-indicating Drierite with a ½ in. (1.25 cm) layer of indicating Drierite on the top. The input tubing is 6 mm ID glass tubing. (b) When used as a humidifier, the flask contains 400 ml of deionized water. The input tubing is tapered to a capillary opening. A coil of wire is used to suspend a layer of glass wool above the surface of water to stop the transmission of water aerosol into the test chamber. A mantle surrounds the base of the flask, and finally, a thermometer is included, the bulb of which is level with the output of the flask.
8–11	Test Chamber The chamber consists of a Lab-Line 1475 Alumaloy Desiccator: 2 - SS-400-1-OR Fittings; input fitting below sample level, output fitting above sample level. 6 x ¼ in. diameter Steel Tubing connected to input and output fittings; a 1/16 in. (0.16 cm) Silicon gasket between the top and bottom halves of the desiccator; 2 - Bandit ⅜ in. Box Clamps to hold the top and bottom halves of the chamber together; Western Model 2281 Dial Thermometer, ¼ in. NPT fitting, 0–250° F (0–120° C) Range. Finally, the Chamber sits on a Corning PC-35 Hot Plate.
12	Output from Chamber to first Impinger This consists of a 6 in. (15 cm) length of ¼ in. SS Tubing wrapped with a 1.5 ft (46 cm) length of heating tape.
13	Absorption Impingers (2) 25 ml Midget Impingers containing 15 ml of deionized water
14	Output bubble flowmeter 10 ml bubble flowmeter
15	Water trap 125 ml Side arm filter flask with 6 mm ID input tube
16	Needle valve Nupro B-4SG, fine metering valve
17	Pump Neptune Dyna-pump model 2

Further Notes

The humidifier heating mantle, PC-35 hot plate, and the output heat tape are controlled by separate Powerstat Variable Transformers, 3PN-1168.

All electrical devices are plugged into a Markson Multiple Outlet, which, in turn, is connected to an Intermatic Model T101, 24 hr Dial, Time Switch to permit automatic power up before the beginning of a working day. With this device, temperature equilibrium can be achieved at the start of the working day.

All tubing other than the input and output tubes from the Chamber is Tygon, the lengths of which are kept to a minimum.

(a) See *Figure* 1.

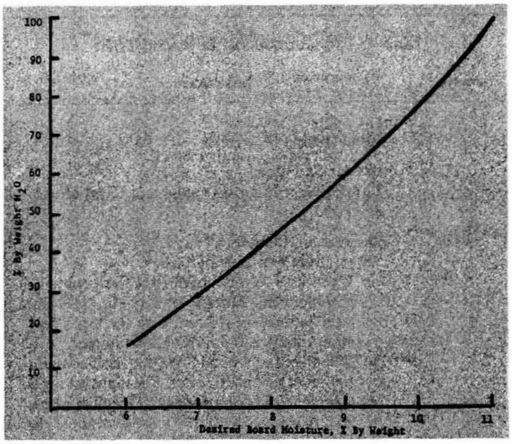

Figure 2—Desired board moisture content vs composition of water-sulfuric acid conditioning solution

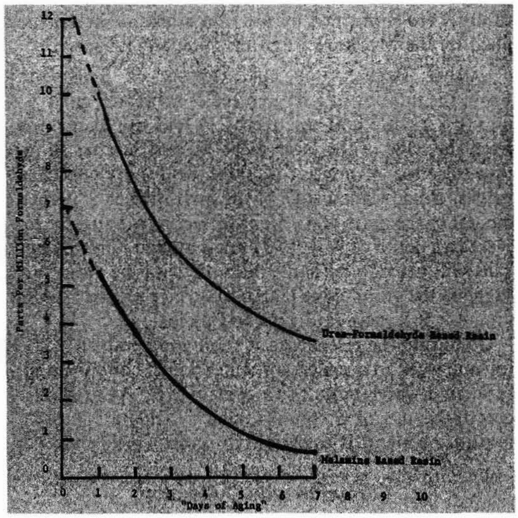

Figure 4—Pretesting aging vs formaldehyde evolution level; 0 days of aging is defined as the day the substrate was coated

purple monocationic chromogen. The absorbance of the colored solution in a spectrophotometer at 580nm is read and is proportional to the quantity of formaldehyde in the solution. For concentrations of the recommended standards, this relationship follows Beer's Law. This procedure is virtually identical to the analytical method recommended by NIOSH for the determination of formaldehyde.

PREPARATION OF REAGENTS:

(1) *Chromotropic acid reagent*—dissolve 0.25 g of 4,5-dihydroxy-2,7 naphthalenedisulfonic acid disodium salt (Eastman Kodak Company, Rochester, New York, Cat. No. P230) in water and dilute to 25ml. Filter if necessary and store in a refrigerated bottle protected from light. Make up fresh weekly.

(2) *Concentrated sulfuric acid*

(3) *Formaldehyde standard solution "A"* (1 mg/ml)* —Sodium formaldehyde bisulfite (Eastman Kodak Company, Cat. No. P6450) is used as a primary standard. Dissolving 4.4703 g in distilled water and diluting to one liter will yield a 1 mg/ml solution.

(4) *Formaldehyde standard solution "B"* (10 g/ml) —Dilute 5 ml of standard solution "A" to 500 ml with distilled water. Make up fresh daily.

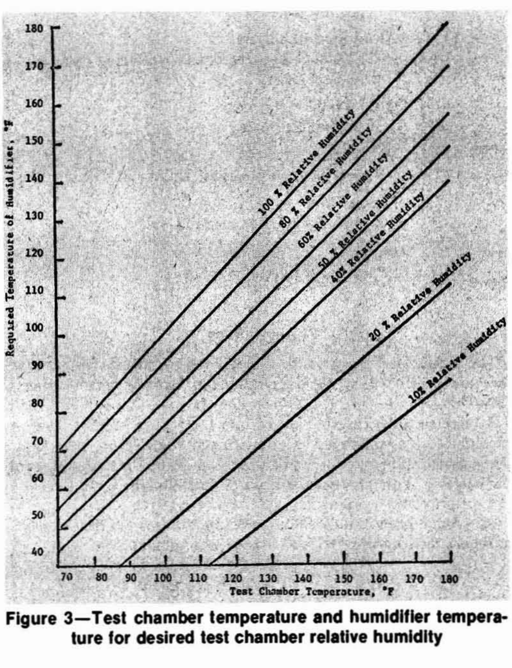

Figure 3—Test chamber temperature and humidifier temperature for desired test chamber relative humidity

PREPARATION OF STANDARD CURVE: Measure 0, 0.25, 0.75, 1.25, 1.75, 2.5, and 5.0 ml of standard solution "B" into glass test tubes with a pipette and dilute each of these aliquots to 10 ml with distilled water. Develop the color as described in the following analysis, beginning with the third step. Plot absorbance against micrograms of formaldehyde in the color developed solutions.

ANALYSIS:

(1) Combine impinger washings from outlet side of chamber and dilute in a 100 ml volumetric flask to 100 ml. Mix thoroughly. This solution is referred to as the sampling solution.

(2) With a pipette, measure a 10 ml aliquot of the sampling solution into a pyrex glass test tube. A reagent blank containing 10 ml of distilled water must also be run.†

(3) Add 0.25 ml of 1% chromotropic acid reagent to the solution in the glass tube and mix by swirling.†

(4) To the solution, pipette slowly and cautiously 15 ml of concentrated sulfuric acid. The solution becomes

*Use of soldium formaldehyde bisulfite as a primary standard is the major change from the original NIOSH procedure.

†The amounts of reagents used are 2.5 times larger than the amount suggested by the original NIOSH procedure.

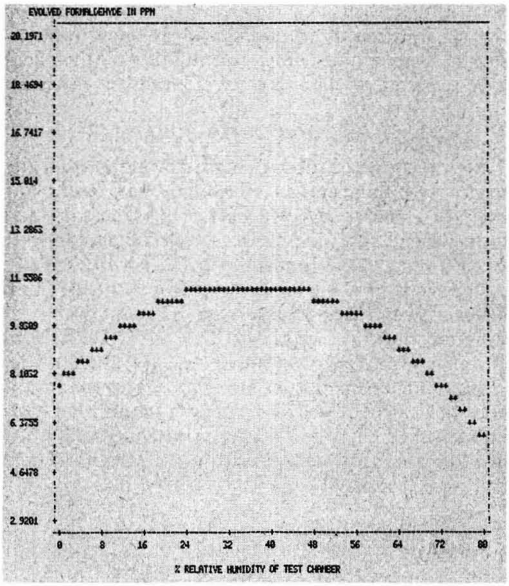

Figure 5—% RH vs formaldehyde evolution level

extremely hot during the addition of the sulfuric acid. Mix the solution by gently swirling the test tube during addition of the acid to prevent loss of sample due to bumping, spattering, or volatilization.†

(5) Allow to stand for 25 min, then cool tubes under running tap water. Zero the spectrophotometer using the reagent blank, and then determine the absorbance of samples at 580 nm in 1 cm cells. Use curve previously prepared to determine the formaldehyde content of the samples. If the formaldehyde content of the aliquot exceeds the limit of the calibration curve, a smaller aliquot diluted to 10 ml with distilled water is used. Include at least one standard as a check for the instrument and reagents. Results for the included standard should not differ from previous determinations by more than 5%.

CALCULATIONS: Determine the total concentration (C_t) of formaldehyde present as follows:

$$C_t = C \times F$$

C_t = total μg of formaldehyde evolved during the test period.

C = μg of formaldehyde in the sample solution aliquot as determined from the calibration curve.

F = respective aliquot factor; where

$$F = \frac{\text{sampling soln. Vol in ml.}}{\text{ml. aliquot used}}$$

The concentration of formaldehyde in the sampled atmosphere may be calculated by using the following equation, assuming standard conditions are taken as 760 mm of mercury and 25° C:

$$\text{Formaldehyde, ppm (by weight)} = \frac{C_t \times 24.47}{Vs \times M.W.}$$

where Vs = total sampling time in minutes × flow-rate in liters per minute.

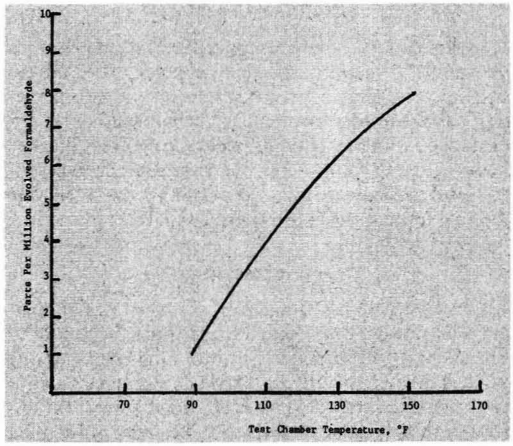

Figure 6—Test chamber temperature vs formaldehyde evolution level

The total sampling time includes the two hours bake time plus one hour cool down period, i.e., the total time of test specimens in the chamber. MW = molecular weight of formaldehyde = 30.03; 24.47 = μl of formaldehyde gas in one micromole at 760 mm Hg and 25° C.

DISCUSSION

Use the procedure as presented has permitted study of a variety of coatings and substrates and has yielded considerable data concerning the effect of various variables on formaldehyde evolution. Some of the variables studied and their effect on formaldehyde evolution are as follows:

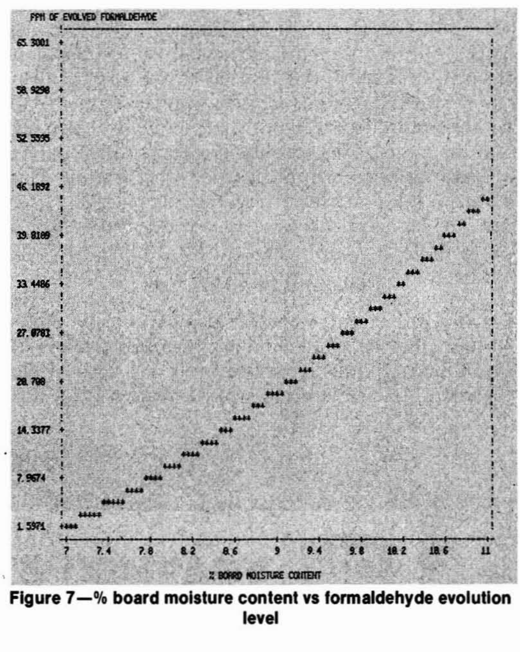

Figure 7—% board moisture content vs formaldehyde evolution level

Polymerization of Formaldehyde

Unless the test chamber is "baked out" at temperatures above 100°C, some formaldehyde polymerizes on the sides of the chamber biasing results low. Experimentation has shown this phenomenon accounts for a significant amount of the total formaldehyde evolved. The one hour "bake-out" procedure is therefore a critical aspect of the total procedure. It has been demonstrated that any residual formaldehyde is purged within this time period.

Age of Sample

Formaldehyde-based materials in substrates or coatings will slowly evolve formaldehyde for long periods of time. Plotting of formaldehyde evolution during testing vs days of aging before testing yields a graph similar to an exponential decay curve. After about a week, the difference in formaldehyde evolution becomes quite small and the precision of testing duplicate samples improves significantly. This is why the seven day sample aging time has been selected (*Figure* 4).

Percent Relative Humidity of Test Chamber

The RH of the test chamber has an interesting effect on the amount of evolved formaldehyde, as depicted in *Figure* 5, a computer representation of results obtained from a statistical study. Apparently, formaldehyde evolution is partially dependent upon loss or gain of moisture, such that for low values of RH, moisture is pulled from the substrate carrying formaldehyde with it. However, at high values of RH, moisture is driven into the board or at least inhibited from being lost, consequently reducing the amount of evolved formaldehyde.

Temperature

Any variation in temperature during aging or testing will affect final results. The higher the temperature, the higher the rate of formaldehyde evolution. During most of our work, 49°C was selected as the test chamber temperature. Since formaldehyde evolution was found to be predictably dependent on temperature, it is believed that the use of 49°C provides greater precision during analysis since more formaldehyde is generated. This alleviates the problem of very long sampling times for very low formaldehyde emitting systems (*Figure* 6).

Percent Board Moisture

The board moisture content also has a major effect on formaldehyde evolution levels. Increasing values of board moisture usually elevate levels of formaldehyde evolution. As mentioned in a previous discussion, it is believed that when moisture is driven from a substrate or coating, it carries formaldehyde with it. Also, a relationship between moisture and acid residues on formaldehyde releasing reactions may be at play here (*Figure* 7).

Substrate

Both the type of substrate and location of sampling from a given substrate can influence the final results. For example, standard plywood yields much higher levels of formaldehyde than does veneer which contains no glue. Furthermore, values from 4 × 4 in. (10.2 × 10.2 cm) test panels cut from 4 × 8 ft sheet of plywood can vary by a factor of two. One noticeable trend is that samples taken from the edge of a large sheet have lower values than samples taken from the interior of the board. Also, coatings under the test on metal substrates will invariably yield much lower formaldehyde results than coatings tested on any wood substrate, including solid wood in difference to plywoods, due to the presence of moisture and wood porosity.

SUMMARY

Use of the experimental method introduced here, though relatively simple and economical, has been found to yield a precision level of 6.5% for determinations made at 0% chamber RH and about 10% for all other levels of percent RH. This level of reproducibility has offered the opportunity to study formaldehyde evolution under a variety of conditions and has yielded extensive information about the variables which control formaldehyde evolution. In particular, the strong effect percent board moisture has on formaldehyde production was interesting, if not surprising. Through additional studies and quality control monitoring of other substrates, glue types, and coating types, the objective of reducing formaldehyde generation will be realized.

ACKNOWLEDGMENT

The authors wish to thank the other members of the Robertson Research Center of Reliance Universal for their suggestions and assistance in preparing this study. In particular, the assistance of M. B. Price was greatly appreciated.

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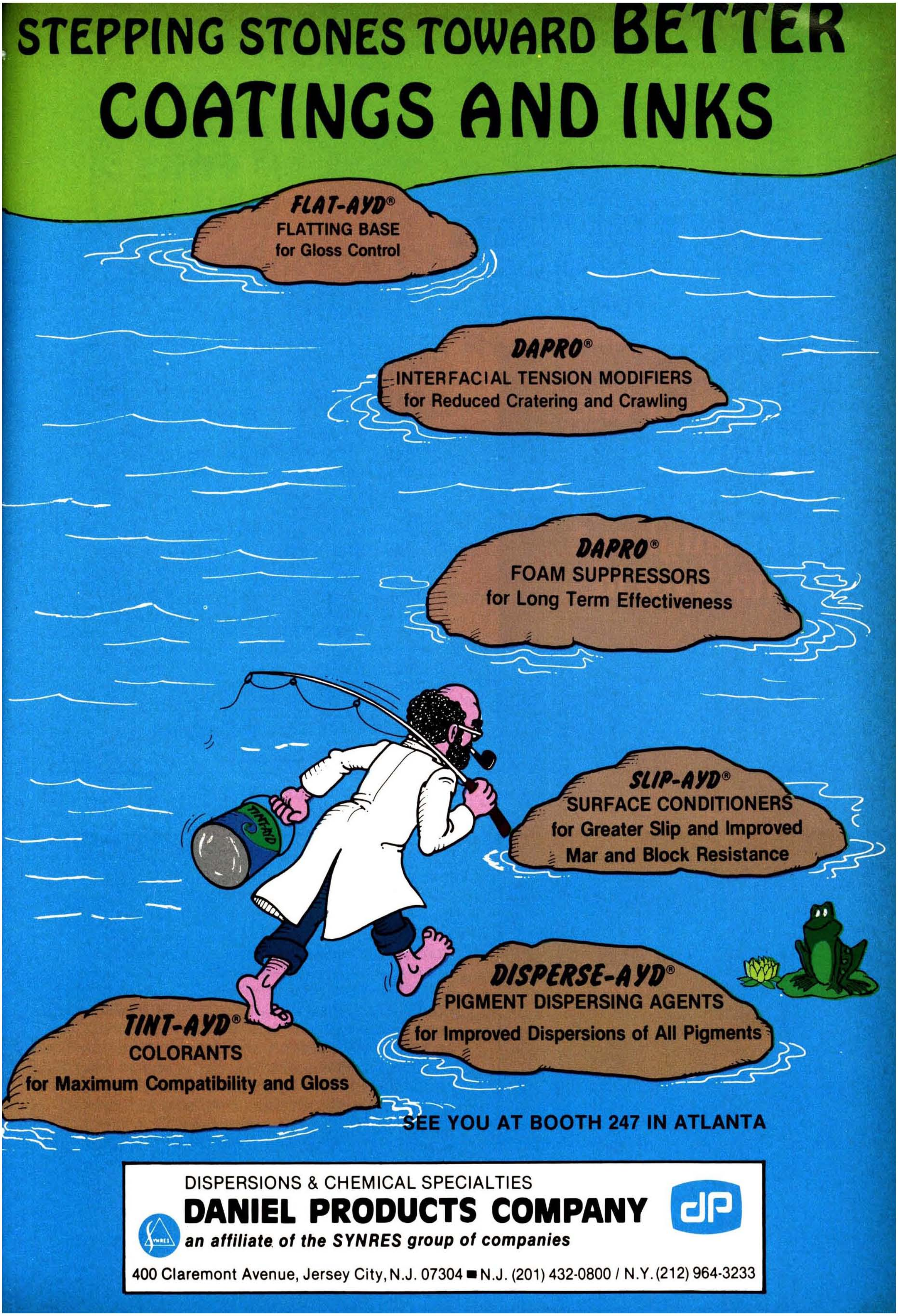

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Adhesive Characteristics Of Ultraviolet Radiation Curable Resins

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Hitachi Limited*

The adhesive characteristics of ultraviolet radiation curable resins are discussed for the mixtures of 1,2-polybutadiene dimethacrylate and reactive monomers (7:3 by wt). The tensile adhesive strength to an aluminum oxide substrate is significantly affected by the internal stress of the resins. The addition of monomers containing the hydroxyl group gives resins which exhibit excellent adhesion. The large decrease in adhesive strength which appears in the systems with polyfunctional monomers after water absorption, is explained by the increase of internal stress. The effects of the additives and other oligomers are also discussed.

INTRODUCTION

Recently, ultraviolet radiation curable resins (UV resins) have become commercially available for paints,[1-3] adhesives,[4] and electronic applications.[5-9] Their major uses are as surface coatings, such as solder masks, plating and etching resists, and printing inks. The features of UV resins include rapid curing, virtually no solvent emission, and long pot life. These materials can be converted from a liquid to a thermoset solid within seconds through crosslinking reactions under UV radiation.

The mechanisms of UV-initiated polymerization[10-14] and the hardening properties of pigmentated UV-curable resins[15-17] are discussed in detail in the prior literature. But, few reports on the adhesive characteristics of UV-cured resins have been published in spite of their inferiority to the thermosetting resins.[18]

This study was undertaken to elucidate the adhesive characteristics of some UV-cured resins, especially with respect to the effect of reactive monomers and additives. The experiments were carried out for the mixtures of 1,2-polybutadiene dimethacrylate and reactive monomers (7:3 by wt).

EXPERIMENTAL

Materials

The reactive oligomer was 1,2-polybutadiene dimethacrylate (MW2600) which was obtained from Nippon Soda KK. The reactive monomers and photoinitiators were commercially available grades and used without further purification.

UV Sources

Two UV sources were used. The first source consisted of a high-pressure, mercury-vapor lamp, ballasted at 30 watt per cm. The second one consisted of a metallic, halide-vapor lamp, ballasted at 80 or 120 watt per cm with a polished aluminum reflector. Cooling air was blown over the lamp and the samples.

Measurements of Adhesive Strength

Tensile adhesive strengths of UV-cured resins to an aluminum oxide substrate were measured with Instron Universal Testing Instruments, model TT-5000 using the samples as shown in *Figure* 1. The strain rate of measurements is 5 mm/min and each result was shown with the average of ten measurements. Using the screen-printing technique, a UV resin, containing a photoinitiator, was coated to a thickness of 50 μm on a plate of 96% α-Al_2O_3 1 cm^2 in area. After curing by UV radiation, both sides of the resin-coated plate were bonded to jigs with epoxy adhesive and kept at room temperature for 24 hr before being used in the adhesive strength test.

Calorimetric Analysis

The UV curing time was measured by calorimetric analysis. A Rigaku Electric DSC 8001 differential scan-

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Table 1—Effect of Photoinitiators and UV-Radiation Conditions on the Tensile Adhesive Strengths (F_{obsd}) of the UV Resins

Photoinitiator (P.I.)	Amount of P.I. (phr)	Radiation Time (min)	Radiation Distance (cm)	F_{obsd} (MPa)
Ben-Pr[a]	1	3	15	6.4
2-Methylanthraquinone	1	0.5	15	7.4
		1		7.6
		3		7.5
		5		7.6
	0.5	3		7.0
	2			6.8
	1		10	6.6
			20	7.2
Benzil	1	3	15	4.6
Benzophenone	1	0.5	15	3.1
		1		6.8
		3		7.2
		5		7.0
Benzoin	1	3	15	4.8

(a) Benzoinisopropylether

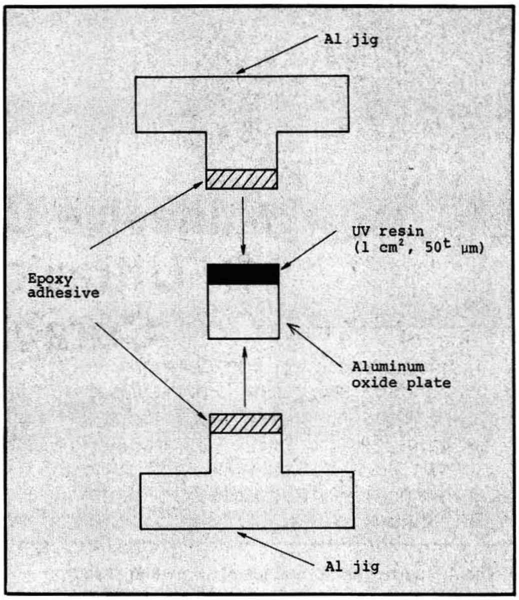


Figure 1—Sample measuring tensile adhesive strength

ning calorimeter was modified to be irradiated and used for the measurements. A 250 watt high-pressure, mercury-vapor lamp was used as a UV source, and 10 mg of the samples were used.

Measurements Of Tensile Strength and Elongation

The dumbbell-like samples of cured UV resins were prepared according to ASTM D882 D-651 and the free films were used. Tensile strengths and elongations of UV resins were measured with Instron Universal Testing Instruments. The strain rate of measurements is 5 mm/min and each result was shown with the average of ten measurements.

Abbreviation of Monomers

The monomers used in this paper were abbreviated as shown below:

LMA: lauryl methacrylate
2-EHMA: 2-ethylhexyl methacrylate
n-HMA: n-hexyl methacrylate
2-HEMA: 2-hydroxyethyl methacrylate
2-HPMA: 2-hydroxypropyl methacrylate
EGDMA: ethyleneglycol dimethacrylate
TMPTMA: trimethylolpropane trimethacrylate

Table 2—Relative Reactivity of UV Polymerization in 1,2-Polybutadiene—EGDMA (7:3 by wt) at 30°C

Photo-initiator	Benzoin-isopropyl-ether	2-Methyl-anthra-quinone	Benzoin	Benzo-phenone	Benzil
Relative reactivity[a]	13	9.0	2.3	2.0	1.0

(a) Measured from DSC analysis. (Photoinitiator) = 0.04 mol/l.

RESULTS AND DISCUSSION

Effects of Photoinitiators And UV Radiation Conditions

The tensile adhesive strengths (F_{obsd}) of UV resin to the substrate (aluminum oxide plate) were measured for various photoinitiators, radiation times, and radiation distances. The results are shown in *Table* 1.

As shown in *Table* 1, there are practically no differences in these photoinitiators, whether the species decompose by homolysis under UV radiation (benzoinisopropylether and bensoin)[10,19] or initiate the photopolymerization by hydrogen abstraction (2-methylanthraquinone, bensil, and benzophenone).[11,12]

The resins containing benzoin or benzophenone have low tensile adhesive strengths at low initiator concentrations and short radiation times, owing to the low reactivity of these resins and incomplete cure. These facts were ascertained by measuring the curing time, using the calorimetric analysis (*Table* 2).

In the system containing 2-methylanthraquinone, it is seen that F_{obsd} hardly varied for radiation times of 0.5–5 min and radiation distances of 10–20 cm. The lamp also used radiated heat rays and the temperature of the resins rose from 50 to 150°C during the radiation. Therefore, it was shown that F_{obsd} was not affected by radiation heat. Hence, 2-methylanthraquinone (1 phr) was used as the photoinitiator in the succeeding experiments because it

Table 3—Glass Transition Temperature (T_g) of UV Resins in *Figure* 2

Monomer	LMA	2-EHMA	n-HMA	2-HEMA	2-HPMA	EGDMA	TMPTMA
T_g(°C)	−40	−40	0	10	10	40	50

gave rapid UV curing rates and good quality of the surface hardening, in addition to its independence of the radiation conditions.

Effects of Reactive Monomers

The F_{obsd} values were measured for the resins containing several methacrylate monomers at 25°C. The results are shown in *Figure* 2. The resins formed using polyfunctional monomers (EGDMA and TMPTMA) showed poor adhesion to the aluminum oxide plate. Their primary mode of failure was adhesive. The monofunctional monomers containing a hydroxyl group (2-HEMA and 2-HPMA) gave resins with better adhesion than those from other monofunctional monomers (n-HMA, 2-EHMA, and LMA). The primary mode of failure was mixed (cohesive and adhesive) for these resins with the exception of the lauryl methacrylate, which showed cohesive failure. This is explained by the mechanical properties of the resins. The glass transition temperatures (T_g) of UV resins from *Figure* 2 are shown in *Table* 3.

Here, T_g values were measured by changes of the resin hardness. Mechanical properties of UV resins are shown in *Table* 4. The F_{obsd} decreased when T_g of UV resins was higher than the measurement temperature (25°C). The resin containing the monomer with hydroxyl groups had good adhesion. The resin containing lauryl methacrylate monomer did not show high tensile adhesive strength in spite of the lowest T_g. In this case, the failure was cohesive, and it was ascertained that it was due to the low tensile strength of the resin. On the other hand, the resins containing the monomer with hydroxyl groups (2-HEMA and 2-HPMA) had higher tensile strengths and greater elongation as compared to the resins containing the polyfunctional monomers (EGDMA and TMPTMA). This is explained by the intermolecular hydrogen bonding of the hydroxyl groups, which participate in adhesion.

Table 4—Mechanical Properties of UV Resins

Monomer / Property	LMA	2-EHMA	n-HMA	2-HEMA	2-HPMA	EGDMA	TMPTMA
Tensile strength (MP_a)	1.2	2.5	5.9	14	15	11	10
Elongation (%)	54	85	38	39	18	9.5	9.0
Young's modulus (MP_a)	1.9	2.5	18	32	100	94	94

The resins containing polyfunctional monomers show unusually low tensile adhesive strength. This indicates that internal stress developed in the UV resin in spite of its comparatively low curing temperature. Therefore, the volume contraction of the UV resin, which is one cause of the internal stress, is measured by changes in the specific gravity. The results are shown in *Table* 5. There is no difference between the monofunctional monomers and the polyfunctional ones. The volume contractions in each case are large and seem to be important in adhesion, especially in the case of rapid curing.

Effect of Water Absorption

The F_{obsd} values after boiling in water for 1 hr were measured and are shown in *Figure* 2. The resins containing polyfunctional monomers (EGDMA and TMPTMA) failed completely at the boundary between the substrate and the resin. The F_{obsd} of the resin containing 2-EHMA decreased somewhat after boiling in water. On the other hand, the resins containing 2-HEMA, 2-HPMA, n-HMA, or LMA hardly decreased in tensile adhesive strength. The resins containing LMA and 2-EHMA mainly showed cohesive failure. These facts can be explained by the change of mechanical properties before and after the boiling test. These results are summarized in *Figure* 3.

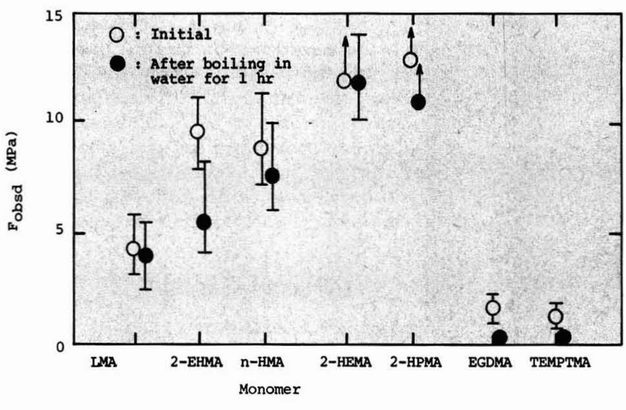


Figure 2—Effect of methacrylated monomers on the tensile adhesive strengths of UV resins. LMA: Lauryl MA; 2-EHMA: 2-Ethylhexyl MA; n-HMA: n-Hexyl MA; 2-HEMA: 2-Hydroxyethyl MA; 2-HPMA: 2-Hydroxypropyl MA; EGDMA: Ethyleneglycol DIMA; TMPTMA: Trimethylolpropane TrIMA

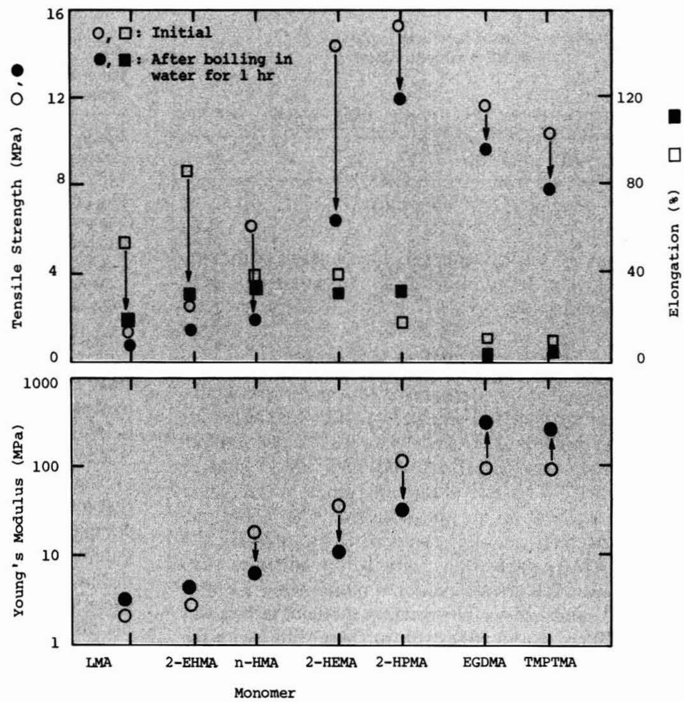


Figure 3—Mechanical properties of UV resins

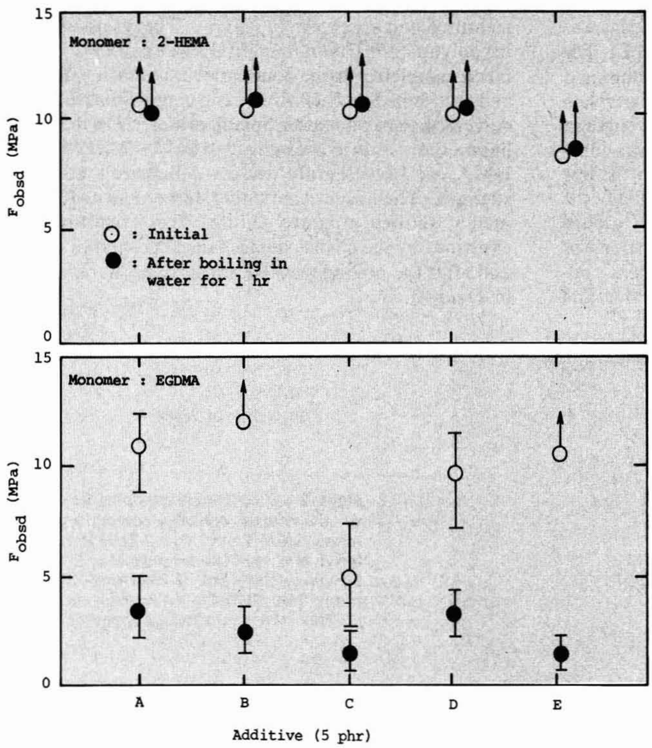


Figure 4—Effect of additives on the tensile adhesive strength of UV resins. A: γ-Aminopropyltriethoxysilane; B: (p-Vinylstylyl) (trimethoxysilylpropylaminoethyl) ammonium chloride; C: γ-Methacryloyloxypropyltrimethoxysilane; D: Vinyltris (β-methoxyethoxy) silane; E: Methacryloyloxyethylphosphate

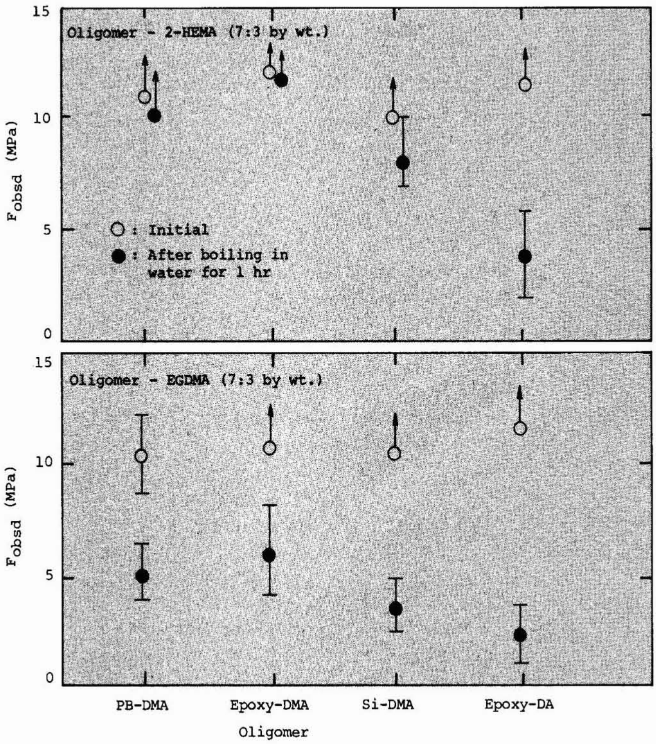
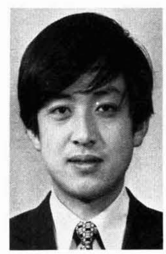


Figure 5—Effect of acrylate oligomers on the tensile adhesive strength. (Additive: γ-Aminopropyltriethoxysilane, 5 phr) PB-DMA: 1,2-Polybutadiene dimethacrylate; Epoxy-DMA: 2,2′-Bis(4-methacryloxydiethoxyphenyl) propane; Si-DMA: Organopolysiloxane dimethacrylate; Epoxy-DA: 2,2′-Bis(4-acryloxyphenyl) propane

Tensile strengths of the UV resins decreased by water absorption in all cases, and the elongation in the resins containing LMA or 2-EHMA was greatly reduced. As a result, Young's modulus increased after the boiling test in the case of resins containing EGDMA, TMPTMA, 2-EHMA, or LMA, and decreased in the resins containing 2-HPMA, 2-HEMA, or n-HMA. As we have seen, the big decrease of F_{obsd} with water absorption in the resins containing EGDMA or TMPTMA (T_g> room temperature) depends on the increase of internal stress in the resins. As UV curing occurs at comparatively low temperature, the crosslinking reaction takes place in the case of resins containing polyfunctional monomers when the UV-cured resins leave at higher temperature than the curing temperature. About 2–4 wt% of water absorption takes place in the case of resins containing monomers with hydroxyl groups and about 4 wt% of evaporation of the unreacted monomer takes place in the case of resins containing the other monofunctional monomers in the similar condition. The change in Young's modulus during the boiling test is explained by crosslinking reaction, the water absorption, and the evaporation of the unreacted monomer. These facts were ascertained by a heat aging test under the same conditions of 100° C at 1 hr.

Effects of Additives

The F_{obsd} values were measured with several additives mainly using silane coupling agents. The results are shown in *Figure* 4. In the resins containing 2-HEMA (T_g< room temperature), F_{obsd} values were greater than 10 MPa, except for additive E. On the other hand, F_{obsd} values in the resins containing EGDMA (T_g> room temperature) were significantly increased by using silane coupling agents or similar agents (additives A, B, D, and E); however, after the resin was boiled in water, F_{obsd} decreased in the presence of any additives. These results



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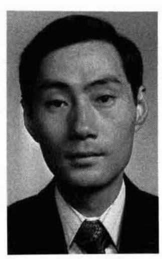

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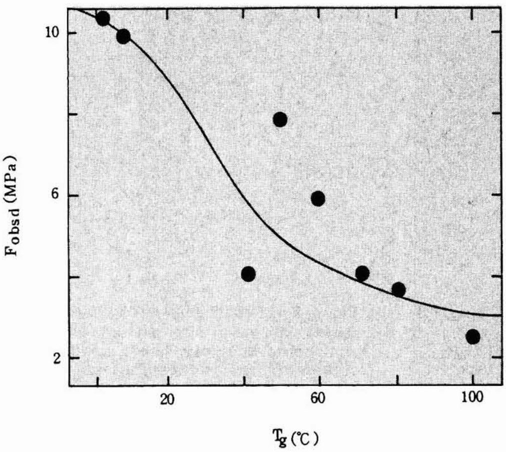

Figure 6—Relation between T_g values and F_{obsd} values after boiling in water

indicate that the characteristics of the monomer are more important to adhesive strength than the additive.

Effects of Acrylate Oligomers

The F_{obsd} values were measured for various UV-curable oligomers (epoxy diacrylates and a silicone dimethacrylate). The results are shown in *Figure* 5. Tensile adhesive strengths, especially after boiling in water, decreased in the order of epoxy dimethacrylate, 1,2-polybutadiene dimethacrylate, silicone dimethacrylate, and epoxy diacrylate, where epoxy dimethacrylate was a flexible oligomer possessing four ethylene oxide units in a molecule.

The relation between T_g values of these resins and F_{obsd} values after boiling in water are shown in *Figure* 6. As seen here, a large drop in F_{obsd} was observed, as the T_g values of UV resins were greater than the temperature at which measurements were carried out. These facts indicate that tensile adhesive strengths are significantly affected by the internal stress of the resins, whatever UV resins are used.

CONCLUSIONS

The adhesive characteristics of ultraviolet radiation curable resins were discussed. On the basis of this study, it is concluded that the adhesive tensile strength is significantly affected by the internal stress of the resins. The addition of monomers containing the hydroxyl groups

Table 5—Volume Contraction of UV Resins

Monomer	2-HEMA	2-HPMA	EGDMA	TMPTMA
Volume contraction (%)	10.4	10.0	10.4	9.4

gives resins excellent adhesion. The large decrease in adhesive strength which appears in the systems with polyfunctional monomers after water absorption is explained by the increase of internal stress. The best combination of materials and variables is flexible epoxy dimethacryle or 1,2-polybutadiene dimethacrylate, methacrylate monomer with hydroxyl groups, 2-methylanthraquinone, and silane coupling agent with amino groups.

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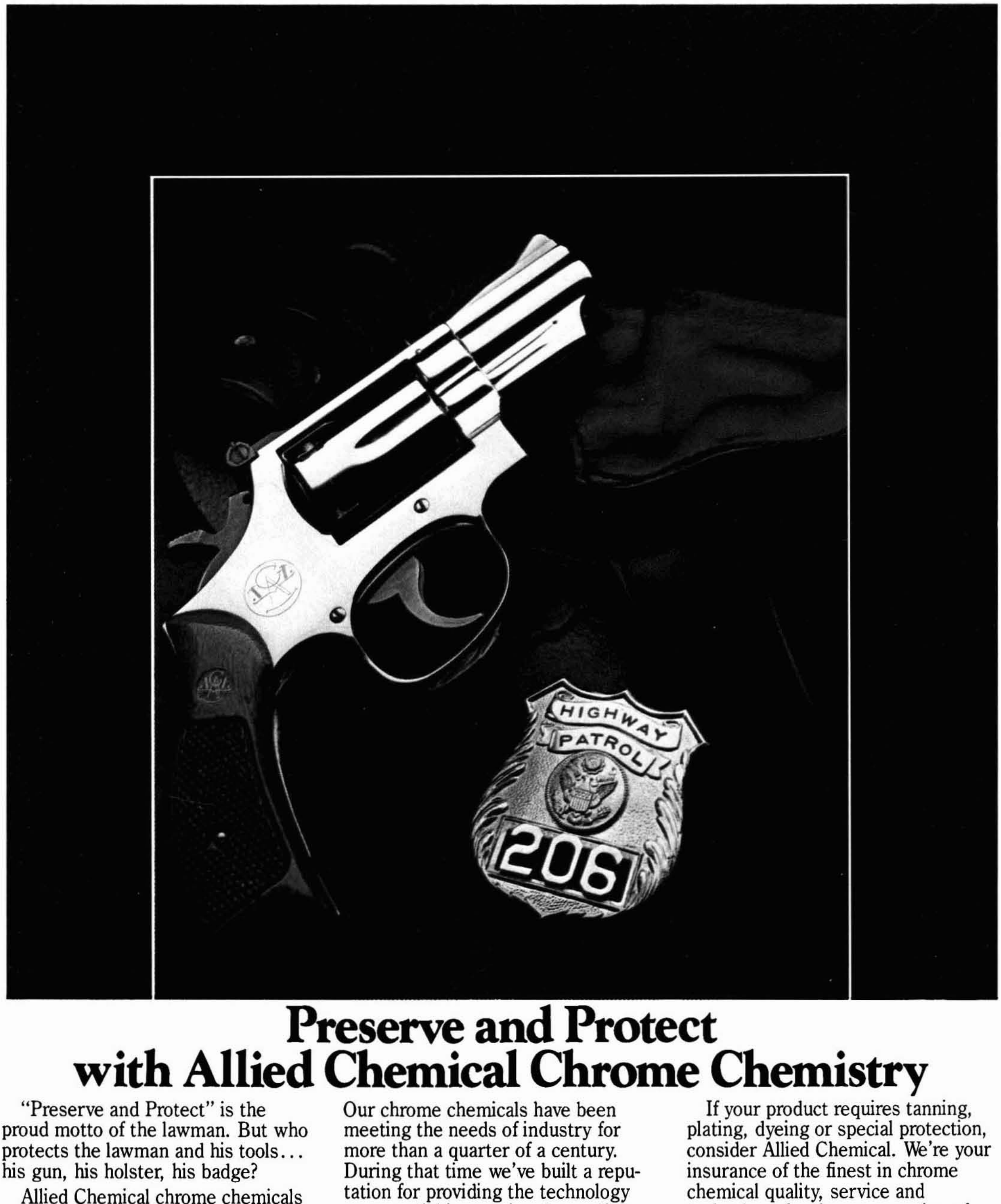
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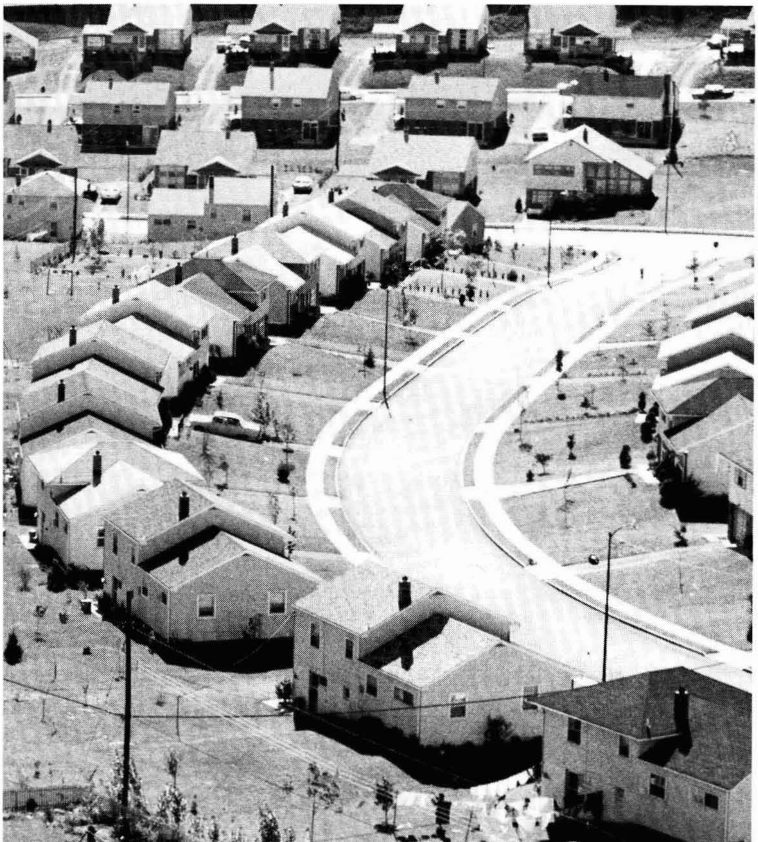

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A Simplified Quality Control Method Applicable to Copper(I) Oxide Based Antifouling Paints

Frank Marson
Defence Science and Technology Organization*

To reduce the time and expense involved in leaching studies, a simple technique has been developed to continuously monitor the increase in copper concentration during the leaching of antifouling paints in alkaline glycinate accelerated leaching solutions. The copper concentration is measured by direct estimation of the copper glycine complex using a simple immersion absorptiometer. This paper briefly describes the techniques and apparatus used. The absorptiometer head, which consists of an incandescent light source and vacuum photodetector, is treated in more detail. The use of the technique is illustrated by experimentally-determined leaching curves of contact leaching antifouling paints, indicating the effect of changes in pigment volume content, vehicle type, and pigment grade. The use of a simple exponential equation of the form:

$$\exp(x/30) \quad a + bT$$

where x is the total amount of copper (gm^{-2}) leached after time T(s), a is a constant which ideally should be 1.0, and b is a constant defining the leaching characteristics of the paint, is shown to be applicable to this type of paint. This method and apparatus developed for routine quality assessment appear capable of refinement to yield more detailed information for use in research and development.

INTRODUCTION

Antifouling paint performance has, in practice, always been variable, largely due to changes in application technique, ship usage, and variations in the physical and biological environment. However, there is little doubt that differences in the paints themselves contribute substantially to this variability. For this reason, considerable efforts have been devoted to the development of quality control techniques intended to insure satisfactory performance. The most effective method of quality control to date appears to be that carried out by the manufacturer who insures that the raw materials used in the formulation of the paint are of consistent quality, and that each batch is manufactured in the same way. On the other hand, the user is generally limited to the comparison of batches with an original sample using simple quantitative tests, such as solids content and density, perhaps supplemented by the measurement of the total copper content of the paint. Although the purchaser can test batches of antifouling paint by practical trials on ships or by immersion of painted test panels at a fouling test site, this would take far too long. Testing, which would have to continue until fouling settlement occurred, could take several years.

The more sophisticated technique of measuring the leaching rate of the toxic component of the antifouling paint, usually copper, to establish the leaching characteristics of the film, is somewhat quicker, since the leaching pattern can be reasonably well established after several months of testing. This, however, is still not suitable under normal circumstances for a quality control test. Consequently, a number of workers seem to consider that the best method of developing a quality control test lies in accelerating the leaching rate of the paint film chemically, to enable its characteristics to be determined in a comparatively short period of time. They assume that, if the accelerated leaching characteristics remain the same, the leaching performance under natural conditions would also be the same, particularly if the accelerated test is coupled with the more normal quality control tests applied to antifouling paints. Although this assumption would be difficult to prove, it is highly probable that if the antifouling performance of one batch of paint, when compared with another, differed markedly in practice, under similar conditions of exposure, then the accelerated leaching characteristics would also differ.[1] Conversely, if the accelerated leaching results differ markedly, it is likely that practical performance will also change.

Accelerated leaching methods, such as those proposed by Ketchum,[2] Burns,[3] Jedlinksi, et al.,[4] and Marson,[1]

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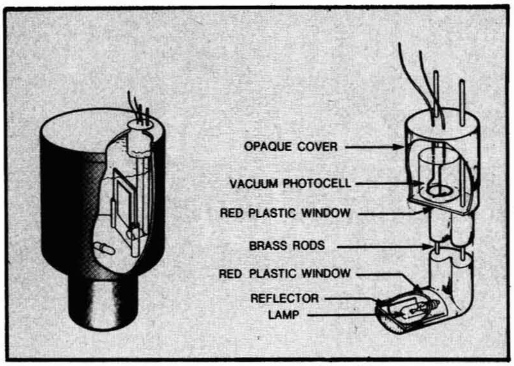

Figure 1—Diagramatic representation of leaching apparatus and absorptiometer head

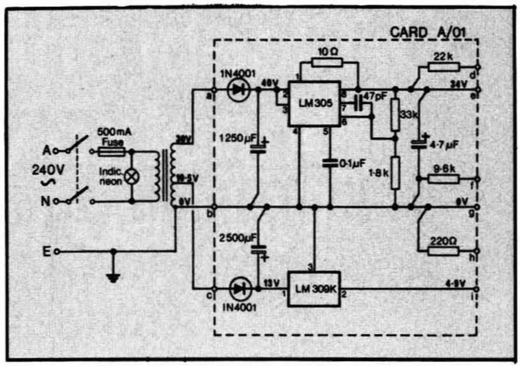

Figure 3—Circuit diagram of power supply

which yielded some information on the leaching properties of paints, are all capable of adaptation for quality control use. The author previously proposed a modified "glycine" test as a quality control method.[5] Although this technique uses less complex apparatus and requires fewer analyses than the method on which it is based,[1] it is still time consuming and requires accurate analyses. In order to reduce the time and skills required still further, a simplified quality control technique, based on the use of an immersed absorptiometer, is proposed. The apparatus and method used are described, together with some experimental results indicating the applicability of the technique.

EXPERIMENTAL DETAILS

Apparatus

Figure 1 shows the main features of the apparatus. The light-tight leaching container (130 mm in diameter, 150 mm high), the panel supports, and lid were constructed with rigid PVC. Uniform agitation was provided by a PTFE-coated bar stirrer, rotated at a fixed speed by an external magnet, driven by a 250 rpm synchronous motor. As the leaching rate of copper(I) oxide increased several percent for each degree centigrade, it was necessary to dissipate the heat generated by the stirring motor by attaching a 105 mm six-bladed fan to the stirring magnet.

The absorptiometer head consisted of a miniature instrument light bulb separated from a vacuum tube photodetector by a rigid support 110 mm long made from two glass rods and epoxy resin. The epoxy resin used to encapsulate the bulb and detector incorporated a small quantity of red dye (CI Solvent Red 24) to reduce the unwanted wavelengths not absorbed by the copper glycinate complex, bis(glycinato) copper(II), thus greatly increasing the sensitivity of the instrument. Except for the colored "windows" of the source and the detector, that portion of the absorptiometer head within the leaching container was coated with black epoxy paint to reduce unwanted reflections. None of the dimensions or constructional details appeared critical except that the apparatus was light-tight and the wavelength of the source matched the absorption band of the copper complex, which is around 640 nm. The absorptiometer was mounted behind the test panel so that changes in reflectivity of the face of the panel during leaching had little or no effect.

A block diagram of the electronic layout is shown in *Figure* 2. The choice of light source and detector was made on two main grounds. The light output of the filament bulb, even when run at reduced voltage to improve long-term stability, as well as to bias its spectral output towards the region required, was greater than that available from light-emitting diodes. It appeared much easier to minimize temperature effects and drift using a filament bulb and vacuum photodetector rather than an

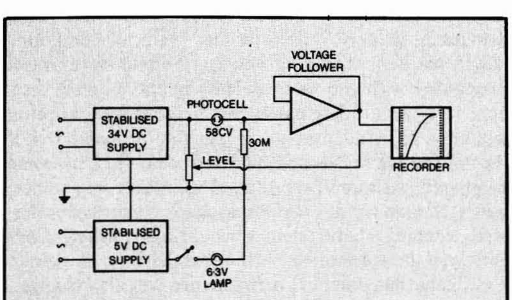

Figure 2—Block diagram of absorptiometer circuit

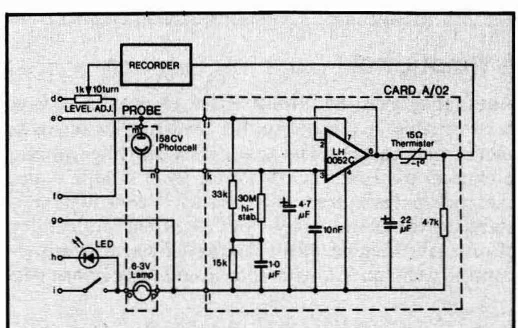

Figure 4—Circuit diagram of absorptiometer

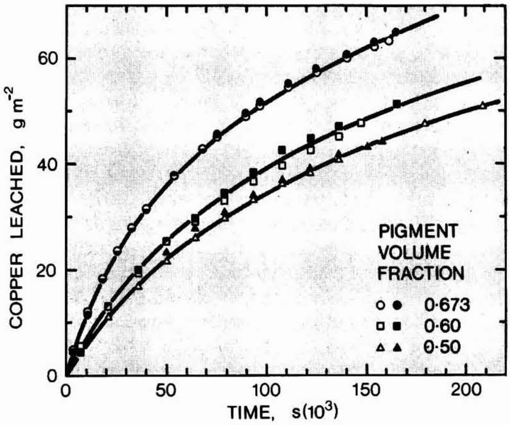

Figure 5—Increase in copper concentration with time for paints based on VYHH resin and Red Copper(I) Oxide

LED light source and phototransistor detector. In the apparatus described, stabilized supplies of 5 and 34 volts were used for source and detector, respectively. The current induced in the photocell was converted to volts across the 30 MΩ resistor, the voltage follower integrated circuit isolating the recorder from this part of the circuit. The voltage change when the source was switched on and no copper complex was in solution was about 200 millivolts. The voltage follower was mounted as close to the photocell as possible and was well screened to avoid stray current pickup. The recorder used had a sensitivity of 5 mV/cm.

The prototype instrument which was used for this work used an early voltage follower integrated circuit with a fairly high bias current. Despite considerable temperature dependence, the equipment was quite satisfactory when used in an air conditioned laboratory with reasonably tight temperature control.

The current instrument uses a precision operational amplifier with greatly reduced bias current as the voltage follower. Metal film resistors replace the carbon resistors in the prototype, with the exception of the 30 MΩ current/voltage converter which is a precision wire wound resistor. Final temperature control is carried out using a single thermistor in the operational amplifier output which reduces temperature drift to less than 0.1 mV/°C. It is still necessary to keep the leachate temperature constant. *Figures* 3 and 4 show the circuit diagrams of the latest instrument.

Panel Preparation

Paints with pigment volume fractions of 0.50, 0.60 and 0.67 were prepared based on a commercial polyvinyl chloride resin (Vinylite VYHH) and red copper(I) oxide pigment (Nordox Cuprous Oxide Red). Paints were also made substituting the resin with one containing 6% vinyl alcohol (Vinylite VAGH) and substituting a micronized, yellow copper(I) oxide pigment (Nordox Cuprous Oxide Yellow) for the standard grade.

The paints were applied by spraying one side of rigid PVC panels 55 × 80 mm. The panels were prepared for leaching by grinding the paint surface flat and smooth using 600 grade wet and dry paper. Then the paint was carefully cut back about 7.5 mm from the edges giving a paint area of approximately 2500 mm^2. The panels were washed thoroughly with deionized water prior to commencement of leaching.

Absorptiometer Calibration

The prototype absorptiometer was calibrated periodically by adding known amounts of relatively concentrated copper solution (1 and 10 g/l copper) to a standard leachate charge of 1800 g of 0.025 M sodium glycinate: 0.48 M sodium chloride solution, a correction being made for the dilution which occurred. Best results were obtained when the apparatus was left on continuously with the light source operating, the source switched off briefly to establish the dark current setting and about 30 min to an hour allowed after switching the source back on to insure stability.

The present instrument is far less critical in operation, but does require several hours operation after a long idle period to stabilize. The optical density as measured by the instrument varies directly with copper concentration up to about 0.2 g of added copper. The copper concentration of check samples of leachate withdrawn during and at the completion of leaching runs has been determined independently using atomic absorption and it indicates that any drift that occurred during the run was minimal.

Leaching Procedure

A standard leachate charge of 1800 g of 0.025 M sodium glycinate: 0.48 M sodium chloride solution at the laboratory temperature, 25° C, was used. Because of the bulk of the leachate, the laboratory temperature control was usually accurate enough to keep the leachate temperature within ± 1° C. Prior to the commencement of each trial, an unpainted panel of the same size and material as the test panel to be used was inserted in the holder, so that the side facing the absorptiometer head reflected the same amount of light to the detector as the test panel.

Table 1—Experimental Results Quality Control Test

Type of Paint	Pigment Volume Fraction	Regression Line: Intercept a	Regression Line: Slope b (10^{-3})	Slope, Invariant at zero time b (10^{-3})
	0.50	1.021	0.0211	0.0211
		1.097	0.0208	0.0217
Red copper(I) oxide/VYHH resin	0.60	0.951	0.0281	0.0276
		0.994	0.0255	0.0254
	0.673	1.010	0.0468	0.0469
		1.068	0.0445	0.0452
Yellow copper(I) oxide/VYHH resin	0.60	0.942	0.0232	0.0227
	0.673	0.864	0.0348	0.0338
Red copper(I) oxide/VAGH resin	0.50	1.021	0.0152	0.0154
		1.030	0.0154	0.0157
	0.673	1.009	0.0240	0.0241

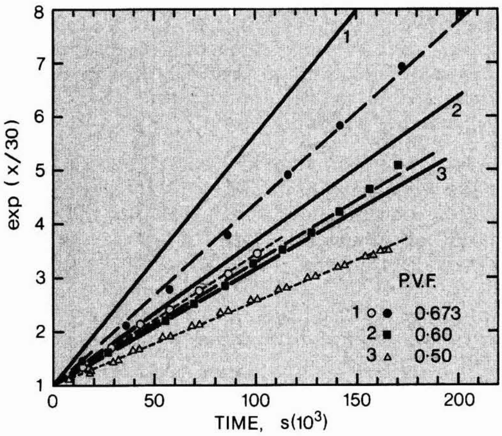

Figure 6—Variation in exp (x/30) with time

Stirring was commenced and the zero and 100 percent transmission checked to ensure stability in a similar manner to that described under "absorptiometer calibration." When stable, the test panel was introduced and leaching was allowed to continue for two to three days. Provided the total copper leached is less than about 0.2 g, the recorder plot is directly proportional to absorbance, and conversion to the amount of copper leached for a given area is straightforward. In the experimental work described the average amount of copper leached was 0.12 g and the maximum 0.18 g.

RESULTS AND DISCUSSION

Figure 5 illustrates the leaching curves obtained for duplicate panels of the three standard paints based on VYHH resin and the standard grade of copper(I) oxide. The experimental points represent readings taken directly from the recorder chart. The experimental points indicate the reproducibility obtained, while the curves themselves show the effect of varying the volume fraction of copper(I) oxide. The curves appear exponential in form and, indeed, the data show a very close fit to an equation of the form:

$$\exp(x/30) = a + bT \quad (1)$$

where x is the total amount of copper (gm^{-2}) leached after time T (s), a is a constant, which to satisfy the equation should be 1.0, and b is a constant. The exponential relationship is to some extent fortuitous and occurs because of the short period of leaching and the depressive effect on solution rate of copper already in solution. Longer periods of leaching show increasing departure from it. *Table* 1 gives the values for a and b obtained from the regression analysis of the above equation for all the experimental panels. The mean value for a is 1.0006, which is very close to the ideal value of 1.0. The correlation coefficients for a linear fit of the data for all panels were 0.999 or above, except for one which was coated with the paint based on yellow copper(I) oxide with a pigment volume fraction of 0.60 which was 0.997.

Because of this excellent correlation, it appears that the leaching behavior of these paints can be expressed by the slope of the straight line of best fit assuming an invariant intercept of 1.0. This slope, b, is given in the final column of *Table* 1 and was used to generate the curves for the standard paints shown in *Figure* 5.

Figure 6 illustrates the data points obtained for the modified paints and the lines of best fit for all paints assuming an invariant intercept. It is apparent that, for simple paints of this type, leaching characteristics can be defined by a single parameter, b, which varies considerably with gross changes in pigment content or type and with a major change in vehicle. The reproducibility of the method can be estimated from the mean difference in slope, b, for duplicate panels which was 4.1%. A change of 5% in the pigment volume content gave a mean change in slope of 13.2%; the substitution of VYHH resin by VAGH resin, 47% and the replacement of the standard grade of red copper(I) oxide by the micronized form, 23%.

These results indicate the potential usefulness of this technique in rapidly determining the effect of formulation changes. By replacing the leaching solution after a given period of time with fresh leaching solution, it is possible to determine with greater precision the accelerated leaching rate of partially spent antifouling paints after a known amount of copper has already been leached. The level of accuracy obtained, particularly with paints whose leaching characteristics are fairly well established, is more than sufficient for many research and development purposes.

CONCLUSIONS

The glycine-accelerated leaching technique described is a relatively quick, simple, and inexpensive method of establishing the accelerated leaching characteristics of copper-based antifouling paints. The immersion absorptiometer itself determines the buildup in copper concentration with sufficient accuracy for use as a quality control instrument and, using a modified technique, for some research and development purposes.

The leaching behavior of the simple contact leaching paints used in this study could be defined by a simple exponential function with only one variable which indicated that changes in pigment content of about 5% should be readily detectable as would gross changes in vehicle composition or pigment grade.

ACKNOWLEDGMENTS

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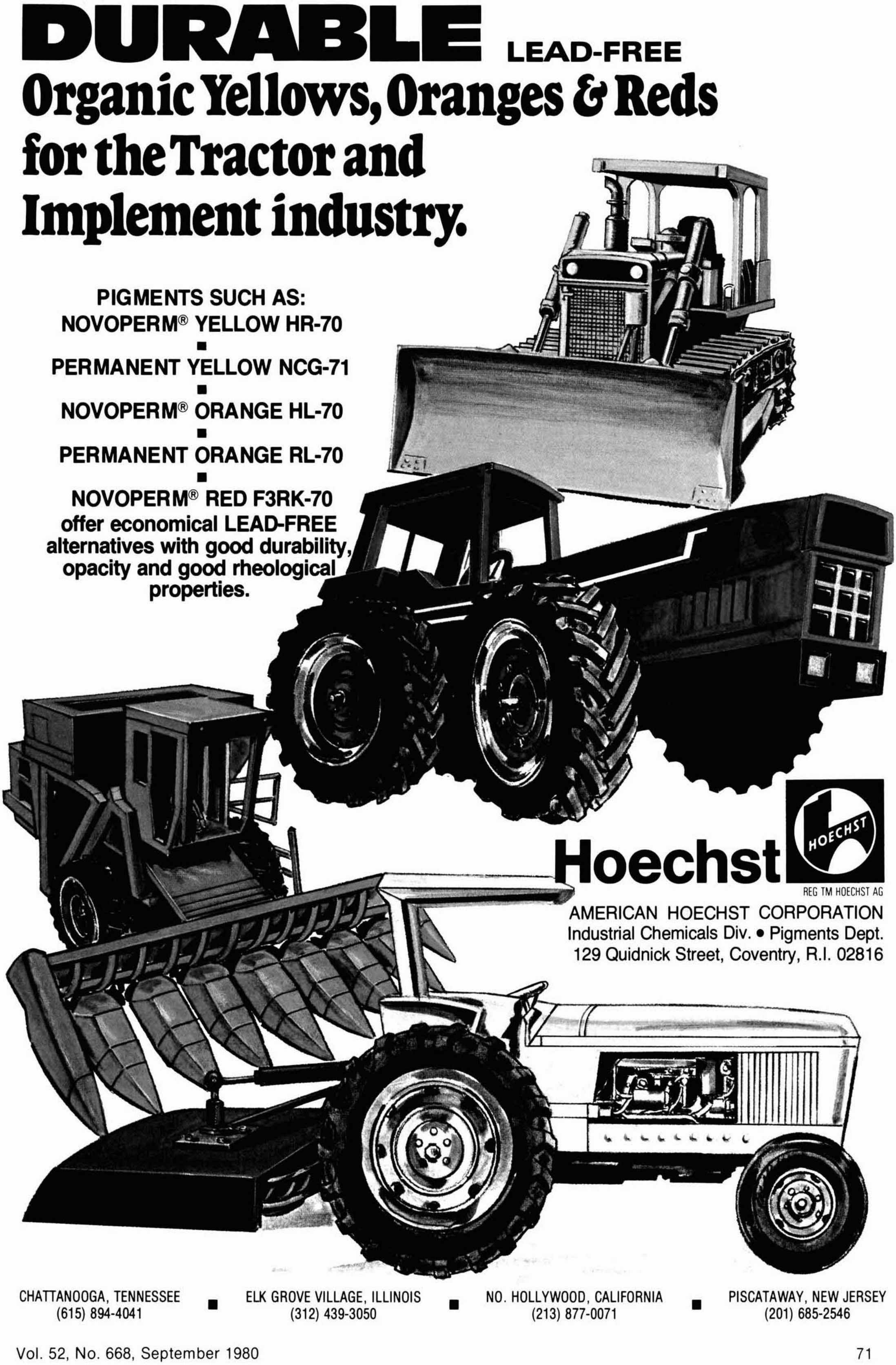
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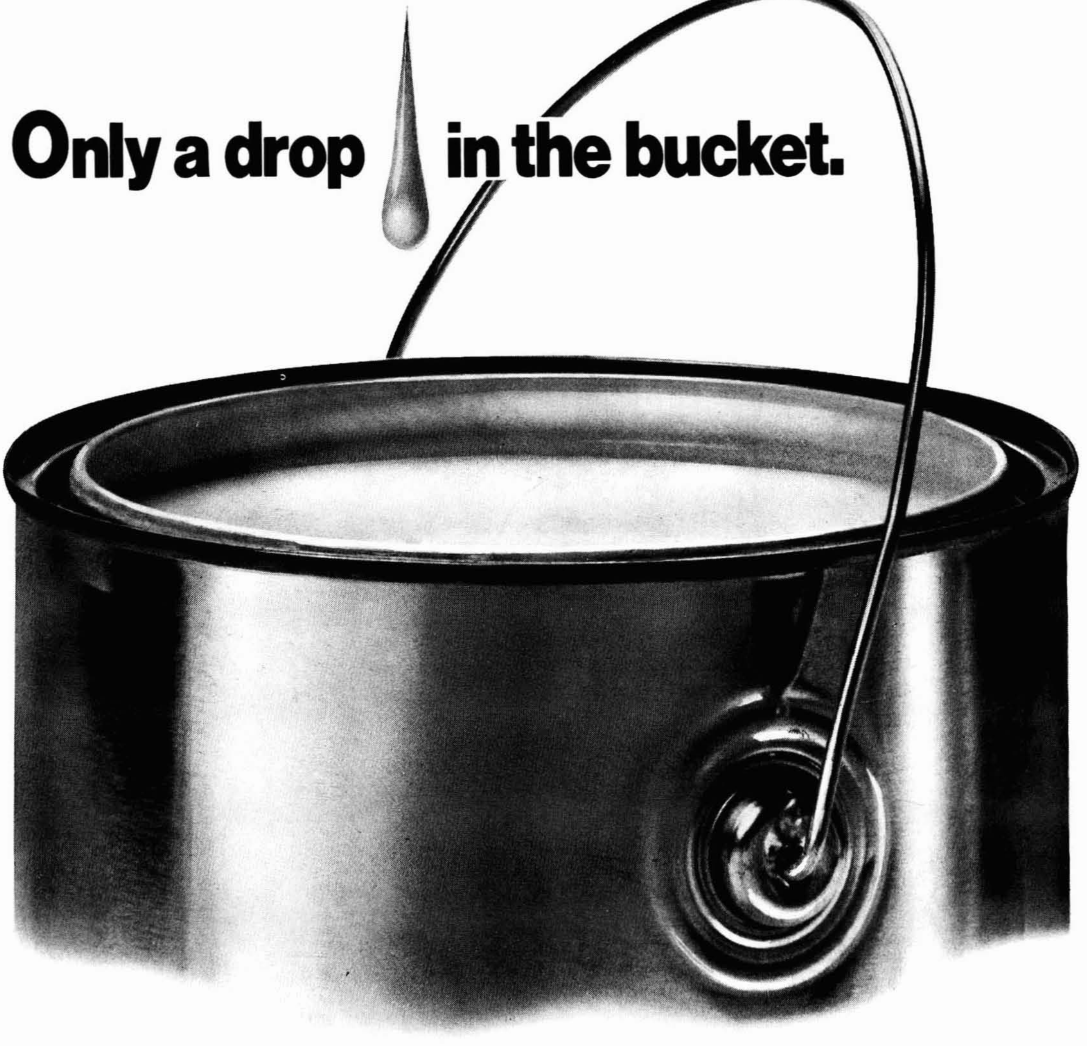

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Determination Of Water-Miscible Melamine Resins In Water-Based and Solvent-Based Coatings

James B. Lear
PPG Industries, Incorporated*

A method is presented for the isolation and identification of various water-reducible melamine resins from both water-soluble and high-solids coatings. The use of a hexane extraction from air-dried films yields an extract that can be examined by IR and NMR spectra to provide identification. Knowledge of melamine resin type aids in product formulation.

INTRODUCTION

The use of water-miscible melamine resins as crosslinking agents in both water-based and solvent-type coatings has increased dramatically in recent years.[1-5] Environmental restrictions, ecological awareness, and energy saving features have stimulated this use. The use of water as a primary solvent encompasses all of these areas. In the case of high-solids, solvent-based formulations, the low viscosity and higher functionality per mole of these resins greatly aid in formulation as compared to conventional butylated melamine resins.

In melamine resins of the type described, various types and degree of alkylation are used. The simplest case of a fully alkylated, water-reducible melamine is hexamethoxy methyl melamine (Cymel® 300, 301, 303). In addition, some resins are mixed methylated/ethylated (Cymel 116), methylated/butylated (Resimine® 755), and partially methylated and polymerized (Cymel 370).

These materials can be differentiated by IR and NMR spectra (*Figures* 1 and 2) when in the uncombined state. However, when formulated in a coating the presence of other resinous materials usually prevents positive identification. Since the use of each of these materials affects the stability of the formulation along with rapidity and temperature of cure, it is often of interest to know the particular melamine resin used in a coating. For this reason an attempt was made to isolate such resins from a coating to provide identification.

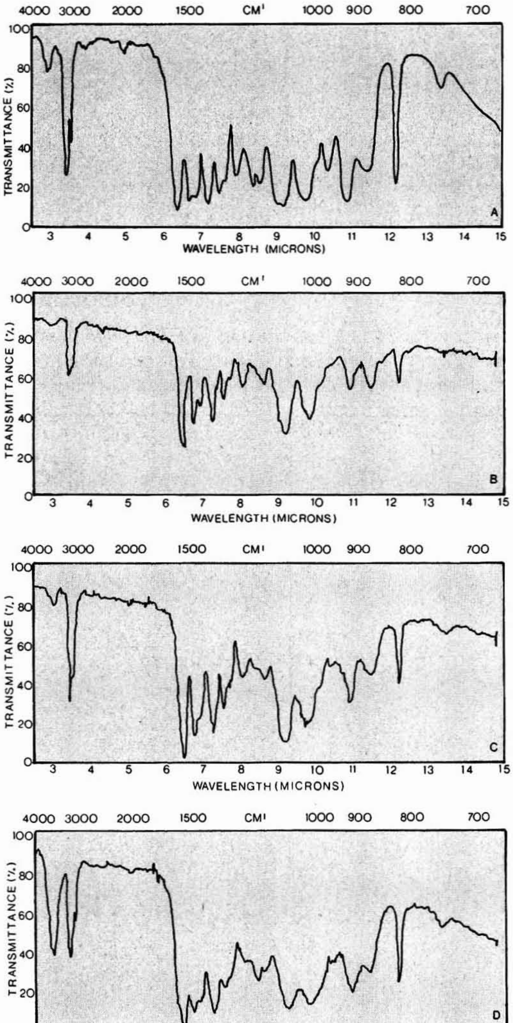

Figure 1—IR spectra of water-reducible melamine resins. (A) Cymel 300; (B) Cymel XM 1116; (C) Resimine 755; (D) Cymel 370

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Cymel is a registered trademark of American Cyanamid Co.; Resimine is a registered trademark of Monsanto.

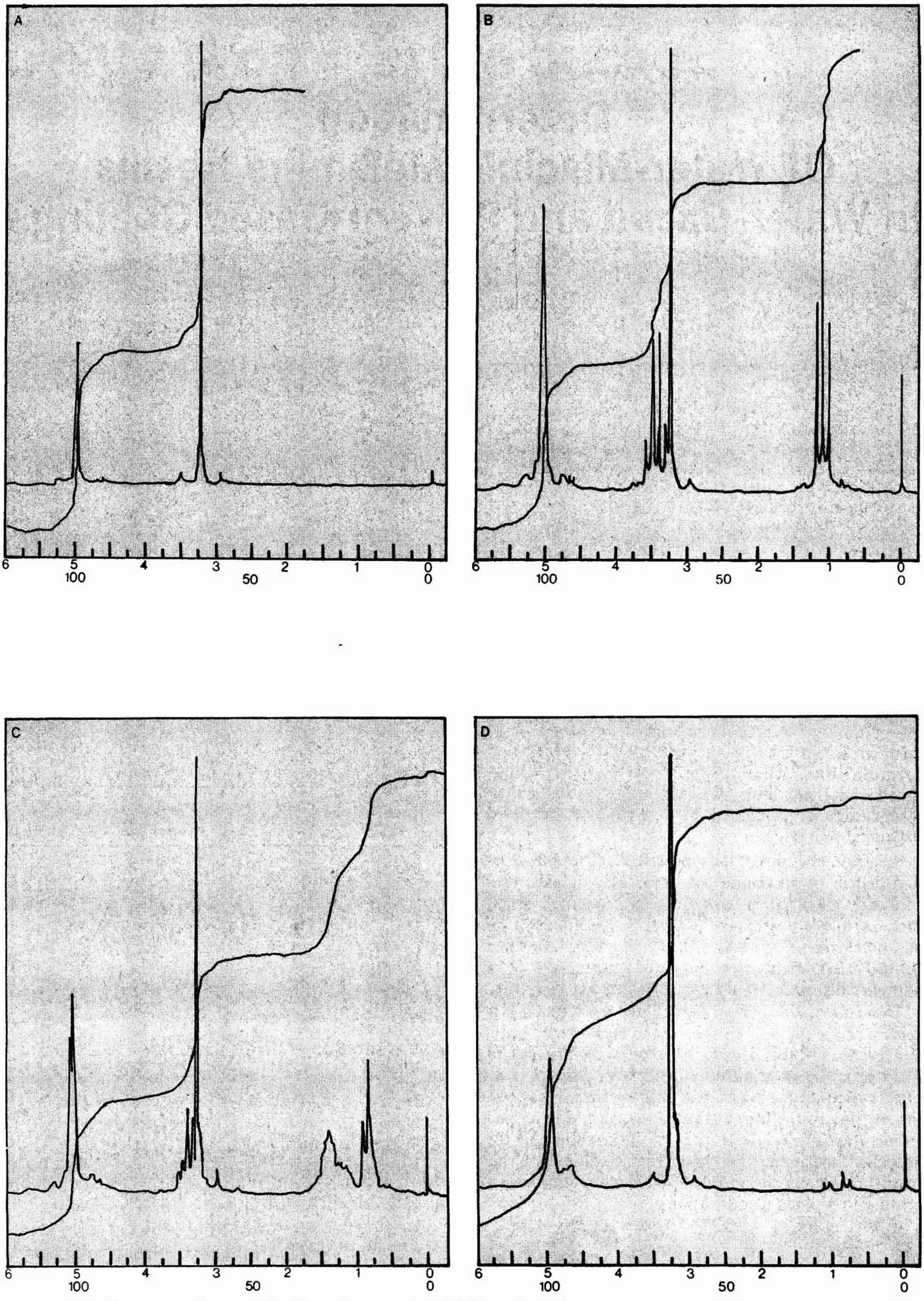

Figure 2—NMR spectra of water-reducible melamine resins. (A) Cymel 300; (B) Cymel XM 1116; Resimine 755; (D) Cymel 370

Table 1—Recovery of Melamine Resin By Hexane Extraction

Melamine Type	% Recovery
Cymel 300	24
Cymel 1116	71
Cymel 370	2
Resimine 755	51

Table 2—Recovery of Melamine Resins From Paint Samples

Sample	% Recovery
Silver-metallic paint	42
White high-solids paint	17

EXPERIMENTAL

It has been noted in our laboratory that several of the water-reducible melamine resins had some solubility in hexane. This is not the case with the other resins commonly used with these melamine resins to formulate water-reducible or high-solids coatings (acrylics, polyesters, alkyds, etc.).

A series of clear, water-reducible coatings were made containing 75 parts of an amine-solubilized acrylic resin and 25 parts of Cymel 303, Cymel 370, Cymel XM1116, and Resimine 755 resins, respectively. A portion of each coating was spread in a thin film on a glass plate (6×6″) and allowed to air dry for 18 hr.

Dried films were removed from the glass plates by scraping with a razor blade. About 0.5 g of each film was placed in a preweighed 8 dram glass vial having a plastic cover and the vial was reweighed. After the addition of 25 ml of hexane, the vials were covered and taped and placed on a wrist-type shaker for 4 hr. The hexane from each vial was decanted into a preweighed evaporating dish and the hexane removed by blowing with a stream of N_2. The amount of extractibles was found by weighing the evaporating dishes after hexane removal. Knowing the amount of extractibles, the original film weights, and the percent melamine resin in the coatings, the percent recovery of the melamine resin could be calculated. The IR and NMR spectra of the extractibles were obtained.

RESULTS

Although recovery was not complete, in at least three cases sufficient extract was isolated for an examination of the extracts by IR and NMR spectroscopy (*Table* 1). The low recovery of Cymel 370 indicates low solubility of melamine resins of this type in hexane. Advantage of this fact can be taken in the case where a coating known to contain a water-reducible melamine resin is extracted with hexane but yields very little extract. The presence of a melamine of the Cymel 370 type would be postulated.

The extracts from the coatings containing Cymel 300, Cymel 1116, and Resimine 755 were examined by IR and NMR spectra. Identification of the particular melamine resin by IR and NMR spectra was unequivocal.

To test the efficacy of the method on actual commercial samples, the procedure was repeated on a water-reducible, silver-metallic automotive coating and on a high-solids, white solvent-based industrial coating. IR examination of the vehicles from these paints showed the silver-metallic paint was of acrylic quality and the white high-solids coating was a polyester and that both contained water-reducible melamine resins.

The percent recovery of the extracts of these paints is given in *Table* 2. The percent N had been determined on the vehicles of the paints and calculated back to a percent melamine resin. Comparison with data in *Table* 1 would indicate that the silver paint most likely contained Resimine 755 and the white high-solids paint contained Cymel 300. IR and NMR spectra of the respective extracts confirmed this conclusion.

CONCLUSION

Preliminary investigation showed that hexane extraction of dried films of coatings containing water-reducible melamine resins can be used to isolate such resins from coatings and that IR and NMR spectra of the extract can be used to identify the specific melamine resin used in the coating.

Use of the procedure on both a water-based and a solvent-based commercial coating containing water-reducible melamine resin shows the applicability of the method in the identification of specific melamine resins from such samples.

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Zinc Oxide Stability In Exterior Latex Paints

Zinc Institute, Inc.*
Paint Evaluation Group

A stability study of zinc oxide containing exterior latex paints was initiated using eight anionic surfactants at three levels in conjunction with six latex resins.

Independent laboratories prepared 240 paints which were distributed for viscosity testing. Each paint was monitored for viscosity change in four stability tests. The data show the oven-stability test to be the most rigorous.

Results show that the vinyl acrylic and vinyl copolymer resins produce very stable zinc oxide containing exterior latex paints. Data on the acrylic paints, both zinc-free and zinc oxide containing, show that careful selection of the surfactant system is required. Of significant interest is that all paints made with two of the surfactant systems passed all four stability tests.

Introduction

The Zinc Institute, through its Paint Evaluation Group, has been evaluating exterior latex paints containing zinc oxide for over 20 years. This work was originally undertaken because it was found that some formulations had poor viscosity stability. The development of new raw materials has necessitated periodic reviews and updating of previous studies. The results of these investigations consistently showed that latex paints can be formulated with zinc oxide to give excellent stability.

With the changes in latex emulsions and the trend toward higher solids, the present study was initiated to provide an update on exterior latex house paints. Surfactants and latexes known to be in current use by paint manufacturers were selected for testing. In all, 240 different paints were prepared. Each was monitored for viscosity change in four stability tests.

Formulating Stable Paints

The reason that some latex paint formulations containing zinc oxide are unstable is not completely known. However, it is known that the choice of surfactant can be critical. If appropriate surfactants are not provided in the paint formulation, the pigment may "rob" them from the latex. This could, in turn, cause the latex particles to coagulate and, in extreme cases, cause the paint to gel.

The Zinc Institute approached the formulation of stable latex paints containing zinc oxide primarily by selecting combinations of surfactants compatible with those in the latex dispersion. Since it is not generally known which surfactants are contained in a specific latex paint, the process of selecting surfactant combinations for latex formulations was based primarily upon experience, often obtained by trial and error. Experimental results showed that every latex has its own requirements.

Only those formulations found to be stable in all four tests were considered to have passed in this experiment. Many of the formulations not included in this group would undoubtedly provide paints of excellent stability under less stringent conditions. The purpose here, however, was to emphasize only the formulations found to be the most stable.

Procedure

A standard grind procedure was utilized to prepare paints with 0.5 lb of zinc oxide per gallon. Four latex suppliers were asked to furnish their best exterior latex and general purpose latex. Eight anionic dispersants designed for improved zinc oxide stability were selected and used at three different levels. These were combined in all cases with fixed levels of a nonionic wetting agent Igepal® CO-630, and potassium tripolyphosphate (KTPP). In addition, a zinc-free formulation was prepared with each vehicle using the fixed surfactant system and the lowest level of anionic dispersant. Further, in order to determine the effect of adding a surfactant later, additional dispersant was added in the let-down to raise the total dispersant to the highest level tested. A total of 240 paints was prepared: 6 latexes × 8 surfactants × 3 levels = 144; plus 6 latexes × 8 surfactants × 1 level zinc-free = 48; and an additional 48 samples in the group where dispersant was added also in the let-down.

Paint Formulation

All paint formulations are shown in the Appendix. In calculating the % PVC, % solids by weight, and % solids by volume, only the pigments, extenders, and vehicle solids were included. The study was designed to give coatings of 40% PVC and 58% solids by weight.

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Table 1—Viscosity-Kreb Units

Latex: Ucar 508®

Surfactant	lb/100 gal	(kg/100 1)	Initial	10 Day Mechanical	1 Week Freeze-Thaw	30 Day Oven	12 Month Shelf
Tamol 850	11	(1.32)	93	86	89	101.5	95
	13	(1.56)	93	86	89	103.0	99
	16	(1.92)	94	83	88	103.0	98
	11 + 5		90	—	—	—	
	11[a]	(1.32)	100.5	83	93	102.0	99
Victawet 35-B	5	(0.60)	94	81	88	96	87
	6	(0.72)	93	83	88	95	90
	7	(0.84)	94	83	88	95	90
	5 + 2		92	—	—	—	
	5[a]	(0.60)	100.5	83	94	102.0	97
Strodex MOK-70	5	(0.60)	99	83	90	108.0	93
	6	(0.72)	101.0	83	91	108.5	100
	7	(0.84)	100.0	82	90	106.0	96
	5 + 2		95.0	—	—	—	
	7[a]	(0.84)	97.5	84	94	107.0	102
Polywet ND-1	13	(1.56)	102.0	86	91	138.0	120
	16	(1.92)	97.5	86	93	112.0	106
	19	(2.28)	100.0	86	93	106.0	108
	13 + 6		99.0	—	—	—	
	13[a]	(1.56)	97.5	83	87	100.0	95
Natrol 42	6	(0.72)	90	83	87	93	88
	8	(0.96)	90	83	87	93	89
	10	(1.20)	91	85	88	93	89
	6 + 4		101	—	—	—	
	6[a]	(0.72)	99.5	88	90	101.0	97
Tamol 960	8	(0.96)	89	83	86	95	90
	10	(1.20)	90	83	88	97	94
	12	(1.44)	90	81	88	97	90
	8 + 4		91	—	—	—	
	8[a]	(0.96)	100.0	89	90	100.5	96
Colloid 212	11	(1.32)	92	84	89	101.0	90
	13	(1.56)	91	86	90	102.0	92
	16	(1.92)	94	86	91	102.0	91
	11 + 5		92	—	—	—	
	11[a]	(1.32)	100.0	84	90	102.0	98
Tamol SG-1	9	(1.08)	97.5	84	91	110.0	98
	11	(1.32)	95.0	83	90	100.0	94
	14	(1.68)	97.5	84	91	100.0	93
	9 + 5		95.5	—	—	—	
	9[a]	(1.08)	102.0	86	92	102.0	96

(a) Zinc-free paints

Table 2—Viscosity-Kreb Units

Latex: Wallpol 40-140

Surfactant	lb/100 gal.	(kg/100 1)	Initial	10 Day Mechanical	1 Week Freeze-Thaw	30 Day Oven	12 Month Shelf
Tamol 850	11	(1.32)	89	86	88	86	88
	13	(1.56)	93	90	91	91	91
	16	(1.92)	92	90	88	89	70
	11 + 5		89	—	—	—	89
	11[a]	(1.32)	91	87	91	89	89
Victawet 35-B	5	(0.60)	94	81	88	84	86
	6	(0.72)	93	83	88	85	86
	7	(0.84)	94	83	88	88	88
	5 + 2		89	—	—	—	87
	5[a]	(0.60)	92	87	92	93	93
Strodex MOK-70	5	(0.60)	92	88	91	91	93
	6	(0.72)	94	90	93	94	96
	7	(0.84)	94	90	95	95	95
	5 + 2		91	—	—	—	90
	7[a]	(0.84)	93	90	90	95	93
Polywet ND-1	13	(1.56)	97	91	94	100	99
	16	(1.92)	97	91	95	103	101
	19	(2.28)	95	88	93	93	92
	13 + 6		98	—	—	—	97
	13[a]	(1.56)	89	84	84	82	87
Natrol 42	6	(0.72)	91	88	89	91	90
	8	(0.96)	90	87	89	88	89
	10	(1.20)	90	87	89	90	90
	6 + 4		91	—	—	—	90
	6[a]	(0.72)	86	80	90	80	86
Tamol 960	8	(0.96)	91	89	91	90	90
	10	(1.20)	91	87	91	90	90
	12	(1.44)	90	87	89	80	90
	8 + 4		91	—	—	—	91
	8[a]	(0.96)	83	79	80	80	82
Colloid 212	11	(1.32)	92	84	89	88	90
	13	(1.56)	91	86	90	87	89
	16	(1.92)	94	86	91	90	90
	11 + 5		89	—	—	—	86
	11[a]	(1.32)	89	84	86	86	88
Tamol SG-1	9	(1.08)	80	75	80	76	76
	11	(1.32)	84	80	85	82	84
	14	(1.68)	86	81	85	82	84
	9 + 5		82	—	—	—	80
	9[a]	(1.08)	87	81	84	81	82

(a) Zinc-free paints

Table 3—Viscosity-Kreb Units

Latex: Wallpol 40-410 Surfactant	lb/100 gal.	(kg/100 1)	Initial	10 Day Mechanical	1 Week Freeze-Thaw	30 Day Oven	12 Month Shelf
Tamol 850	11	(1.32)	86	85	90	94	89
	13	(1.56)	86	86	91	94	89
	16	(1.92)	86	86	91	95	88
	11 + 5		90	—	—	—	90
	11[a]	(1.32)	87	87	91	94	87
Victawet 35-B	5	(0.60)	88	89	99	101	89
	6	(0.72)	91	90	97	97	89
	7	(0.84)	90	89	96	94	88
	5 + 2		93	—	—	—	87
	5[a]	(0.60)	86	86	90	101	87
Strodex MOK-70	5	(0.60)	89	89	94	107	92
	6	(0.72)	91	91	97	112	93
	7	(0.84)	91	90	95	109	92
	5 + 2		93	—	—	—	90
	7[a]	(0.84)	86	87	93	102	88
Polywet ND-1	13	(1.56)	92	88	98	136	99
	16	(1.92)	92	89	97	136	102
	19	(2.28)	91	88	95	136	97
	13 + 6		97	—	—	—	97
	13[a]	(1.56)	87	87	89	93	84
Natrol 42	6	(0.72)	88	87	92	123	98
	8	(0.96)	90	88	94	115	92
	10	(1.20)	88	87	92	98	90
	6 + 4		90	—	—	—	91
	6[a]	(0.72)	86	86	89	93	85
Tamol 960	8	(0.96)	85	85	89	94	87
	10	(1.20)	86	86	90	93	88
	12	(1.44)	85	84	88	92	86
	8 + 4		87	—	—	—	87
	8[a]	(0.96)	87	88	90	92	86
Colloid 212	11	(1.32)	88	88	93	101	91
	13	(1.56)	90	89	94	101	93
	16	(1.92)	88	88	92	101	91
	11 + 5		90	—	—	—	90
	11[a]	(1.32)	87	88	91	96	88
Tamol SG-1	9	(1.08)	90	87	93	120	98
	11	(1.32)	90	88	95	118	97
	14	(1.68)	91	89	95	119	98
	9 + 5		91	—	—	—	95
	9	(1.08)	88	88	91	99	89

(a) Zinc-free paints

Table 4—Viscosity-Kreb Units

Latex: Rhoplex AC-388 Surfactant	lb/100 gal.	(kg/100 1)	Initial	10 Day Mechanical	1 Week Freeze-Thaw	30 Day Oven	12 Month Shelf
Tamol 850	11	(1.32)	83.1	81.4	87.1	93.8	92.3
	13	(1.56)	84.5	80.0	86.4	93.9	91.3
	16	(1.92)	86.5	82.4	87.9	94.6	92.6
	11 + 5		87.1	—	—	—	91.4
	11[a]	(1.32)	91.4	88.2	92.0	94.6	92.6
Victawet 35-B	5	(0.60)	88.1	83.7	87.9	108.0	90.8
	6	(0.72)	88.1	83.5	88.3	108.4	89.5
	7	(0.84)	88.3	83.3	89.2	99.2	90.8
	5 + 2		88.3	—	—	—	89.5
	5[a]	(0.60)	88.4	88.1	90.2	103.0	92.9
Strodex MOK-70	5	(0.60)	89.5	85.5	92.0	125.0	97.5
	6	(0.72)	90.2	86.4	93.5	gel	97.0
	7	(0.84)	91.4	88.7	94.1	gel	98.0
	5 + 2		88.9	—	—	—	93.2
	7[a]	(0.84)	88.4	88.9	92.0	115.8	95.0
Polywet ND-1	13	(1.56)	94.1	86.0	97.0	gel	105.6
	16	(1.92)	95.4	85.8	97.7	gel	105.2
	19	(2.28)	95.0	87.1	99.2	124.8	106.8
	13 + 6		96.5	—	—	—	105.6
	13[a]	(1.56)	93.6	89.0	92.0	97.5	90.8
Natrol 42	6	(0.72)	89.3	85.2	96.0	117.3	97.4
	8	(0.96)	91.4	87.3	97.0	101.2	97.4
	10	(1.20)	92.3	88.1	97.5	99.5	97.7
	6 + 4		90.2	—	—	—	95.0
	6[a]	(0.72)	93.2	88.7	94.4	93.0	95.1
Tamol 960	8	(0.96)	87.7	83.7	89.5	89.5	90.2
	10	(1.20)	89.0	85.4	92.6	95.0	94.4
	12	(1.44)	88.9	87.1	93.8	93.8	93.2
	8 + 4		88.7	—	—	—	91.3
	8[a]	(0.96)	93.8	90.4	97.5	95.5	95.7
Colloid 212	11	(1.32)	90.2	85.8	95.0	97.7	93.9
	13	(1.56)	91.7	88.7	98.5	100.6	96.7
	16	(1.92)	90.2	88.2	102.4	99.5	98.0
	11 + 5		89.2	—	—	—	95.0
	11[a]	(1.32)	93.8	90.8	102.4	96.4	95.5
Tamol SG-1	9	(1.08)	81.8	74.4	95.0	gel	91.7
	11	(1.32)	89.5	84.2	98.0	117.0	100.8
	14	(1.68)	85.8	79.8	92.0	105.0	94.7
	9 + 5		83.1	—	—	—	89.8
	9[a]	(1.08)	88.5	86.5	92.0	94.1	91.8

(a) Zinc-free paints

Table 5—Viscosity-Kreb Units

Latex / Surfactant	lb/100 gal.	(kg/100 l)	Initial	10 Day Mechanical	1 Week Freeze-Thaw	30 Day Oven	12 Month Shelf
Rhoplex AC-64							
Tamol 850	11	(1.32)	88.0	87.0	88.0	88.0	92
	13	(1.56)	84.0	82.0	82.0	81.0	83
	16	(1.92)	83.0	82.0	81.0	82.0	83
	11 + 5		90.0	—	—	—	93
	11[a]	(1.32)	85.0	82.0	86.0	80.0	82
Victawet 35-B	5	(0.60)	89.0	> 141.0	94.0	131.0	92
	6	(0.72)	90.0	> 141.0	94.0	109.0	89
	7	(0.84)	90.0	> 141.0	96.0	101.0	93
	5 + 2		89.0	—	—	—	89
	5[a]	(0.60)	90.0	> 141.0	96.0	101.0	88
Strodex MOK-70	5	(0.60)	93.0	> 141.0	94.0	> 141.0	100
	6	(0.72)	92.0	> 141.0	95.0	139.0	101
	7	(0.84)	93.0	109.0	95.0	138.0	100
	5 + 2		89.0	—	—	—	95
	7[a]	(0.84)	86.0	85.0	96.0	93.0	89
Polywet ND-1	13	(1.56)	92.0	89.0	91.0	> 141.0	101
	16	(1.92)	91.0	87.0	90.0	123.0	97
	19	(2.28)	90.0	88.0	89.0	116.0	98
	13 + 6		93.0	—	—	—	99
	13[a]	(1.56)	82.0	80.0	87.0	76.0	78
Natrol 42	6	(0.72)	90.0	95.0	90.0	118.0	95
	8	(0.96)	92.0	90.0	90.0	103.0	98
	10	(1.20)	92.0	95.0	90.0	91.0	93
	6 + 4		87.0	—	—	—	89
	6[a]	(0.72)	85.0	86.0	86.0	80.0	82
Tamol 960	8	(0.96)	89.0	89.0	89.0	78.0	90
	10	(1.20)	88.0	90.0	87.0	86.0	89
	12	(1.44)	89.0	86.0	87.0	86.0	90
	6 + 4		86.0	—	—	—	89
	8[a]	(0.96)	85.0	83.0	88.0	79.0	82
Colloid 212	11	(1.32)	92.0	91.0	93.0	96.0	98
	13	(1.56)	92.0	91.0	91.0	96.0	98
	16	(1.92)	90.0	87.0	89.0	92.0	93
	11 + 5		93.0	—	—	—	96
	11[a]	(1.32)	86.0	83.0	85.0	83.0	86
Tamol SG-1	9	(1.08)	80.0	> 141.0	83.0	140.0	89
	11	(1.32)	81.0	> 141.0	83.0	132.0	85
	14	(1.68)	85.0	> 141.0	88.0	132.0	92
	9 + 5		85.0	—	—	—	90
	9[a]	(1.08)	84.0	83.0	84.0	80.0	82

(a) Zinc-free paints

Table 6—Viscosity-Kreb Units

Latex / Surfactant	lb/100 gal.	(kg/100 l)	Initial	10 Day Mechanical	1 Week Freeze-Thaw	30 Day Oven	12 Month Shelf
Polyco 2158							
Tamol 850	11	(1.32)	86	83	87	92	89
	13	(1.56)	86	82	87	88	89
	16	(1.92)	89	87	89	92	92
	11 + 5		86	—	—	—	89
	11[a]	(1.32)	88	85	90	90	90
Victawet 35-B	5	(0.60)	87	84	90	88	89
	6	(0.72)	87	84	89	90	88
	7	(0.84)	89	87	91	92	90
	5 + 2		89	—	—	—	91
	5[a]	(0.60)	89	88	91	87	88
Strodex MOK-70	5	(0.60)	89	86	93	89	88
	6	(0.72)	89	89	91	92	88
	7	(0.84)	92	92	94	94	92
	5 + 2		90	—	—	—	92
	7[a]	(0.84)	92	91	89	107	106
Polywet ND-1	13	(1.56)	86	83	87	89	86
	16	(1.92)	87	85	87	87	89
	19	(2.28)	87	86	89	90	88
	13 + 6		89	—	—	—	92
	13	(1.56)	90	87	91	103	104
Natrol 42	6	(0.72)	83	82	84	86	84
	8	(0.96)	85	82	86	86	87
	10	(1.20)	89	89	90	91	89
	6 + 4		86	—	—	—	86
	6[a]	(0.72)	87	87	91	87	88
Tamol 960	8	(0.96)	85	85	91	87	86
	10	(1.20)	86	83	87	88	88
	12	(1.44)	87	85	91	92	88
	8 + 4		87	—	—	—	88
	8[a]	(0.96)	89	87	89	89	92
Colloid 212	11	(1.32)	83	82	84	86	86
	13	(1.56)	86	82	86	85	87
	16	(1.92)	84	82	85	84	85
	11 + 5		83	—	—	—	89
	11[a]	(1.32)	89	86	91	102	93
Tamol SG-1	9	(1.08)	77	74	76	80	78
	11	(1.32)	78	77	78	80	80
	14	(1.68)	86	82	85	87	81
	9 + 5		78	—	—	—	84
	9[a]	(1.08)	89	86	89	89	86

(a) Zinc-free paints

All paints contained 15% alkyd modification and a fixed surfactant system of 2.0 lb/100 gal KTPP and 2.5 lb/100 gal Igepal CO-630. The zinc oxide was American process, lead-free, with medium-sized nodular particles. It meets Federal Specification TT-P-463a and ASTM D79-44.

Paint Preparation

D/L Laboratories was contracted to prepare the paints. Guidelines established by the Paint Evaluation Group were:

(1) Grind temperature to be held below 135°F

(2) One-hour viscosity to be adjusted to 88 ± 2 KU with remaining water and/or thickener

(3) Final pH adjustment by adding ammonia

(4) The three levels of surfactants, all to be added in the grind. To develop data with respect to adding part of the surfactant later, a ½-pint sample of each paint with the minimum surfactant level for each latex studied was set aside and adjusted to the maximum level by adding surfactant in the let-down.

D/L Laboratories shipped the finished paints to participating members of the Paint Evaluation Group.

Each 0.5 gal sample was divided among four 0.0625 gal lined cans and a 0.25 gal can, leaving approximately 0.5 in. air space in each can. The four 0.0625 gal portions, labeled A, B, C, and D, were tested as follows:

Shelf Stability (A Portions)—The paints were stored in a constant-temperature room maintained at 77°F (25°C). The viscosity of each paint was measured with the Stormer Viscometer when received, after 30 days, and after 3, 6, 9, and 12 months.

ASTM Standard Method of Test for Consistency of Paints using the Stormer Viscometer D562-55 was used.

Heat Stability (B Portions)—These cans of paint were placed into a controlled-temperature oven maintained at 120°F (49°C), removed after 30 days, and allowed to stabilize at room temperature (77°F). The viscosity was measured at 77°F with a Stormer Viscometer and reported in Kreb Units.

Mechanical Stability (C Portions)—These cans of paint were placed upon rolls turning at 80 rpm for 10 days at room temperature. The viscosity of paints was then measured at 77°F with a Stormer Viscometer and reported in Kreb Units.

Table 7—Pass/Fail Oven Test

	Lbs/100 Gal	(kg/100 1)	Ucar 508	Wallpol 40-140	Wallpol 40-410	Rhoplex 388	Rhoplex 64	Polyco 2158
Tamol 850	11	(1.32)	P[b]	P	P	P	P	P
	13	(1.56)	P	P	P	P	P	P
	16	(1.92)	P	P	P	P	P	P
	11[a]	(1.32)	P	P	P	P	P	P
Victawet 35-B	5	(0.60)	P	P	F	F	F	P
	6	(0.72)	P	P	P	F	F	P
	7	(0.84)	P	P	P	F	F	P
	5[a]	(0.60)	P	P	F	F	F	P
Strodex MOK-70	5	(0.60)	P	P	F	F	F	P
	6	(0.72)	P	P	F	F	F	P
	7	(0.84)	P	P	F	F	F	P
	7[a]	(0.84)	P	P	F	F	P	F
Polywet ND-1	13	(1.56)	F[c]	P	F	F	F	P
	16	(1.92)	F	P	F	F	F	P
	19	(2.28)	P	P	F	F	F	P
	13[a]	(1.56)	P	P	P	P	P	F
Natrol 42	6	(0.72)	P	P	F	F	F	P
	8	(0.96)	P	P	F	F	F	P
	10	(1.20)	P	P	P	P	P	P
	6[a]	(0.72)	P	P	P	P	P	P
Tamol 960	8	(0.96)	P	P	P	P	P	P
	10	(1.20)		P	P	P	P	P
	12	(1.44)	P	P	P	P	P	P
	8[a]	(0.96)	P	P	P	P	P	P
Colloid 212	11	(1.32)	P	P	F	P	P	P
	13	(1.56)	F	P	F	P	P	P
	16	(1.92)	P	P	F	P	P	P
	11[a]	(1.32)	P	P	P	P	P	F
Tamol SG-1	9	(1.08)	F	P	F	F	F	P
	11	(1.32)	P	P	F	F	F	P
	14	(1.68)	P	P	F	F	F	P
	9[a]	(1.08)	P	P	P	P	P	P

(a) Zinc-free paints
(b) P = Pass
(c) F = Fail

Freeze-Thaw Stability (D Portions)—These cans of paint were conditioned in a freezer at 15°F ± 5° for 16 hr, removed and allowed to stand at room temperature for six hours. The paints were then hand mixed with a spatula, examined for specks and granulation, and measured for viscosity. After four such freeze-thaw cycles, the fifth cycle consisted of placing the paints into the freezer for seven days, letting them thaw at room temperature for six hours, and testing them in the same manner.

Results and Discussion

Viscosity measurements taken initially and upon completion of each of the four stability tests are given for each latex in a separate table (*Tables* 1-6). *Table* 7 summarizes Pass/Fail of the paints in the oven test based upon the criterion that an increase in viscosity of more than 10 Kreb Units constituted failure.

The viscosity tabulations show that one year shelf stability, 10 day mechanical, and one week freeze-thaw for all paints tested resulted in good stability.

Examination of *Table* 7, Pass/Fail in the oven test shows the following: The majority of paints passed; all paints made with Wallpol® 40-140 passed; all paints that contained zinc oxide and Polyco® 2158 passed; all paints made with Tamol® 850 and Tamol® 960 passed; stable formulations were obtained with all six latexes; and stable formulations were obtained with all eight dispersants.

Five zinc-free paints failed, some in instances where the zinc-containing counterpart passed. This finding indicates that it is essential to determine the proper surfactant system for any latex formulation regardless of whether or not it contains zinc oxide.

ZINC INSTITUTE PAINT EVALUATION GROUP

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Conclusions

The levels of dispersants selected for this study were based upon past experience, and adjusted to yield equal concentrations of the active ingredient. The results show that some formulations passed at the low dispersant level and some only when the high level was employed. Others did not pass at any of the chosen concentrations. Perhaps, for these last formulations, higher levels of dispersants would have given stable paints.

The most reliable method of determining the effect of a surfactant system upon the stability of a latex paint is to test it in the specific formulation under consideration. The two systems with Tamol 850 and Tamol 960 which resulted in stable paints are verification of this statement.

Evidence that the best mildew-resistant paints contain zinc oxide has been increasing. The fungistatic properties of zinc oxide, combined with its known tint-retention characteristics, have undoubtedly contributed to the growing use of this pigment in exterior latex paints. The results of this study suggest that most formulations containing zinc oxide can be adjusted to yield stable paints.

APPENDIX A

ZINC OXIDE PAINTS—BASE FORMULATIONS

Formulations	Latex 508	40-140	40-410	388	64	2158
Water	63.0					
Natrosol 250 MHR (2.5)	120.0					
Surfactant—See Appendix	B	C	D	E	F	G
Igepal CO-630	2.5					
KTPP	2.0					
Ethylene glycol	25.0					
Merbac-35	1.0					
Nopco NXZ	1.0					
R-902 TiO_2	220.0					
Zinc Oxide[a]	50.0					
Minex 4	100.0					
Super Talc	90.0					
Disperse at high speed. Add						
Ucar 508 (53.0)	375.0					
Wallpol 40-140 (65.0)		301.3				
Wallpol 40-410 (50.0)			380.4			
Rhoplex AC-388 (50.0)				375.1		
Rhoplex AC-64 (60.5)					310.0	
Polyco 2158 (54.0)						366.9
Aroplaz 1271 (100)	35.1					
NuXtra Co-6%	0.2					
NuXtra Zr-6%	0.6					
Propylene glycol	35.0					
Texanol	10.0					
Nopco NXZ	2.0					
HN_4OH (Ammonia) See Appendix	B	C	D	E	F	G
Water	B	C	D	E	F	G
Natrosol 250 MHR	B	C	D	E	F	G

(a) Zinc Oxide Description:
Type—American process lead-free
Particle—Medium sized nodular
Specifications—TT-P-463a, ASTM D79-44
Rub-out Oil Absorption
12 pounds oil/100 pounds pigment

APPENDIX B

UCAR 508 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Low							
Tamol 850	30.0	11.0	28.7	25.0	1.0	86	8.1
Victawet 35-B	70.0	5.0	49.0	10.0	1.3	86	8.1
Strodex MOK-70	70.0	5.0	58.7	—	1.0	86	8.1
Polywet ND-1	25.0	13.0	26.5	25.0	1.8	86	8.2
Natrol 42	50.0	6.0	27.5	30.0	1.5	87	8.0
Tamol 960	40.0	8.0	25.0	32.0	1.5	86	8.3
Colloid 212	30.0	11.0	29.1	25.0	1.5	86	8.3
Tamo SG-1	35.0	9.0	37.5	17.5	2.0	88	8.0
Medium							
Tamol 850	30.0	13.0	27.7	26.0	1.0	87	8.0
Victawet 35-B	70.0	6.0	49.0	10.0	1.3	88	8.0
Strodex MOK-70	70.0	6.0	50.0	8.7	1.0	88	8.0
Polywet ND-1	25.0	16.0	26.5	25.0	1.8	86	8.2
Natrol 42	50.0	8.0	22.5	35.0	1.5	86	8.1
Tamol 960	40.0	10.0	25.0	32.0	1.5	87	8.3
Colloid 212	30.0	13.0	24.1	30.0	1.5	87	8.2
Tamol SG-1	35.0	11.0	35.0	20.0	2.0	86	8.1
High							
Tamol 850	30.0	16.0	26.5	27.0	1.0	86	8.1
Victawet 35-B	70.0	7.0	46.6	12.5	1.3	86	8.1
Strodex MOK-70	70.0	7.0	50.0	8.7	1.0	87	8.1
Polywet ND-1	25.0	19.0	26.5	25.0	1.8	85	8.2
Natrol 42	50.0	10.0	25.0	32.5	1.5	87	8.0
Tamol 960	40.0	12.0	25.0	32.0	1.5	86	8.3
Colloid 212	30.0	16.0	24.1	30.0	1.5	87	8.2
Tamol SG-1	35.0	14.0	30.0	25.0	2.0	86	8.1

(a) Measured at 77° F (25° C)

APPENDIX C

WALLPOL 40-140 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Low							
Tamol 850	30.0	11.0	71.0	50.0	1.5	85	8.4
Victawet 35-B	70.0	5.0	82.5	44.5	1.5	86	8.3
Strodex MOK-70	70.0	5.0	81.1	45.0	1.0	85	8.6
Polywet ND-1	25.0	13.0	56.7	62.5	1.0	86	8.8
Natrol 42	50.0	6.0	60.2	65.0	1.0	87	8.3
Tamol 960	40.0	8.0	54.9	69.5	1.0	86	8.2
Colloid 212	30.0	11.0	59.0	62.5	1.0	86	8.6
Tamol SG-1	35.0	9.0	97.5	25.0	1.0	86	8.4
Medium							
Tamol 850	30.0	13.0	61.0	60.0	1.5	86	8.6
Victawet 35-B	70.0	6.0	85.0	42.0	1.5	85	8.3
Strodex MOK-70	70.0	6.0	75.0	50.0	1.0	87	8.6
Polywet ND-1	25.0	16.0	56.7	62.5	1.0	86	8.7
Natrol 42	50.0	8.0	62.7	62.5	1.0	86	8.4

APPENDIX C (Continued)

WALLPOL 40-140 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Medium							
Tamol 960	40.0	10.0	54.9	69.5	1.0	86	8.5
Colloid 212	30.0	13.0	59.0	62.5	1.0	86	8.5
Tamol SG-1	35.0	11.0	80.0	42.5	1.0	86	8.4
High							
Tamol 850	30.0	16.0	66.0	55.0	1.5	86	8.5
Victawet 35-B	70.0	7.0	77.0	50.0	1.5	88	8.3
Strodex MOK-70	70.0	7.0	66.1	60.0	1.0	86	8.6
Polywet ND-1	25.0	19.0	59.2	60.0	0.8	86	8.6
Natrol 42	50.0	10.0	60.2	65.0	1.0	86	8.4
Tamol 960	40.0	12.0	40.2	50.2	1.0	86	8.5
Colloid 212	30.0	16.0	59.0	62.5	1.0	87	8.5
Tamol SG-1	35.0	14.0	80.0	42.5	1.0	86	8.4

(a) Measured at 77°F (25°C)

APPENDIX D

WALLPOL 40-410 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Low							
Tamol 850	30.0	11.0	—	35.0	1.5	82	8.8
Victawet 35-B	70.0	5.0	—	40.0	1.5	86	9.0
Strodex MOK-70	70.0	5.0	17.5	22.2	1.5	84	9.0
Polywet ND-1	25.0	13.0	—	32.8	1.5	85	9.0
Natrol 42	50.0	6.0	5.0	33.8	1.5	84	9.0
Tamol 960	40.0	8.0	—	38.0	1.3	82	9.0
Colloid 212	30.0	11.0	—	35.1	1.5	83	9.1
Tamol SG-1	35.0	9.0	19.0	17.5	1.8	87	9.1
Medium							
Tamol 850	30.0	13.0	—	35.0	1.5	83	9.0
Victawet 35-B	70.0	6.0	—	40.0	1.3	88	8.8
Strodex MOK-70	70.0	6.0	17.5	22.2	1.5	86	9.3
Polywet ND-1	25.0	16.0	—	32.8	1.5	85	9.2
Natrol 42	50.0	8.0	—	38.8	1.5	84	9.1
Tamol 960	40.0	10.0	—	38.0	1.8	82	9.1
Colloid 212	30.0	13.0	—	35.1	1.5	84	9.0
Tamol SG-1	35.0	11.0	16.5	20.0	1.8	87	9.0
High							
Tamol 850	30.0	16.0	—	35.0	1.5	82	9.0
Victawet 35-B	70.0	7.0	—	40.0	1.5	85	9.0
Strodex MOK-70	70.0	7.0	15.0	24.7	1.5	85	9.2
Polywet ND-1	25.0	19.0	—	32.8	1.5	83	9.2
Natrol 42	50.0	10.0	—	38.8	1.5	84	9.3
Tamol 960	40.0	12.0	—	38.0	1.5	82	9.3
Colloid 212	30.0	16.0	—	35.1	1.5	85	9.1
Tamol SG-1	35.0	14.0	16.5	20.0	1.8	87	9.1

(a) Measured at 77°F (25°C)

APPENDIX E

RHOPLEX AC-388 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Low							
Tamol 850	30.0	11.0	17.5	24.2	1.5	83	9.1
Victawet 35-B	70.0	5.0	20.0	27.0	1.5	83	9.2
Strodex MOK-70	70.0	5.0	20.0	26.7	1.5	84	9.0
Polywet ND-1	25.0	13.0	9.8	30.0	1.0	83	9.1
Natrol 42	50.0	6.0	5.0	40.8	1.5	84	8.9
Tamol 960	40.0	8.0	—	45.0	1.5	83	8.9
Colloid 212	30.0	11.0	5.0	37.1	1.5	84	9.1
Tamol SG-1	35.0	9.0	43.0	—	2.0	84	9.0
Medium							
Tamol 850	30.0	13.0	17.5	24.2	1.5	84	9.1
Victawet 35-B	70.0	6.0	20.0	27.0	1.5	84	9.0
Strodex MOK-70	70.0	6.0	17.5	29.2	1.5	84	9.2
Polywet ND-1	25.0	16.0	9.8	30.0	1.0	82	9.1
Natrol 42	50.0	8.0	—	45.8	1.8	86	9.1
Tamol 960	40.0	10.0	—	45.0	1.8	86	9.1
Colloid 212	30.0	13.0	—	42.1	1.5	84	9.0
Tamol SG-1	35.0	11.0	20.0	23.5	2.0	89	9.0
High							
Tamol 850	30.0	16.0	15.0	26.7	1.5	86	9.2
Victawet 35-B	70.0	7.0	20.0	27.0	1.5	83	9.2
Strodex MOK-70	70.0	7.0	12.5	34.2	1.5	85	9.1
Polywet ND-1	25.0	19.0	4.8	35.0	1.0	85	9.1
Natrol 42	50.0	10.0	—	45.8	1.8	86	9.1
Tamol 960	40.0	12.0	—	45.0	1.8	86	9.1
Colloid 212	30.0	16.0	—	42.1	1.5	83	9.0
Tamol SG-1	35.0	14.0	26.0	17.5	2.0	87	9.1

(a) Measured at 77° F (25° C)

APPENDIX F

RHOPLEX AC-64 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Low							
Tamol 850	30.0	11.0	40.0	65.0	1.0	86	9.2
Victawet 35-B	70.0	5.0	45.0	65.0	1.5	86	9.1
Strodex MOK-70	70.0	5.0	45.0	50.0	1.5	86	9.2
Polywet ND-1	25.0	13.0	48.0	50.0	1.5	87	9.1
Natrol 42	50.0	6.0	35.0	74.0	1.5	86	9.0
Tamol 960	40.0	8.0	35.0	73.0	1.5	85	9.0
Colloid 212	30.0	11.0	30.0	75.0	1.5	87	9.2
Tamol SG-1	35.0	9.0	85.0	21.8	2.0	88	9.0
Medium							
Tamol 850	30.0	13.0	75.0	30.0	1.0	86	9.2
Victawet 35-B	70.0	6.0	45.0	65.0	1.5	86	9.1
Strodex MOK-70	70.0	6.0	45.0	50.0	1.5	84	9.2
Polywet ND-1	25.0	16.0	48.0	50.0	1.5	88	9.1
Natrol 42	50.0	8.0	35.0	74.0	1.5	86	9.3

APPENDIX F (Continued)

RHOPLEX AC-64 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Medium							
Tamol 960	40.0	10.0	35.0	73.0	1.5	85	9.0
Colloid 212	30.0	13.0	30.0	75.0	1.5	86	9.2
Tamol SG-1	35.0	11.0	96.8	15.0	2.5	86	9.0
High							
Tamol 850	30.0	16.0	75.0	30.0	1.0	86	9.2
Victawet 35-B	70.0	7.0	45.0	65.0	1.5	86	9.1
Strodex MOK-70	70.0	7.0	45.0	50.0	1.5	84	9.2
Polywet ND-1	25.0	19.0	48.0	50.0	1.5	88	9.1
Natrol 42	50.0	10.0	35.0	74.0	1.5	86	9.1
Tamol 960	40.0	12.0	35.0	73.0	1.5	86	9.0
Colloid 212	30.0	16.0	35.0	70.0	1.5	87	9.2
Tamol SG-1	35.0	14.0	81.5	25.0	2.5	90	9.0

(a) Measured at 77°F (25°C)

APPENDIX G

POLYCO 2158 PAINTS

Formulations Surfactant Level	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Low							
Tamol 850	30.0	11.0	27.5	35.0	2.0	86	8.1
Victawet 35-B	70.0	5.0	37.5	25.0	2.0	88	8.1
Strodex MOK-70	70.0	5.0	37.0	25.0	2.0	86	8.0
Polywet ND-1	25.0	13.0	30.2	25.0	2.0	85	8.0
Natrol 42	50.0	6.0	31.0	30.0	2.0	86	8.0
Tamol 960	40.0	8.0	30.4	30.0	2.0	85	8.0
Colloid 212	30.0	11.0	30.0	27.5	2.0	83	8.0
Tamol SG-1	35.0	9.0	58.9	—	2.0	83	8.0
Medium							
Tamol 850	30.0	13.0	27.5	35.0	2.0	86	8.1
Victawet 35-B	70.0	6.0	37.5	25.0	2.0	88	8.1
Strodex MOK-70	70.0	6.0	37.0	25.0	2.0	86	8.0
Polywet ND-1	25.0	16.0	25.2	30.0	2.0	87	8.0
Natrol 42	50.0	8.0	26.0	35.0	2.0	85	8.0
Tamol 960	40.0	10.0	25.4	35.0	2.0	86	8.0
Colloid 212	30.0	13.0	30.0	27.5	2.0	83	8.0
Tamol SG-1	35.0	11.0	30.0	28.5	2.0	87	8.0
High							
Tamol 850	30.0	16.0	27.5	35.0	2.0	85	8.1
Victawet 35-B	70.0	7.0	32.5	30.0	2.0	87	8.1
Strodex MOK-70	70.0	7.0	32.2	30.0	2.0	86	8.0
Polywet ND-1	25.0	19.0	25.2	30.0	2.0	87	8.0
Natrol 42	50.0	10.0	11.0	50.0	2.0	86	8.0
Tamol 960	40.0	12.0	20.4	40.0	2.0	86	8.0
Colloid 212	30.0	16.0	30.0	27.5	2.0	83	8.0
Tamol SG-1	35.0	14.0	43.5	15.0	2.0	85	8.0

(a) Measured at 77°F (25°C)

APPENDIX H

ZINC-FREE PAINTS—BASE FORMULATION

Formulations	Latex 508	40-140	AC-410	388	64	2158
Water	63.0					
Natrosol 250 MHR (2.5)	120.0					
Surfactant		See Appendix I				
Igepal CO-630	2.5					
KTPP	2.0					
Ethylene glycol	25.0					
PMA-100	1.0					
Nopco NXZ	1.0					
R-902 TiO_2	230.0					
Minex 4	98.4					
Super Talc	110.0					
			Disperse at high speed.	Add		
Ucar-508 (53.0)	375.0					
Wallpol 40-140 (65.0)		301.3				
Wallpol 40-410 (50.0)			380.4			
Rhoplex AC-388 (50.0)				375.1		
Rhoplex AC-64 (60.5)					310.0	
Polyco 2158 (54.0)						366.9
Aroplaz 1271 (100)	35.1					
NuXtra Co-6%	0.2					
NuXtra Zr-6%	0.6					
Igepal Co-630	3.0					
Propylene glycol	35.0					
Texanol	10.0					
Nopco NXZ	2.0					
NH_4OH (Ammonia)		See Appendix I				
Water		See Appendix I				
Natrosol 250 MHR (2.5)		See Appendix I				

APPENDIX I

ZINC-FREE PAINTS

Formulations	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Latex-Ucar 508							
Tamol 850	30.0	11.0	35.2	17.5	2.0	87	8.1
Victawet 35-B	70.0	5.0	37.8	17.5	2.0	88	8.2
Strodex MOK-70	70.0	5.0	32.5	16.9	2.0	86	8.0
Polywet ND-1	25.0	13.0	48.4	—	2.5	86	8.2
Natrol 42	50.0	6.0	40.0	14.1	3.0	88	8.4
Tamol 960	40.0	8.0	38.3	15.0	2.5	87	8.3
Colloid 212	30.0	11.0	30.7	20.0	1.8	87	8.1
Tamol SG-1	35.0	9.0	51.9	—	2.8	90	8.4
Latex Wallpol 40-140							
Tamol 850	30.0	11.0	67.5	50.0	1.3	86	8.6
Victawet 35-B	70.0	5.0	73.5	50.0	1.3	88	8.6
Strodex MOK-70	70.0	5.0	72.1	50.0	1.3	89	8.6
Polywet ND-1	25.0	13.0	65.0	51.0	1.3	86	8.6
Natrol 42	50.0	6.0	91.5	30.0	1.3	84	8.6
Tamol 960	40.0	8.0	81.0	40.0	1.3	84	8.6

APPENDIX I (Continued)

Colloid 212	30.0	11.0	75.0	43.5	1.3	85	8.6
Tamol SG-1	35.0	9.0	99.4	20.0	1.3	88	8.6
Latex Wallpol 40-410							
Tamol 850	30.0	11.0	15.0	16.3	1.0	86	9.3
Victawet 35-B	70.0	5.0	15.0	21.3	1.0	86	9.1
Strodex MOK-70	70.0	5.0	15.0	20.8	1.0	88	9.2
Polywet ND-1	25.0	13.0	12.5	17.1	1.0	86	9.2
Natrol 42	50.0	6.0	15.0	20.0	1.0	87	9.3
Tamol 960	40.0	8.0	15.0	19.3	1.0	88	9.2
Colloid 212	30.0	11.0	12.5	19.3	1.0	88	9.1
Tamol SG-1	35.0	9.0	15.0	17.9	1.0	86	9.1

(a) Measured at 77° F (25° C)

APPENDIX J

ZINC-FREE PAINTS

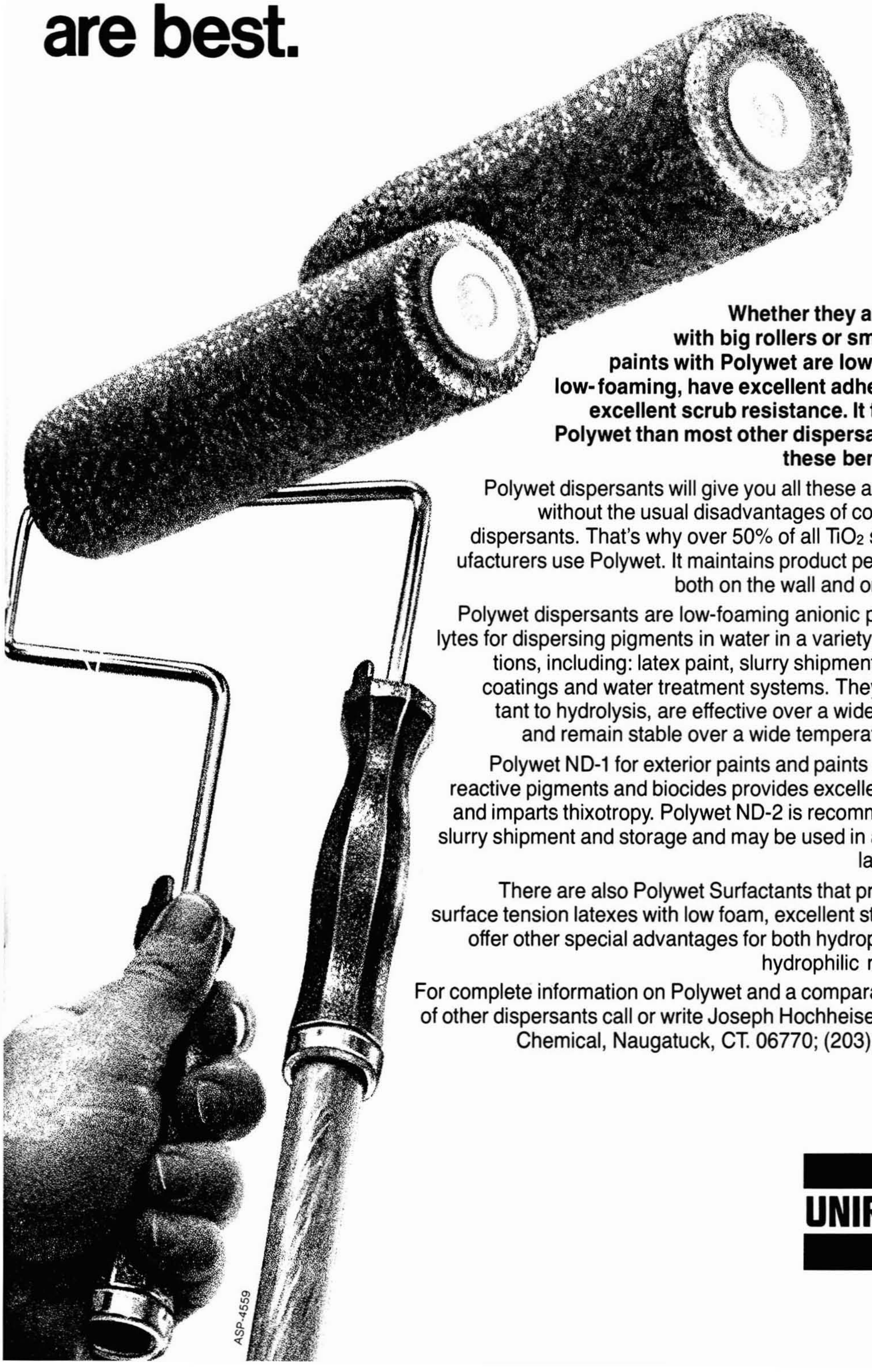
Formulations	(%)	Surf. (gms)	Water (gms)	HEC-2½% (gms)	Ammonia (gms)	Visc.[a] (KU)	pH
Latex Rhoplex-AC-388							
Tamol 850	30.0	11.0	20.8	17.5	1.0	87	9.3
Victawet 35-B	70.0	5.0	15.0	28.2	1.0	87	9.1
Strodex MOK-70	70.0	5.0	22.9	20.0	1.0	87	9.2
Polywet ND-1	25.0	13.0	19.0	17.5	1.0	87	9.2
Natrol 42	50.0	6.0	20.0	22.0	1.0	87	9.2
Tamol 960	40.0	8.0	21.2	20.0	1.0	87	9.2
Colloid 212	30.0	11.0	15.0	23.7	1.0	88	9.3
Tamol SG-1	35.0	9.0	39.9	—	1.0	86	9.1
Latex Rhoplex-AC-64							
Tamol 850	30.0	11.0	65.0	36.5	1.0	87	9.3
Victawet 35-B	70.0	5.0	65.0	41.5	1.0	86	9.2
Strodex MOK-70	70.0	5.0	65.0	41.5	1.0	88	9.3
Polywet ND-1	25.0	13.0	80.0	19.5	1.0	86	9.2
Natrol 42	50.0	6.0	65.0	25.0	1.0	85	9.1
Tamol 960	40.0	8.0	55.0	40.0	1.0	87	9.2
Colloid 212	30.0	11.0	45.0	64.0	1.0	86	9.1
Tamol SG-1	35.0	9.0	70.0	25.0	1.0	88	9.2
Latex Polyco 2158							
Tamol 850	30.0	11.0	26.1	27.5	2.0	87	7.9
Victawet 35-B	70.0	5.0	31.2	27.5	2.0	87	7.9
Strodex MOK-70	70.0	5.0	38.4	20.0	2.0	87	7.9
Polywet ND-1	25.0	13.0	46.9	5.0	2.0	86	7.9
Natrol 42	50.0	6.0	27.5	30.0	2.0	86	7.9
Tamol 960	40.0	8.0	31.7	25.0	2.0	86	8.0
Colloid 212	30.0	11.0	24.1	30.0	2.0	86	8.0
Tamol SG-1	35.0	9.0	30.0	25.0	2.0	86	8.0

(a) Measured at 77° F (25° C)

Trademark References

Igepal .... General Dyestuffs Corp.
Polyco .... Borden, Inc.
Rhoplex .... Rohm and Haas Co.
Tamol .... Rohm and Haas Co.
Ucar .... Union Carbide Corp.
Wallpol .... Reichhold Chemicals, Inc.

Low cratering is just one reason why Polywet® dispersants are best.



Whether they are applied with big rollers or small rollers, paints with Polywet are low cratering, low-foaming, have excellent adhesion, and excellent scrub resistance. It takes less Polywet than most other dispersants to get these benefits, too.

Polywet dispersants will give you all these advantages without the usual disadvantages of conventional dispersants. That's why over 50% of all TiO_2 slurry manufacturers use Polywet. It maintains product performance both on the wall and on the shelf.

Polywet dispersants are low-foaming anionic polyelectrolytes for dispersing pigments in water in a variety of applications, including: latex paint, slurry shipment, specialty coatings and water treatment systems. They are resistant to hydrolysis, are effective over a wide pH range, and remain stable over a wide temperature range.

Polywet ND-1 for exterior paints and paints containing reactive pigments and biocides provides excellent stability and imparts thixotropy. Polywet ND-2 is recommended for slurry shipment and storage and may be used in all types of latex paints.

There are also Polywet Surfactants that provide high surface tension latexes with low foam, excellent stability and offer other special advantages for both hydrophobic and hydrophilic monomers.

For complete information on Polywet and a comparative study of other dispersants call or write Joseph Hochheiser, Uniroyal Chemical, Naugatuck, CT. 06770; (203) 723-3445.

UNIROYAL

ASP-4559

Constituent Societies Report on Education Programs

This report is published to keep members informed of educational activities, both underway and planned, and to stimulate interest in formulating new programs at both local and national levels.

Birmingham

Completed production of four-part A/V program on "The Setaflash Tester;" scripts, slides, and tapes have been forwarded to Federation for reproduction . . . Nearing completion of A/V program on "An Introduction to the Paint Industry," aimed at assisting in recruitment of personnel . . . Sponsored symposium on "Effects of Current Legislation in the U.K. Upon Industry."

Chicago

Educational activities are jointly sponsored with Chicago PCA . . . Major emphasis is on two annual seminars—one of which deals with technology, the other with management. SYMCO '80 had as its theme, "Additives—The Secret Agents," and featured papers on current technology as applied to both trade sales and industrial coatings; the two-day seminar is designed to update coatings chemists' awareness of developments in the industry . . . One-day management seminar is designed to help managers, group leaders, and others to better understand forces at work in society today; 1980 event focused on stress and time management . . . Coatings course initiated at Elmhurst College for the 1978-79 academic year was very successful and will be repeated for 1980-81; course will be divided into a basic and semi-advanced, two-semester format.

C-D-I-C

Portion of each monthly meeting program is devoted to educational presentations; current meeting year featured speakers who discussed: drug abuse; making of steel; static electricity; chemical facts of life; paint identification in criminal investigations; and mining and processing of raw materials for paint manufacture.

Cleveland

Two-day conference on "Advances in Coatings Technology" featured presentations on recent developments in deposition technology, corrosion concepts and analysis, low-temperature/ambient cure, and high-performance technologies; attendance totaled 116 registrants from 15 states and Canada . . . Committee provided two $50 awards for Northeastern Ohio Science Fair—one each for junior and senior high school students; winning efforts were for a project on coefficient of linear expansion of metals, and for a device to measure mechanical properties of polymers . . . Continued assistance in planning and publicizing 12-session Saturday morning, introductory undergraduate 3-hour credit course on coatings technology at Kent State University; 91 students registered for course . . . Committee helped establish Society scholarship fund for use by members wishing to attend various coatings courses at Kent State . . . Helped plan and publicize four short courses at Kent State: Coatings and Polymer Characterization; Dispersion of Pigments and Resins in Fluid Media; Adhesion Principles and Practice for Coatings and Polymer Scientists; and Applied Rheology for Industrial Chemists . . . Issued "call for papers" for 1981 technical conference, to be held March 24-25 . . . Will assist Society effort to line up members to address high school students on careers in the coatings industry; also plan to expand Science Fair competition program.

Detroit

Jointly sponsors with Detroit PCA three coatings courses at University of Detroit: 14-week course on "Surface Coatings Technology;" 12-week course on "Modern Resin Technology;" and 7-week coatings laboratory course . . . Helps publicize and provide instructors for University of Detroit's credit courses on "Chemistry of Protective Coatings" and "Synthesis of Organic Coating Polymers," as well as for annual Polymer Conference Series . . . Sponsored annual symposium on Future of Coatings Under Study (FOCUS) in May; topic was "Environmental Challenges to Automotive Coatings." . . . Planning to introduce a Color Matching Laboratory Course in Fall of 1980, along with a course on "Principles of Automotive Finishing." . . . Will hold Education Night in October; high school and college science teachers will be invited and given paint-related experiment kits . . . Makes Federation A/V programs available on loan basis to area paint companies and students in paint courses.

Golden Gate

Jointly sponsors with Golden Gate PCA a course on Coatings Technology; 36-week (3 hours per week) course runs from September through May. The 1980-81 course will include five plant tours . . . Fund has been established to provide three $500 scholarships . . . Continuing efforts to expand Coatings Section at Redwood City Library . . . Establishing laboratory to be used in conjunction with coatings course and by Society members.

Kansas City

Production nearly completed on audio/visual program on "Hiding;" expect to have package finished and submitted to Federation in next few months . . . Sponsored May symposium on "The Modernistic Approach to Hiding," which featured presentations on titanium dioxide, hiding effects of fine particle extenders, and plastic pigment . . . Continuing participation in KC Science Fair by assisting in judging and providing prizes; three winners are each awarded $50 bonds, with matching cash sum contributed to prizewinners' science department. Winning students, their parents, and their science teachers are invited to Society May meeting, and their winning entries are exhibited for membership . . . Considering providing some type of assistance to Missouri Junior Academy of Science.

Los Angeles

Continuing sponsorship of Paint Manufacturing Technology course at Los Angeles Trade-Technical College; two-year curriculum (four semesters of three-hour weekly evening classes) focuses on paint fundamentals, technical preparation, raw materials, and formulation. Students completing all four semesters earn a certificate . . . Continuing maintenance of coatings library at City of Commerce . . . Scholarship program which Society funds has been revised to give preference to students planning to major in some aspect of coatings technology.

Louisville

Maintains close liaison with University of Louisville, where coatings courses are sponsored. Last fall presented course on introduction to resin technology; spring course will focus on formulation of chemical coatings. 1980 fall course will deal with water-borne coatings; 1981 spring course will deal with quality control, which will emphasize "hands on" demonstrations. Fall of 1981 will feature course on instrumental analysis in coatings industry, which was given previously in 1977 and 1979.

Mexico

Sponsored 5-day seminar on resins in March at Instituto Politecnico National . . . Will also sponsor 5-day seminar on pigments and dyestuffs at Universidad La Salle, August 11-15; designed to give basic understanding of organic and inorganic pigments, dyestuffs, quality control, etc.

Montreal

Continues sponsorship of 15-week evening course (three hours per week) on Introductory Coatings Technology, which provides a basic understanding of raw materials used, as well as techniques of formulation, manufacturing, and quality control; Society grants certificate to all who successfully pass final exam for the course . . . Plans for 1980-81 include organizing series of lectures on subjects of interest to members, as well as pursuing effort to have educational programs associated with local junior college.

New England

Continues to support and publicize courses offered at University of Lowell on "Polymer Structure, Properties and Application" and "Rheology in Plastics and Coatings Processing;" these can be taken in either the graduate or undergraduate programs leading to degree in coatings and plastics technology . . . Have initiated study grant program—Society pays expenses of member to attend selected coatings seminar and make report to membership . . . Considering development of basic coatings course, to be offered in fall of 1980 . . . Provided cooperation and support for two Society seminars: "Pigment Dispersion" (January) and "Hazardous Waste Disposal" (February).

New York

Continues to co-sponsor with New York PCA two coatings courses: (1) "Fundamentals of Coatings Technology," two semester course for new chemists and advanced technicians, given at New York City Community College; and (2) "Laboratory Course for Coatings Technicians," 12-week evening "hands-on" lab course designed for technicians in coatings industry, held at laboratories of various coatings and raw materials manufacturers . . . "Principles of Color Technology," previously given annually, will be given every two or three years . . . Membership being surveyed to determine additional courses of interest . . . Hopeful of getting grant from New York State to fund establishment of coatings lab to train technicians.

Northwestern

Educational and Technical Committees jointly sponsored Annual Symposium; 1980 event had twin topics: "Emission Regulations Updated" and "Air-Dry Maintenance Coatings Meeting Regulations." . . . Maintains close liaison with North Dakota State University, and contributes financial support for purchase of coatings equipment . . . Maintains library of Federation audio/visual programs, which are made available on loan basis to members.

Pacific Northwest

Coatings technology courses being reevaluated; local contractors and retailers being surveyed to determine interest in having their people attend to acquire basic understanding of the products they sell and apply.

Philadelphia

Sponsored five-week, limited enrollment course on "Color Theory—Colorant Formulation and Color Matching;" planning to produce audio/visual program based on course and make available to Federation for distribution . . . Working on production of audio/visual program on "Microbiological Audit of a Paint Plant." . . . Cooperated with Technical Committee in sponsoring May symposium on "Quality Assurance—Survival in the 80's."

Piedmont

Attempting to establish ACS-accredited degree program in polymers at University of North Carolina at Greensboro, in effort to bring technically trained personnel into local coatings industry; area firms being solicited to provide employment for students as part of work-study program. Course, which will lead to a B.S. degree in chemistry, is expected to be available by September 1980.

Pittsburgh

Sponsored May symposium on "Hazardous Waste Disposal" . . . Held spring seminar for high school students to introduce them to the varied aspects of the coatings industry and to encourage them to consider a career in coatings . . . Continuing participation in regional Science and Engineering Fair by assisting in judging and providing two awards for coatings-related projects.

Southern

Educational efforts are focused on maintaining close liaison and cooperative efforts with University of Southern Mississippi . . . Co-sponsors with USM annual symposium on Water-Borne and Higher Solids Coatings . . . Invites USM students to present papers at Society Annual Meeting . . . Provides funds for USM scholarship program . . . Members serve on USM Industry Advisory Committee.

St. Louis

Prime undertaking continues to be annual Educational Night, to which area high school science teachers are invited, and which has become increasingly successful since its inception in 1976; lab experiments are demonstrated, and teachers are provided with kits so they can perform the experiments in their classrooms . . . Participates in local Science Fair; provides two cash awards for coatings-related projects . . . Contributes to scholarship fund at University of Missouri—Rolla . . . One monthly meeting each year is devoted to program featuring speakers from FSCT, NPCA, Decorating Retailers, and Painting Contractors; members of all four groups are invited to attend.

Toronto

Continuing sponsorship of coatings courses at George Brown College; these include basic and advanced coatings technology, as well as one for technicians. Certificates awarded to those successfully completing courses . . . Completed slide/tape program on "Introduction to Resin Operations."

Western New York

Planning to implement efforts to generate interest among local high school science teachers to promote careers in coatings industry . . . Nearing completion of audio/visual program on "Impact Resistance."

June 1980 Subcommittee Reports of ASTM Committee D-1

The June 1980 meeting of ASTM Committee D-1 on Paint and Related Coatings and Materials was held on June 22-25 at the Niagara Hilton Hotel, in Niagara Falls, NY. In the three and one half days preceding the final report session and general meeting of Committee D-1, 125 members and 33 guests met in 142 scheduled meetings of D-1 Subcommittees and Working Groups. The present membership of Committee D-1 is 539.

One of the highlights of the meeting was the presentation of two awards to members of Committee D-1. Mark P. Morse received the Henry A. Gardner Award for outstanding competence in managing various subcommittees over the years. Harry A. Wray received the ASTM Award of Merit and became a Fellow for his distinguished service to the Society and the cause of voluntary standardization.

Subcommittee Officers appointed by Chairman S.B. Levinson were: Sub. D01.07 on Government Contacts, R.F. Brady to replace L.S. Birnbaum as Chairman: Sub. D01.95 on D-1 Handbook, R.A. Wint to replace J.P. McGuigan as Chairman; and G.G. Schurr as cochairman of the January 1981 Symposium.

Highlights

The following projects of major interest to the coatings industry represent areas of new or increased emphasis since the previous reports:

D01.21.25—complete revision of Method D2832 is anticipated wherein the standard will become three separate standards on coatings, pigments and resins, and solvents.

D01.23.10—determine the precision of the Bell manual and Bell modified testers.

D01.23.11—develop a new method for the use of notched gauges in measuring wet film thickness.

D01.23.14—develop a method to determine abrasion resistence with the Taber Abrader.

D01.23.15—evaluate a method using a tensile tester to measure the instantaneous force required to put a sled in motion on the surface of a coated panel.

D01.24—initiate work on a new method for determining the surface tension of paints and varnishes.

D01.33.12—study new method for free isocyanate determination by liquid chromatography.

D01.33.14—evaluate new method for determination of ortho phthalic acid anhydride and fatty acids in alkyds by gas chromatography.

D01.33.23—evaluate a new method for total chlorine in epoxy resins utilizing sodium biphenyl.

D01.33.24—develop a practice for nitrogen resins.

D01.33.26—working on freeze-thaw and heat-age stability tests for emulsions.

D01.33—develop a new method for improving and combining separate nonvolatile methods for varnishes and resin solutions. Preparation of a practice for testing vinyl resins and coatings.

D01.35.01—combine D235 (petroleum spirits) and D484 (hydrocarbon dry cleaning solvents) into a single specification.

D01.35.02—combine all ketones under one specification.

D01.42.06—develop a practice for testing latex semi-gloss paints.

D01.42.07—develop a new method for evaluating leveling.

D01.46.03—develop method for field identification of coating films. Develop practice for selecting coatings that will be compatible with existing coated surfaces.

D01.46.07—revise proposed test method for pull-off adhesion testing in the field.

D01.46.09—develop a guide for topcoating zinc rich primers.

D01.46.10—formation of a new group on topcoating galvanize.

D01.52.12—develop a test method for determining durability of finishes on textured paneling by using a soil, clean, soil technique.

D01.56—develop a laboratory test method for predicting smoke emissions from a stack. Develop a method for measuring the relative tinting strength of ink colors.

Future Meetings of ASTM Committee D-1

January 18–22, 1981	June 21–24, 1981	January 17–20, 1982
Dutch Inn	Biltmore Plaza	Monteleone
Orlando, Fla.	Providence, R.I.	New Orleans, La.

DIVISION 1 ADMINISTRATIVE

SUBCOMMITTEE D01.13 CONSUMER AFFAIRS

E.T. Mooney, Chairman

Group 2 on Individual Consumer Affairs met and decided to request that it be placed on an inactive status. It was felt by the members that some of the work done by this group had been taken over by Sub. D01.41 and that there is no need for a working group within Sub. D01.13 at this time.

At its main meeting, Sub. D01.13 members agreed to deactivate Group 2. The subcommittee will continue to function as an administrative subcommittee in a liaison capacity. It will monitor the work done in the consumer field by other organizations such as NPCA. Officers and members will be appointed by the Chairman of Committee D-1.

The group was given an update on the activities of NPCA in trying provide help for the paint consumer. A Consumer Relations Manual is being prepared which will aid paint manufacturers to assist paint users in making intelligent buying decisions.

SUBCOMMITTEE D01.16 DEFINITIONS

S. LeSota, Chairman

There was discussion on a suggestion that action be taken to delete the present definition of "industrial talc, nonasbestos type" from Standard D16 since it is inconsistent with the ASTM aims of avoiding absolute terms such as nonasbestos.

The group also discussed the terms: batch, acid number, natural spreading rate, and soil vs. stain. It is planned to mail out first drafts of these definitions to subcommittee members for their critique.

DIVISION 20 RESEARCH AND GENERAL METHODS

SUBCOMMITTEE D01.20 STATISTICS AND SAMPLING

H.E. Ashton, Chairman pro-tem

It was reported that the Specification for Standard Environment would be issued as D3924 and the Practice for Sampling as D3925. The revision of D3925 to add sampling at the factory had been submitted to subcommittee letter ballot. Comments from two voters were considered and, where appropriate, changes were made. The revision will be submitted to Committee D-1 letter ballot.

The results of the D-1 ballot on the Practice for Interlaboratory Testing were reviewed. One negative vote concerned with the fact that the Precision statement does not take into consideration the variation between different batches of paint was withdrawn with the understanding that this point will be subjected to subcommittee voting. The second negative voter will be asked to withdraw his negative so that the main reason for the vote, blind replication instead of day replication, can receive more thorough discussion by the subcommittee. The suggestion on an abstaining vote that results from interlaboratory tests should be compared with the calculated acceptable ranges and, when necessary, be rejected if divergent results have not already been discarded, will be submitted to subcommittee letter ballot. Several editorial corrections submitted by various voters were made in the Practice which can be sent to Society ballot providing the negative voter is agreeable to the request to withdraw.

SUBCOMMITTEE D01.21

CHEMICAL ANALYSIS OF PAINT AND PAINT PRODUCTS

R.W. Scott, Chairman

The following actions were taken to resolve negatives received during the recent letter ballot: On the revision to new "Standard Method of Test for Cerium in Paint Driers by the Ceric Sulfate Method," the written comments in the negative were not received in time for review. The chairman of Task Group D01.21.61 will attempt to resolve the negative as soon as possible. On the new "Standard Practice for Determining Volatile Organic Content (VOC) of Paints and Related Coatings," the seventh draft received a negative vote based on meanings of symbols in the equation in section 8.2.3 for VOC in paints containing water. This was resolved by improving the subscripts to the symbols. Comments with affirmative votes were found related to the negative vote and accommodated by the same revision of symbols. On reapproval (with editorial revision) of Method D2832, "Practices for Determining the Nonvolatile Content of Paints and Paint Materials," one voter agreed to withdraw his negative since the method is now undergoing a critical review and probably extensive revision. The second negative was withdrawn when it was agreed to retain the section on Naval Stores.

Group 13: Coordination of VOC Standards. J.C. Weaver, Chairman, reported that a recommended practice had successfully passed main committee letter ballot and is being submitted for Society ballot. Interaction between this group and EPA continues. This activity has aided in resolution of problems concerning (1) New Source Performance Standards, (2) Control Technology Guidelines, and (3) EPA's Draft Method #24. The group through its members continues to maintain contact with appropriate government agencies and industry associations.

Group 22: Electrocoat Bath Samples. A.G. Yeramyan, Chairman, is continuing work on methods for determination of percent NVM and pigment content. The method will be submitted for subcommittee and main committee letter ballot. A new round robin will be initiated for determination of acid and base values. A gas chromatographic method for solvent determination may be evaluated by a round robin.

Group 23: Hot Melt Traffic Paint. D.R. Miller, Chairman, has work underway to determine TiO_2 and lead chromate content of white and yellow thermoplastic traffic markings.

Group 24: Revision of D2369. A.C. Abbott, Chairman, has completed its round robin work and a method calling for determination of VOC at 110°C for one hour has been successfully voted on in subcommittee. This method will now be inserted into D2369. The final version of D2369 will contain two sections, i.e., 20 min at 110°C and 60 min at 110°C for determination of VOC. No further round robin work is planned. The group should go on inactive status after the January 1981 meeting.

Group 25: Revision of D2832. D. Campbell, Chairman, has expanded into one main and four sub-task groups. A complete revision of D2832 Practice for volatile/nonvolatile methods will include separation of about 30 methods into four Practices for coatings, pigments, resins, and solvents. This becomes important because of increasing regulation by government (mainly EPA and CARB) of volatile organic contents (VOC) in coating.

Group 26: Revision of D2697. E.A. Praschan, Chairman, reported that a modified procedure for determination of volume solids has been evaluated in the laboratory of the task group chairman. A round robin study of this modification will be conducted with six laboratories participating.

Group 42: AAS Analysis of Pigments. W.V. Moseley, Chairman, is continuing work on the method which is now in the seventh draft. Further modification may be required before determination of high level pigment elements in paint by use of atomic absorption spectroscopy is acceptable.

Group 46: X-Ray Analysis of Pigments. H. Neubold, Chairman, reported difficulty has been encountered in finding a suitable internal standard. A new round robin will be run using Scandium or Bromine as the internal standard element. Tetra methyl ammonium bromide will be used first.

Group 52: Trace Levels of Benzene in Paints. R. Domingo, Chairman, will soon start the second round robin for "Determination of Benzene in Paints." The group will also review methods for determination of halogenated hydrocarbons since this may become a sensitive area.

Group 53: Trace Levels of Monomers. G. Cunningham, Chairman, will be reviewing methods for monomer levels of vinyl acetate and n-butyl acrylate in VA/BA copolymer and for free styrene in S/B resins. A secondary method to determine the detection level of monomers will be evaluated. Residual ACN in nitrile latex will be the subject of a round robin.

Group 54: Water Content of Water Reducible Coatings by Karl Fischer Titration. W.C. Golton, Chairman, reported the method has passed the subcommittee letter ballot and will now be submitted for a main committee letter ballot. The group is also cooperating with Sub. D01.35 to assist in developing a method for low levels of water in urethane solvents.

Group 61: Revision of D564. L. Bazarko, Chairman, reported that, after resolution of a negative and some comments, a "Standard Method of Test for Cerium in Paint Driers by Ceric Sulfate Method" will be submitted for Society ballot. Comments need to be resolved for "New Standard Method of Test for Zirconium in Paint Driers by EDTA Titration" before the method is submitted for Society ballot. In addition, a totally revised D564 and two other methods (Vanadium and Rare Earth Metals) will also go to Society ballot. If no major problems arise, this group will go inactive after the January meeting.

Group 72: Metals in Air Particulates. L. Di Carlo, Chairman, will try a new approach to the preparation of samples and standards. Draft #4 of a proposed method will be used for the analysis.

Group 80: Exploratory Analytical Research. D. Brezinski, Chairman, continues to seek new ideas or new concepts to study in order to better design and develop methods relative to the coatings industry.

SUBCOMMITTEE D01.22 HEALTH AND SAFETY

H.A. Wray, Chairman

It was reported that D1310, "Open Cup Flash Point Method," has passed Society ballot. A request to modify the Open Cup Flash point apparatus to provide a safety feature was discussed. It was decided to circulate the idea among the subcommittee membership to determine the merits of the suggestion. Another suggestion covering the use of the Tag Open Cup Flash Point Tester with a silicone oil bath for determining firepoints will also be circulated for comments. There was no report on the status of the round robin test on D3278, "Seta Flash Closed Cup." Committee D-2 is now using a new Seta Flash Test, D3828, and it is proposed to follow their use of this method. Regarding the status of equilibrium flash point methods, D3934, "Closed Cup Flash Point of Liquids by the Equilibrium Method," has been approved. The second equilibrium method, "Determination of Finite Closed Cup Flash Point," is ready for Society ballot.

On matters relating to the Coordinating Committee on Flash Points, there was some discussion on the Wick Test, a method for mixtures of water and low flash point liquids, and a sustained burning test involving the use of the Seta Flash Open Cup. The Coordinating Committee is also working on a round robin with the purpose of setting up a series of calibrating liquids for flash point work. A task group of the Committee is working on a definition for ignitability. The Committee is working on a Standard Practice for Flash Point Determination and its implications. A subcommittee on Waste Disposal has been formed.

On the status of government regulations, it was reported that D.O.T. has been petitioned to review and adopt some of the useful work and ideas that have evolved from Committees D-1 and D-2 in the past few years; for example, definitions, closed cup flash point methods, etc. The D.O.L. still uses a cut-off of less than 140°F for the limit of flammability rather than less than 100°F for the construction industry. The D.O.L. will be requested to change this so it will be in conformance with other regulatory bodies. An impact statement is now available concerning the effects of the CPSC going from an open cup to a closed cup flash point method. The changeover should be recommended in the Federal Register sometime in October 1980. In EPA, the pesticides group has proposed a closed cup flash point method. The waste disposal group is using the closed cup method to determine the ignitability of waste material (less than 140°F). The open cup flash point method is still being used by the U.S. Coast Guard for the shipment of bulk solvents. Petition will be made to get this changed to closed cup. On peroxides, a modification of the Seta Flash Tester may be necessary to allow for the safe use of peroxides.

Regarding practice on hazardous materials statements, the new "Blue Book" requirements were reviewed including: (1) the requirement for the addition of a caveat to all Standards containing haz-

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ardous material, and (2) the addition of the word "CAUTION" to all standards containing a hazardous material and also to name the substance. "CAUTION" statements and caveats shall be included where appropriate in every ASTM standard as specified in the 1980 ASTM style guide (Blue Book) for all Standards. On D3630, "Practice for Determining Constituents Classified as Hazardous Contained in Protective Coatings," a negative with many editorial comments was received. Most of the comments will be included in a revision. However, the request to delete the reference to standards which are being balloted for withdrawal was rejected but a footnote will be added indicating that withdrawal of these methods is being considered. The voter agreed to accept this and withdrew his negative.

The balloting for withdrawal of the two standards for Fire Retardancy, D1630 and D3806, was discussed. A number of negatives were received to the effect that the methods should not be withdrawn because it was felt they were needed. It was agreed to carry the two methods without the benefit of full precision statements. The work of ISO TC-35 on test methods for ignitability, smoke and flame was discussed. The similarity to work being done at NBS for TC-35 was pointed out. Work on equilibrium methods by TC-35 and TC-28 was reviewed. Objections were raised on two items. One was on changing Flash/No Flash to Fail/Pass. The other was where results of two tests are questionable, the conclusion should be "No Flash" instead of a flash point. Possible improvement of the Seta Flash closed cup instrument was discussed, e.g., digital recording device and a pressure relief valve for the safe testing of materials such as peroxides.

There was discussion of the proposed NPCA In-Plant Hazardous Materials Identification System (HMIS). This system suggests a label containing four parts, i.e., Health, Flammability, Reactivity, and Personal Protective Equipment. The first three categories would be rated by the raw material suppliers—the last part by the paint manufacturer. It was decided to submit the NPCA version (adapted to ASTM format) to the subcommittee for review and comments before proceeding further with task force work. It was announced that NPCA would hold five seminars on this subject for paint manufacturers starting on September 9, 1980 in Houston, followed by New York, Los Angeles, Cleveland, and St. Louis.

It was announced that two new ASTM Health and Safety Committees have been formed: one on Waste Disposal, D-34, and one on Toxic Materials. In regards to the latter, concern was expressed on the scope of this group. Members hope it will be only a coordinating committee not a standards writing committee.

On disposal of harmful wastes, letters were received from a number of companies interested in the work of a group working on disposal of harmful wastes following the announcement in ASTM News regarding the formation of such a committee. An article on "Disposal of Harmful Lab Wastes" appearing in the *Chemist Analyst* [Vol. 68, No. 2, October 1979] was discussed and it was the consensus of the members that this article should be distributed to the membership of Sub. D01.22 for review and comments. It was also believed that information on a possible standard on spill clean up be circulated for review and comment. Projects for future work include: (1) autoignition test and (2) flammability limit test.

SUBCOMMITTEE D01.23 PHYSICAL PROPERTIES OF APPLIED PAINT FILMS

M.P. Morse, Chairman

Subcommittee D01.23 is submitting a revision of Method D968, "Abrasion Resistance of Organic Coatings by the Falling Abrasive Test," for simultaneous subcommittee and Committee D-1 letter ballot.

Group 10: Adhesion, H.E. Ashton, Chairman, advised that as a result of data obtained in a limited round robin test, the Tooke Inspection Gauge is judged to be unsatisfactory for determining the adhesion of coatings and has been eliminated as a possible method. Efforts to evaluate a pull-off method by tensile tester have been hampered by the lack of a satisfactory adhesive. A new candidate has been proposed and will be tested for suitability. A determination of the precision of the Bell manual and Bell modified testers is planned. A series of coated panels differing in adhesion will be prepared for a round robin test.

Group 11: Wet Film Thickness. H.A. Ball, Chairman, advised that the revision of Method D1212, "Measurement of Wet Film Thickness," prepared by this group has been issued in Part 27 of the *1980 Book of Standards.* This method covers the use of the Interchemical and Pfund Gauges. A new method is being developed for the use of notched gauges in measuring wet film thickness. Although this technique measures "minimum film thickness" and lacks the sensitivity of the Interchemical or the Pfund, it is commonly used and prescribed procedures for its application are needed.

Group 12: Dry Film Thickness. K.A. Trimber, Chairman, reported that revision of Method D1400 (for coating thickness over a non-ferrous metal base) and Method D1186 (for coating thickness over a ferrous metal base) have been approved by the members of this group. Results from an extensive round robin test using these methods have been analyzed and precision of several instruments determined. Additional test results are needed to establish the precision of the Dermitron and Accuderm instruments. Microscopic measurements of the thickness of the coated panels used in the round robin test will be taken as a basis for determining the accuracy of the measurements provided by the different types of instruments used in the test program. Tables showing precision and accuracy will be included in the new revisions of the two methods.

Group 14: Hardness, Mar Resistance, and Abrasion Resistance. M.P. Morse, Chairman, reported that the present falling sand method for determining abrasion resistance of coatings (D968) has been revised to include an alternate procedure for the use of silicon carbide as the abrasive. This revision will be submitted to simultaneous subcommittee and Committee D-1 letter ballot. The air blast method for determining abrasion resistance of coatings (D658) has been revised to provide alternate sources of clean air and to permit the use of two flow rates of abrasive. The value of permitting the two flow rates has been questioned and this will be resolved. Otherwise, the method is ready for ballot. A method for determining abrasion resistance with the Taber Abrader is being prepared. Precision data has been obtained for all three of the abrasion tests.

Group 15: Slip Resistance. G.D. Ernst, Chairman, advised that a comparison test of the James, Brungraber, and Liberty Mutual testers was conducted. Each of these instruments measures the coefficient of friction at the point and moment of contact of a shoe on a surface. The agreement of the three instruments was good in their ability to distinguish between coatings having significantly different coefficients of friction. Because of its low cost and portability, the Liberty Mutual tester will be evaluated further. Evaluation of a method using a tensile tester to measure the instantaneous force required to put a sled into motion on the surface of a coated panel is planned.

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SUBCOMMITTEE D01.24 PHYSICAL PROPERTIES OF LIQUID PAINTS & PAINT MATERIALS

C.K. Schoff, Chairman

Group 19: Viscosity by Efflux Cups. The latest draft of the proposed dip cup method was discussed. The two new Shell cups (S-2 ½ and S-3 ½) were added to the method and calibration equations written for them. The method will be submitted to the editorial committee and then to subcommittee ballot. Method D1200, "Viscosity by Ford Viscosity Cup," will be up for reapproval in 1981. A short discussion of the method indicated that changes should be made in the test to reflect the lack of temperature control.

Group 20: Rotational Viscometers. D. Howard, Chairman, reviewed the latest draft of the revision of D2196, "Test for Viscosity Measurements and Thixotropic Properties of Non-Newtonian Materials by Rotational (Brookfield) Viscometer." A few changes will be made and then the method will be submitted to the editorial committee and then to subcommittee ballot. This extensive revision includes techniques for the determination of shear thinning and thixotropy which were not previously included. A precision statement for the method will be written. The Brookfield small sample adapter was also discussed. This device changes a Brookfield into a cup and bob (concentric cylinder) viscometer. It uses a very small sample (~10 ml) and has a well defined geometry. The latter is particularly useful when data are plotted as viscosity versus shear rate or in the form of Casson plots. It is possible that a future method will be written around this device.

Group 21: Stormer Viscometer. M.P. Morse, Chairman, discussed the latest draft of the revision of D562, "Consistency of Paints by Stormer Viscometer." As a result, a number of editorial changes were made in the draft, including providing for increments of one gram at the lower end of the load range. The group recommended that the revised draft be submitted to simultaneous Subcommittee and Committee D-1 letter ballot. Major features of the revised method include a precision statement and a calibration technique.

Group 23: High Shear Viscosity Measurements. The proposed method for Determination of Viscosity of Paints and Varnishes at a High Rate of Shear by the ICI Cone/Plate Viscometer was considered. A number of changes in the method were recommended and these will be included in the next draft. A relevant British Standard method will be consulted as well. A round robin is being set up for the purpose of collecting data for a precision statement for the method.

In addition to the working group reports, there was a short discussion on surface tension. There appears to be no ASTM method for determining the surface tension of paints and varnishes. Existing surface tension measurement techniques, including the DuNoüy ring and Wihelmy plate, will be considered and a proposed method for coatings drafted. Information on methods presently in routine use in industry would be appreciated.

Another item of discussion was Method D1483, "Absorption of Pigments by Gardner-Coleman Method." Questions recently were raised as to the wording of the procedure. It is rather confusing as it specifies transfer of a certain volume weighed to the nearest 0.1 g. The idea is that the method works best with that volume, but that it is not possible to measure out a volume of pigment very accurately. Therefore, the weight corresponding to that volume is used instead. The procedure will be rewritten to clarify the meaning.

SUBCOMMITTEE D01.26 OPTICAL PROPERTIES

C.J. Sherman, Chairman

Group 2: Color Measurement. J.G. Davidson, Chairman, received one negative ballot and several comments on D1729, "Visual Evaluation of Color Difference of Opaque Materials." The negative was accepted and comments accounted for by editorial revisions. The method will be submitted for simultaneous subcommittee and main committee ballot. The proposed draft revision of D3134, "Selecting and Defining Color and Gloss Tolerances of Opaque Surfaces and for Evaluating Conformance," was reviewed. Editorial revisions were made and the method will be submitted for simultaneous subcommittee and main committee ballot. The latest draft of the proposed method for "Visual Evaluation of Metamerism" will be submitted for a subcommittee ballot. No reports were given by the task forces on new methods for "Measurement of Colored Samples," "Methods for Determining Color Differences," and "Color Standards: Current Practices, Definitions, and Methods."

Group 6: Hiding Power. C.J. Sherman, Acting Chairman, reported that D344, "Test for Relative Dry Hiding Power of Paints," is scheduled for review in 1981. It will be revised to include some of the improved methods from a recent round robin test of visual hiding power and submitted for subcommittee ballot.

Group 11: Gloss and Goniophotometry. R.C. Kissler, Chairman, discussed a proposed method for "Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance." The revised draft will be submitted for a subcommittee ballot. A proposed "Method of Test for Reflection Haze of High Gloss Surfaces" was discussed and will be submitted for simultaneous subcommittee and main committee ballot.

Group 19: Hemispherical Reflectance. K. Luyk, Chairman, discussed statements of repeatability and reproducibility for the sixth draft of a "Standard Method of Test for Total Luminous (Hemispherical) Reflectance." Similar data obtained with other instruments are now being obtained. When available, precision data will be added and the method will be submitted for simultaneous subcommittee and main committee ballot.

Group 22: Sample Preparation for Determination of Optical Properties. H. Hammond III, Chairman, discussed comments received on the main committee ballot of a "Standard Practice for Selection of Coating Specimens and Their Preparation for Appearance Measurement." The Standard Practice will now be submitted for Society ballot. With the completion of this work, this task group is dissolved.

Group 23: Retroreflectance of Horizontal Coatings. N. Johnson, Chairman, discussed the negative vote received on the subcommittee ballot of a "Method for Specific Luminance of Horizontal Coatings" and changes were made to the method to resolve the negative. It will now be submitted for simultaneous subcommittee and main committee ballot.

Group 24: Color and Strength of Color Pigments. R.C. Zeller, Chairman, discussed the negative vote on the revision of D387, "Mass Color and Tinting Strength of Colored Pigments." Changes were made to the method in order to resolve the negative vote. Editorial changes were also made and the revised method will now be submitted for simultaneous subcommittee and main committee ballot.

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SUBCOMMITTEE D01.27 ACCELERATED TESTS FOR PROTECTIVE COATINGS

E.A. Praschan, Chairman

Negatives from the main committee ballot were acted upon as follows: Method D714, "Evaluating Degree of Blistering of Paints"—the negative vote on rating system was deemed non-persuasive. It pointed out the difference between ISO and ASTM rating systems; ISO rates 0 as best, ASTM rates 10 as best. The ASTM system is required by ASTM rules. Method D870, "Water Immersion Test of Organic Coatings on Steel"—the negative vote was withdrawn on the basis that it will be considered in the revision of D870 currently under study. A variety of comments were included in the negative. Method D2247, "Testing Coated Metal Specimens at 100 Percent Relative Humidity"—the negative vote was withdrawn on the basis that it will be considered in the revision of D2247 currently under study. A variety of comments were included in this negative. Method D3361, "Operating Light and Water Exposure Apparatus (Unfiltered Carbon Arc Type) for Testing Paint, Varnish, Lacquer and Related Products Using the Dew Cycle"—two negative votes were considered persuasive. These concerned points related to significance (wave lengths less than 280) and rotation of panels. Method D1150, "Single and Multi Panel Forms for Recording Results of Exposure Tests–Paints—two negative votes were received and both were deemed non-persuasive. They referred to (1) no explanation for withdrawal, (2) D1150 is the only source in D-1 for recording data and (3) D1150 is referred to in various standards and methods. It was felt the form receives little, if any, use and is impractical for large numbers of panels. It was suggested that those groups who have a need to reference D1150 should consider accepting responsibility for the method.

The status of several methods and practices were reviewed as follows: Method D3891, "Preparation of Glass Panels for Testing Paint, Varnish, Lacquer and Related Products," has passed Society ballot and has been transferred to Sub. D01.29. Method D1654, "Evaluation of Painted or Coated Specimens Subjected to Corrosive Environment," has been issued as revised. Revision of Method D659, "Evaluating Degree of Chalking of Exterior Paints," has been through the June 1980 Society ballot.

Group 2: Water Test. G. Grossman, Chairman, is working on revisions to Methods D870, D1735, D2247, and D2366.

Group 4: Light and Water Exposure Apparatus. S. Totty, Chairman, is finalizing D3361 (Unfiltered Carbon Arc Type) for reapproval and conducting round robin testing (4 hours light/4 hours dark) for Method D822; results of the latter should be available for the January 1981 meeting.

Group 6: Detergent Test for Organic Finishes. H. Leister, Chairman, has decided to submit Method D2248 for reapproval with the comment that work is continuing on the method in the areas of bath agitation, edge protection and non-phosphate detergent formula.

Group 9: Evaluation of Corroded Specimens. R. Williamson, Chairman, has issued the revision of Method D1654 following Society ballot approval. Discussions are continuing on a recent set of comments and review of an ISO method on salt spray operation.

Group 10: Accelerated Outdoor Exposure. M. Morse, Chairman, is drafting a method encompassing the Black Box, Heated Black Box, and EMMAQA methods.

Group 16: Chalking. J. Robbins, Chairman, is drafting a new chalking standard covering the methods used in a recent round robin. This will be in addition to Method D659 which has just been revised.

Group 17: Evaluation of Weathering Effects. A. Thompson, Chairman, is actively working on revisions/reapprovals of the following methods: D661, on Cracking, D662, on Erosion, D772, on Flaking, D1006, on Test Paints on Wood, and D1543, on Color Permanance.

A new task group, D01.27.14, Filiform Corrosion, has been formed with R. De Graff as Chairman and will concentrate on revision of Method D2803.

SUBCOMMITTEE D01.28 BIODETERIORATION

D.L. Campbell, Chairman

Method D3274, "Evaluating Degree of Surface Disfigurement of Paint Films by Fungal Growth or Soil and Dirt Accumulation," was discussed briefly before deciding to circulate it within the subcommittee for additional comments. Method D3273, "Test for Resistance to Growth of Mold on Surface of Interior Coatings in an Environmental Chamber," was discussed with several editorial comments being suggested. The revised standard will be circulated within the subcommittee for additional comment. Both revised standards will be reviewed at the January 1981 meeting. The revised standard, D3456, "Practice for Determining by Exterior Exposure Tests the Susceptibility of Paint Films to Microbiological Attack," was voted on by the main committee and approved. One affirmative vote was made with comment. These comments were discussed by the subcommittee and the results of that discussion will be reviewed with the voter prior to submitting the revised standard for publication.

Group 1: Package Preservation. W.B. Woods, Chairman, advised that since only two of six participants in the current round robin had reported their results, no definite conclusions could be drawn. Initial indications are that single inoculations of the paints are not successful in promoting sustained bacterial growth in those paints. The feasibility of using a spoiled paint as an inoculum was discussed. Also discussed was a source for such an inoculum should it prove to be the inoculum of choice. The chairman will collect data from the participants in the current round robin, analyze the results, and proposed additional laboratory work to be completed prior to the January 1981 meeting.

Group 2: Determination of Enzymes. D. Flanagan, Chairman, is a new group and the first order of business was to develop a scope of work. A library research program will be conducted to determine which methods for detection of enzymes are available. An initial round robin will utilize spoiled paints from Task Group 1, and will be started as soon as a method can be proposed and the spoiled samples become available. One of the methods proposed is to determine the presence of glucose in a paint sample. As monosaccharides are the result of the decomposition of cellulosic materials by enzymes, the presence of glucose should indicate the presence of enzymes. To make certain that glucose is not a common component of paint, several production samples of paint, known to be biologically inactive, will be examined for glucose.

Group 3: Accelerated Tests. K.A. Haagenson, Chairman, reviewed results of a current round robin. Paints exposed in five different tropical chambers showed similar performance when rated after the fail control showed a growth rate of 2–3 (10 = no growth; 0 = complete failure). The same paints are to be exposed at four exterior exposure sites in the United States and one such site in Puerto Rico. Assuming that a correlation between the tropical chamber studies and the exterior exposure study is achieved, a proposed standard will be written to show the use of accelerated testing as a means of evaluating coatings designed for exterior exposure. A rough draft of

the proposed standard and the initial results from the exterior exposure study will be presented at the January 1981 meeting.

Group 4: Algae Resistance of Paint Films. The need for a method to determine algae growth in the presence (and absence) of mold was discussed. Microscopic and colorimetric methods for differentiation were described. W. Woods agreed to chair this group on a temporary basis and will do the preliminary library research to determine the information available on the subject.

Group 5: Recoating Mildewed Surfaces. A. Juby, Chairman, discussed several practices currently in use. A collection of methods presently in use will be made and a compilation of them will be presented at the January 1981 meeting.

SUBCOMMITTEE D01.29 SUBSTRATE PREPARATION FOR COATING TESTING

S.D. Ozenich, Chairman

The subcommittee considered comments received on Method D1734, "Making and Preparing Concrete and Masonry Panels for Testing Paint Finishes," which had been submitted for reapproval. One voter indicated that *mm* should be given preference to *in.* It was noted that this was contrary to established policy and was, therefore, considered non-persuasive. A second voter commented that reference should be made to the manual on nuclear coating work, Chapter 8. It was felt that this was inappropriate as the method is intended for laboratory testing only. The third voter commented that the bond coat mixture was too thin. Members felt that the current mix was adequate but that changes should be considered when making a major revision of the standard. This voter also felt that the word "cement" should be placed after "asbestos" everywhere the phrase "asbestos shingles" appeared. It was felt that this was a valid comment and the standard will be editorially revised to reflect this change. The fourth voter suggested that a precautionary statement was necessary in the section where the asbestos cement shingles were cut. Members agreed with this comment and drafted the following statement to be inserted in section 5.3 after the phrase "Cut the asbestos cement shingles" [Caution: use vacuum dust collector for removal of asbestos cement particles during cutting]. This was considered to be editorial and the standard will be submitted for reapproval on the Society ballot.

A negative on withdrawal of Method D1733, "Preparation of Aluminum Alloy Panels for Testing Paint, Varnish, Lacquer and Related Products," was discussed. The voter agreed to withdraw his negative upon agreement that development of a new method or recommended practice would be considered at a future date. It was voted to submit Method D2201, "Preparation of Hot Dipped Nonpassivated Galvanized Steel Panels for Testing Paint, Varnish, Lacquer and Related Products," for concurrent subcommittee and main committee ballot. Members were advised that the chairman would be sending out a questionnaire on preparation of sandblasted steel panels for paint testing as a first step in establishing a task group on this subject.

The balance of the 1980 Subcommittee reports of ASTM Committee D-1 will be published in the October 1980 issue of the JCT.—Ed.

United Kingdom Orders of FSCT Educational Literature

Mr. Ray Tennant, of the Birmingham Society, will act as a source of Federation educational literature (Color-matching Aptitude Test Set; Infrared Spectroscopy; Paint/Coatings Dictionary) for United Kingdom customers. Anyone interested in receiving these items is urged to contact Mr. Tennant. His address is: Carrs Paints Limited, Westminster Works, Alvechurch Road, Birmingham B31 3PG, England.

Society Meetings

Birmingham — June 19

Honored guests in attendance included Federation President, Elder Larson, and Executive Vice-President, Frank Borrelle.

To commemorate his visit during the Club's 50th Anniversary, Mr. Larson was presented with the Presidential Jewel. He then presented Society President, John Hitchin, with a Federation certificate in honor of the event. After words of appreciation, Mr. Borrelle congratulated the Club.

Mr. Larson, the Technical Speaker for the evening, spoke on "FLAMMABILITY POTENTIAL OF SURFACE COATINGS."

After outlining the present work on flash points and the explosive limits of solvents and solvent mixtures, Mr. Larson compared different test methods used to determine flash point. Reference was made to the Club's audio-visual presentation on the setaflash.

In conclusion, Mr. Larson stated that present computer calculations were unreliable for predicting the flash points of aqueous solvent blends.

BRIAN ADDENBROOKE, *Secretary*

Golden Gate — June 16

The following officers were elected for 1980-81: President—Sharon Vadnais, of E.T. Horn Co.; Vice-President—E. "Bud" Harmon, of Borden Chemical Co.; Treasurer—Don Mazzone, of The O'Brien Corp.; Secretary—Wayne Cochran, of Tenneco Chemical Co.; and Council Representative—Gordon Rook, of The O'Brien Corp.

Chairman of the Scholarship Committee, Barry Adler, announced that Kenneth Adkins, Melany Shaw, and Tracy Waldron will each be awarded a $500 scholarship for the year 1980-81. Carol Anton, of The O'Brien Corp., was presented with an award for being Top Student in the Society's Paint Education class.

Bill Ellis, President-Elect of the Federation, gave a talk and slide presentation highlighting Federation organization and activities. He emphasized the teaching aids, technical information, and publications which are available for members of the Federation.

DON L. MAZZONE, *Secretary*

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Eudowood Gardens, Towson). DONALD KEEGAN, Valspar Corp., 1401 Severn St., Baltimore, MD 21230.

BIRMINGHAM (First Thursday—Warwickshire County Cricket Club). B. J. ADDENBROOKE, Croda Paints Ltd., Bordesley Green Rd., Birmingham B9 4TE, England.

CHICAGO (First Monday—meeting sites in various suburban locations). LAYTON F. KINNEY, Standard T Chemical Co., Inc., 10th & Washington Ave., Chicago Heights, IL 60411.

C-D-I-C (Second Monday—Sept., Nov., Jan., Mar., May in Columbus; Oct., Dec., Feb., Apr., in Cincinnati, Kings Island Inn). NELSON W. BARNHILL, Inland Div., G.M.C., P.O. Box 1224, Dayton, OH 45401.

CLEVELAND (Second Tuesday—meeting sites vary). CARL J. KNAUSS, Kent State University, Kent, OH 44242.

DALLAS (Thursday following second Tuesday). WILLIAM A. WENTWORTH, Jones-Blair Co., P.O. Box 35286, Dallas, TX 75235

DETROIT (Fourth Tuesday—meeting sites vary). JOHN J. GENTILIA, Union Carbide Corp., 26500 Northwestern Hwy., Southfield, Mich. 48037.

GOLDEN GATE (Monday before third Wednesday—Sabella's Restaurant, San Francisco). WAYNE COCHRAN, Tenneco Chemicals, Inc., P.O. Box 608, Pleasanton, CA 94566.

HOUSTON (Second Wednesday—Look's Sir-Loin Inn). KLEBERT JACOBSON, Cron Chemical Corp., P.O. Box 14042, Houston, TX 77021.

KANSAS CITY (Second Thursday—Cordon Bleu). MIKE BAUER, Tnemec Co., Inc., P.O. Box 1749, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steak House). LLOYD HAANSTRA, Ameritone Paint Corp., P.O. Box 190, Long Beach, CA 90801.

LOUISVILLE (Third Wednesday—Essex House). JOHN LANNING, Porter Paint Co., 400 S. 13th St., Louisville, KY 40203.

MEXICO (Fourth Thursday—meeting sites vary). JUAN IRAZABAL, Grafex De Mexico .S.A., Calz. Tulychaulco 4615, Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Bill Wong's Restaurant). G.L. SIMPSON, Sico, Inc., 3280 Blvd. St. Anne, Quebec, P.Q., Canada G1E 3K9.

NEW ENGLAND (Third Thursday—Fantasia Restaurant, Cambridge). FRAN KOEBERT, Kyanize Paints, Inc., Second & Boston Sts., Everett, MA 02149.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). TED YOUNG, Jesse S. Young Co., Inc., P.O. Box 275, Hewlett, NY 11557.

NORTHWESTERN (Teusday after first Monday—Edgewater Inn). DON EMCH, Valspar Corp., 1101 3rd St. S., Minneapolis, MN 55415.

PACIFIC NORTHWEST (Portland Section—Tuesday following second Wednesday; Seattle Section—the day after Portland; British Columbia Section—the day after Seattle). ROBERT MILLER, Imperial Paint Co., 2526 N.W. Yeon, Portland, OR 97210.

PHILADELPHIA (Second Thursday—Valle's Steak House). WAYNE KRAUS, Lawrence-McFadden Co., 7430 State Rd., Philadelphia, PA 19136.

PIEDMONT (Third Wednesday—Howard Johnson's Coliseum, Greensboro, NC). SARA M. ROBINSON, Union Oil Co. of Calif., P.O. Box 7129, Charlotte, NC 28217.

PITTSBURGH (First Monday—Skibo Hall, Carnegie Mellon Univ.). WILLIAM CIBULAS, Mobay Chemical Co., Penn Lincoln Pkwy. W., Pittsburgh, PA 15205.

ROCKY MOUNTAIN (Monday prior to second Wednesday). DONALD R. BAGGE, George C. Brandt, Inc., 6500 Stapleton Dr. S., Denver, CO 80216.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant). JOSEPH J. WROBEL, JR., CIBA-GEIGY Corp., P.O. Box 26653, St. Louis, MO 63122.

SOUTHERN (Gulf Coast Section—Second Tuesday; Central Florida Section—Thursday after third Monday; Atlanta Section—Third Thursday; Memphis Section—Second Tuesday). WILLIAM G. EARLY, Piedmont Paint Mfg. Co., P.O. Box 6623, Station B, Greensville, SC 29606.

TORONTO (Second Monday—Town and Country Restaurant). A. SUK, K-G Packaging Ltd., P.O. Box 658, Concord, Ontario, Canada L4K 1C7.

WESTERN NEW YORK (Second Tuesday—Holiday Inn, Cheektowaga, NY). CHARLES S. GLINSKI, Pierce & Stevens Chemical Corp., 710 Ohio St., Buffalo, NY 14240.

Elections

GOLDEN GATE

Active

FARRUGIA, JOSEPH—Flecto Co., Inc., Oakland, CA.

GOODSON, KEITH S.—Memorex Corp., Santa Clara, CA.

GRANT FRED—Spencer Kellogg Div., San Carlos, CA.

HARTMANN, MARGARET R.—Midland Div. Dexter Corp., Hayward, CA.

HODSON, MATT E.—Memorex Corp., San Jose, CA.

HUNT, GEORGE C.—Kelly-Moore Paint Co., San Carlos.

MCGURK, ARTHUR C.—Midland Div. Dexter Corp., Hayward.

O'BRIEN, ANN—Flecto Co., Inc., Oakland.

SCHAFER, JULIAN E.—Kelly-Moore Paint Co., San Carlos.

SHUISKY, PAUL—Sem Products, Inc., Belmont, CA.

SULLIVAN, JERRY—Midland Div. Dexter Corp., Hayward.

YU, CECILIA L.—LTY Chemicals, Inc., Albany, CA.

Associate

PRIEBE, CHET H.—Shields, Harper & Co., Oakland, CA.

TOSTTENSON, PATRICIA—Pacific Anchor, Richmond, CA.

VADNAIS, SHARON—E.T. Horn Co., Oakland.

LOUISVILLE

Active

LYNCH, MICHAEL B.—Porter Paint Co., Louisville, KY.

Associate

COWHIG, DENNIS M.—Inmont Corp., Jeffersontown, KY.

NEW YORK

Associate

FEHRS, HERMAN—William B. Sanford, Dover, NJ.

HADDOCK, JOHN E.—Manchem, Princeton Junction, NJ.

JORDAN, JAMES J.—Harmon Colors Corp., Hawthorne, NJ.

ROEST, HANS—Radiant Color, Brookside, NJ.

TORONTO

Associate

ARNOTT, JOHN S.—L.V. Lomas Chemical Co., Mississauga, Ont. Can.

IGOR, NIKOLAJEV—Unique Coatings & Textures Ltd., Rexdale, Ont. Can.

VERA, DAN—Van Waters & Rogers Ltd., Weston, Ont. Can.

WESTERN NEW YORK

Active

FONDA, JAMES R.—Hughson Chemicals, Erie, PA.

KINSELLA, THOMAS P.—Spencer Kellogg, Buffalo, N.Y.

Associate

BETTES, JOHN—Harshaw Chemical, Cleveland, Ohio

KASPRZAK, HENRY A.—Spencer Kellogg, Buffalo, N.Y.

KNOTT, GLENN L.—Mooney Chemicals, Inc., Bloomingdale, NJ.

MAISCH, CHARLES—N L Chemicals, Tonawanda, N.Y.

Technical Articles in Other Publications

Compiled by the Technical Information Systems Committee—H. Skowronska, Chairman

Journal of the Oil and Colour Chemists' Association

Published by Oil and Colour Chemists' Association, Priory House, 967 Harrow Road, Wembley, Middlesex, HAO 2SF England

Vol. 63 No. 2 — February 1980

Banfield, T.A.—"OCCA Monograph Number 1—Marine Finishes. Part I"; 53–60.
Jayasri, A. and Yaseen, M.—"Solubility Parameter Values Suggested Using the Reported and Calculated Values for Organic Compounds"; 61–69.
Kapse, G.W. and Bela Rani, Km.—"Zinc-Rich Paints"; 70–76.
Hendifar, A.R. and Tirgan, M.R.—"Gas Chromatography Technique for the Analysis of Solvent Mixtures Based on Hydrocarbons Ester, Ethers, etc., Used in Paints and Lacquers"; 77–79.

Vol. 63 No. 3 — March 1980

Banfield, T.A.—"OCCA Monograph Number 1—Marine Finishes. Part II"; 93–100.
Goswami, D.N.—"Relationship Between Glass Transition and Melting Temperature of Natural Resins"; 101–102.
Kornum, L.O.—"Evaporation and Water-Dilutable Coatings"; 103–123.

Vol. 63 No. 4 — April 1980

Welch, M.J., Counsell, P.J.C., and Lawton, C.V.—"Study of the Natural Weathering of Sealants"; 137–143.
Rajagopalan, K.S., Guruviah, S., and Rajagopalan, C.S.—"Evaluation of Varnishes by Capacitance and Resistance Measurements"; 144–148.
Tripathi, S.K.M. and Khanna, B.N.—"Modification of Hydrolysed Lac with Epichlorhydrin and Epoxy Resin"; 149–152.
Giudice, C.A., Benitez, J.C., Rascio, V.J.D., and Presta, M.A.—"Study of Variables which Affect Dispersion of Antifouling Paints in Ball Mills"; 153–162.

Vol. 63 No. 5 — May 1980

Colclough, M.L., Smith, N.D.P., and Wright, T.A.—"A Low Shear Viscometer: An Instrument for Measuring Flow and Sag Resistance in Coatings"; 183–193.
Haken, J.K. and Obita, J.A.—"Chromatographic Analysis of Fatty Polyamide Resins after Alkali Fusion"; 194–199.
Croll, S.G.—"Correlation of the Adhesion of a Polystyrene Lacquer to Inorganic Substrates and their Wetting Characteristics"; 200–209.
Smits, C.I., Heertjes, P.M., and Kolar, Z.—"Radiotracer Study of the Competitive Adsorption on Titanium Dioxide of Stearic Acid Paired with Linoleic Acid and Palmitic Acid"; 210–213.

Double Liaison
(in French)

Published by EREC, 68 rue Jean-Jaures, 928000 Puteaux

Vol. 27 No. 294 — March 1980

Plazanet, J. and Lippler, R.—"Residual Solvents in Nitrocellulose Films"; 21-38.
Fabre, P.—"Boles and Disks at High Speed, by Modern Methods of Electrostatic Application of Paints"; 39-43.
Gonnet, O.—"Influence of Dispersing Agents and Thickeners on the Rheology of Emulsion Paints"; 44-46.

Farbe und Lack
(in German)

Published by Curt R. Vincentz Verlag, Schiffgraben 41-43, 3000 Hannover 1, Postfach 6247

Vol. 86 No. 5 — May 1980

Anon.—"Forecast for the West German Printing Ink Industry, in Light of Low Profits and Prices and High Turnover"; 411-412.
Marquardt, W.—"Liquid Epoxy Resins Based on Bisphenol F. Application for Low Viscosity, Non-crystallising Coating Masses, Casting Resins and Laminating Systems"; 413-419.
Brockmann, W., Hennemann, O.-D., and Kollek, H.—"Reactivity and Morphology of Metal Surfaces as a Basis for a Model of Adhesion"; 420-425.
Janik, G. and Möhler, H.—"Quantitative Differential Microcalorimetric Investigations into the Curing of Varnish Systems. (3) Isocyanate Crosslinking Polyester Resins"; 425-429.
Gross, H.—"Some Thoughts on the Introduction of the Term "Nominal Film Thickness" (DIN 55 928 Part 5); 429-430.
Brushwell, W.—"Newly Developed Materials for Corrosion and Building Protection"; 431-436.

Vol. 86 No. 6 — June 1980

Schwegmann, B.—"Rationalisation in Manufacture by the Use of Semi-Finished Products"; 491-492.
Becker, A.—"Electron Microscopic Preparative Techniques. (2)"; 493-498.
Kerner-Gang, W. and Pantke, M.—"Influence of Humidity on Tests with Blue Molds"; 499-504.
Ledwoch, K.-D.—"Insulating Fire Protection Coatings"; 505-506.
Gauler, K.-D. and Mohler, H.—"Quantitative Differential Microcalorimetric Investigations into the Curing of Varnish Systems. (4) Melamine Alkyd Resins"; 507-515.
Brushwell, W.—"New Lacquer Materials for Industrial Applications" (Literature review); 516-521.

Pigment and Resin Technology

Published by Sawell Publications, Ltd., 127 Stanstead Rd., London SE23 1JE

Vol. 9 No. 3 — March 1980

Scott, J.—"Does Correlation Exist between Accelerated and Conventional Exposures? Part II"; 12-14.

Vol. 9 No. 4 — April 1980

Walton, A.J.—"Gas Chromatography Procedures and Equipment for the Paints and Inks Industry. Part I"; 4-9.
Krishnamurti, N.—"Vinyl Monomers from 12-Hydroxy Stearic Acid"; 15-17.

Vol. 9 No. 5 — May 1980

Walton, A.J.—"Gas Chromatography Procedures and Equipment for the Paints and Inks Industry. Part II"; 4-10.

Meetings/Education

Coating Courses Currently Offered at Univ. of Detroit

The Polymer Institute of the University of Detroit, the Detroit Society for Coatings Technology and the Detroit Paint & Coatings Association are jointly sponsoring coating courses currently being held at the university. Beginning in September, the courses offered include:

"Coatings Laboratory"—The 7-week course emphasizes "hands-on" experience as it covers the use and operation of equipment used in quality control and R&D laboratories. Michael King, of Chrysler Corp., is Instructor.

"Fundamentals of Automotive Paint Systems"—A comprehensive survey of basic automotive paint raw materials and process systems is included. Instructor for the 14-week course is Donald Mordis, of Ford Motor Co.

"Modern Resin Technology"—The sessions of the 12-week course will include lectures on modern resin technology which illustrate the relationship between the structure of the resins and the properties of the coatings. Pertinent Federation Series books are also included.

"Principles of Color Technology"—Designed as an introduction for those with no previous education in the field, this "hands-on" course will deal with color matching and color control.

In addition to these offerings, the Polymer Institute is currently sponsoring a two-semester, six-credit course, "The Chemistry of Protective Coatings," which may be used towards a Bachelor's or Graduate Degree. With Dr. T.J. Anagnostou as Instructor, the topics expected to be covered include basic polymer concepts, paint formulation, urethane resin chemistry, emulsion polymerization, and analysis and characterization techniques.

For further details, contact Dr. Raul Chao at the University of Detroit, 4001 West McNichols Rd., Detroit, MI 48221.

Chicago Society to Cosponsor Management Seminar

The Chicago Society for Coatings Technology and the Chicago Paint and Coatings Association will cosponsor a Management Development Seminar to be held at the Fountain Blue, Des Plaines, IL, on October 2.

The seminar will be conducted by Dr. David L. Ward, who will present the topic, "The Money Value of Time." Advance registration is $40; $45 at the time of the seminar.

For more information, or to register, please contact the Seminar Chairman, George Irby, Rohm and Haas Co., 5750 W. Jarvis Ave., Niles, IL 60648; or call, (213) 647-8866.

Montreal and Toronto Joint Symposium Focuses on Corrosion

The 13th annual joint Fall Symposium of the Montreal and Toronto Societies for Coatings Technology examined the topic of "Corrosion" September 17 and 18. The Symposium was held September 17 at Bill Wong's Restaurant in Montreal, and followed on September 18 at the Town & Country Restaurant in Toronto.

The program featured the following presentations:

"Economic Aspects in the Protection of Steel"—Abel Banov, Senior Editor of the American Paint and Coatings Journal.

"Mechanisms of Corrosion"—Dr. G.M. Sastry, of Chrysler Corp.

"Super Coatings"—Dr. Thomas Ginsberg, of Union Carbide Corp.

"Polyurethanes: Coatings of the '80s?"—Ronald G. Eritano, of Mobay Chemicals.

"The Design of Aqueous Coatings and Flash Rusting"—John Fitzwater, of Polyvinyl Chemical Industries, Inc.

"The European View of Corrosion Prevention"—Dr. Tom Bullet, Director of the Paint Research Association, England.

Serving as co-chairmen for the sessions were Bob Rauch (Montreal), of Tioxide, Inc., and Helmut Zapfe (Toronto), of Ashland Chemicals.

Chicago to Offer Course In Coatings Technology

A "Course in Coatings Technology" will be sponsored by the Joint Education Committee of the Chicago Society for Coatings Technology and the Chicago Paint and Coatings Association. The course will be held at Elmhurst College, Elmhurst, IL, on Thursday evenings from 6:00 to 9:00 pm, October 2 through March 26, 1981.

The course is designed to offer the fundamental tools needed in the coatings industry, and will cover such topics as formulating techniques, raw materials, quality assurance, application methods, problem solving, and environmental considerations.

The cost of the course is $300, which includes printed notes and textbook. An optional take home exam will be given with cash awards presented for the best three papers.

To obtain the registration form, contact Ms. Dolores Thomas, Chicago PCA, 35 E. Wacker, Suite 1936, Chicago, IL 60602; or, for more information, write Mr. Fred Foote, U.S. Gypsum Co., 1000 E. Northwest Hwy., Des Plaines, IL 60016.

Rolla Schedules Bridge Maintenance Course in St. Louis

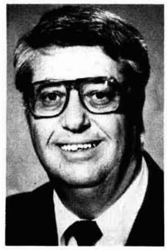
The University of Missouri-Rolla, in cooperation with the Institute for Bridge Integrity and Safety, will present a one-day course on "Protective Coatings for the Maintenance of Bridges and Structures" on Oct. 23, 1980, in St. Louis.

For further information, contact Norma R. Fleming, Conference Coordinator, Arts and Sciences Continuing Education, University of Missouri-Rolla, Rolla, MO 65401.

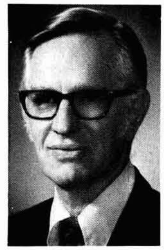
People

Gabriel Malkin recently joined the Jesse S. Young Co., Hewlett, NY, as Manager of Equipment Sales. A member of the New York Society, Mr. Malkin has over 30 years' experience in the chemical and coatings industry. He previously served as Chief Engineer for Benjamin Moore & Co.

G. Malkin



R.E. Collins



P. Stendel

R.W. Kent

The Printing Ink Div. of Borden Chemicals, Columbus, OH, has announced the following appointments: **Thomas Trevor Rhodes**—Director of the Pigments Div. in Cincinnati; **George C. Morehouse, III**—Sales Representative based in the Chicago area; and **Raymond E. Collins**—Sales Representative for the company's line of pigments and related products. Mr. Collins is a member of the Chicago Society.

Following the retirement of Harry H. Kay, Mac-O-Lac Paints, Detroit, MI, has elected **Philip Stendel** President. Mr. Stendel was formerly Vice-President of Operations. He has served as Past-President of the Piedmont Society and is presently a member of the Detroit Society.

The company has also named **Bernard Gardier** to the position of Chemist and **Alan Warchol** to Production Manager.

Robert W. Kent has been promoted to General Manager of the International Division of Carboline Co., St. Louis. He formerly served as Marketing Manager for the division.

In addition, the company has promoted **Michael J. Dugan** to the position of International Technical Manager. In this position, he will be responsible for the general management and expansion of the division.

Dr. Arthur E. Humphrey has been appointed Provost and Vice-President of Lehigh University. Dr. Humphrey, formerly Dean of the College of Engineering and Applied Science at the University of Pennsylvania, will succeed **Dr. A.C. Zettlemoyer**, who will return to his career in research as University Distinguished Professor and President of the American Chemical Society.

Joseph Fath has been promoted to Senior Vice-President of Tenneco Chemicals, Saddle Brook, NJ. Mr. Fath, who previously served as Vice-President, will continue to be responsible for all corporate planning and development, including long-range planning, research and development, and engineering.

Wyandotte Paint Products Co. has appointed **Stanley J. Thompson, Jr.** to the new position of Group Vice-President—Operations. In his new post, he will have overall responsibility for sales, research and development, and manufacturing.

Daniel H. Monroe has been appointed Director of Corporate Purchases for all Lilly Industrial Coatings plants. In addition to his new duties, he will continue as Vice-President of Purchases for the firm's High Point, NC plant.

Robert N. Jones has been appointed President of Davies Can Co., a division of Van Dorn Co. Most recently, Mr. Jones served as President of Energy Conservation, of Cleveland.

Bob Desjardins has been appointed Executive Vice-President for Trade Sales at the Devoe and Raynolds Co. of Louisville. Contributing 34 years' experience in the paint business, he will assume responsibility for sales, marketing, and manufacturing in the division.

Penn Color, Inc., Doylestown, PA, has appointed **David M. McGarrity** Vice-President of sales and marketing. Mr. McGarrity will direct all marketing activities for the company's line of color dispersions and will report to **Edgar N. Putman**, President.

Progress Paint Mfg. Co., of Louisville, has named **Michael L. Platt** Advertising Manager. His duties will include advertising for both the Industrial Coatings Div. and the company's trade sales, which include Gray-Seal paint products.

Cyanamid has appointed **Vincent A. Lindgren** National Sales Manager for its line of color pigments. He will direct the sales activities of the Pigments Dept. from its headquarters in Wayne, NJ.

The Paint Research Association has appointed **M.G.B. Wright** to the newly created post of Seminar Coordinator. Under the direction of **L.A. Tysall**, Training Manager, he will expand the seminar program to meet the needs of PRA's membership, as well as an increasing number of paint user organizations, equipment manufacturers, and instrument makers.

As part of its managerial realignment, Kerr-McGee Chemical Corp., Oklahoma City, has announced the following appointments: **W.L. Johnson**—Vice-President, agricultural products; **J.R. Kelly**—Vice-President, electrolytic products; and **W.B. Hayes**—Vice-President, pigment.

W.W. Young, Executive Vice-President of the firm, is now responsible for soda products operations.

H. Barclay Morley, of Stauffer Chemical Co. was elected Chairman of the Board of the Chemical Manufacturers Association. He succeeds **John M. Henske**, of Olin Corp. **William G. Simeral**, of E.I. du Pont de Nemours & Co., has been named Vice-Chairman and **Paul F. Oreffice**, of The Dow Chemical Co. was elected Chairman of the Executive Committee.

Newly elected to the Board of Directors were: **Richard C. Ashley, Dexter F. Baker, Raymond F. Bentele, Charles E. Brookes, Harry W. Buchanan, Carlyle G. Caldwell, Robert S. Dudley, Richard E. Engebrecht, Alexander F. Giacco,** and **Arthur L. Goeschel.**

Also elected to the CMA board were: **James B. Henderson, William G. Kay, Jr., Dwight C. Minton, Charles W. Parry, M. Whitson Sadler, George J. Sella, Jr., Allan J. Tomlinson, Konrad M. Weis,** and **Louis G. Zachary.**

Literature

Polymeric Resins

Literature is now available which describes polymeric resins which can be used as absorbents, enzyme or catalyst supports, or as polymeric reagents in situations where conventional materials give inadequate performances. Copies of this brochure can be obtained from Ron Lawrence, Diamond Shamrock Corp., 800 Chestnut St., Redwood City, CA 94063.

Solvent

A new glycol ether solvent for use in water-dilutable coating systems is introduced in literature. Among the advantages reported are faster drying time, improved water miscibility at elevated temperatures, lower resin solution viscosity, and low odor. For further information, write Eastman Chemical Products, Inc., Coatings Chemicals Div., B-280, Kingsport, TN 37662.

Chemical Intermediates

Recently released literature describes a new line of chemical intermediates and polymers. Included are polyethylene imine derivatives, used in coatings and printing inks, latex paints and adhesives, water treatment and electroconductive resins. For additional information, contact D. Dorrycott, Thiokol Specialty Chemicals Div., P.O. Box 8296, Trenton, NJ 08650.

Silicas

A new brochure describes a line of silicas which are functional in the plastics, coatings, adhesives, pharmaceutical, and other industries. Also included are the various applications, properties, typical physical and chemical characteristics, and test methods of the silicas. For a copy, write Industrial Chemicals Dept., W.R. Grace & Co., Davison Chemical Div., P.O. Box 2117, Baltimore, MD 21203.

Acrylic Latex Enamel

The advantages and uses of a new water-based gloss enamel are discussed in a recently issued fact sheet. Reportedly designed to provide superior gloss and color retention, the water-based formulation of the enamel enables easy application, low odor, and water clean-up. Complete information can be obtained from The O'Brien Corp., 450 East Grand Ave., South San Francisco, CA 94080.

Filler Products

A 22-page booklet is now available which details information on diatomite filler products. Applications are discussed including grade used, amount suggested, the properties of that grade, and the benefits those properties offer the producer. For a copy of FF-63, contact Carol Ebert, Filtration & Minerals Div., Johns-Manville, Ken-Caryl Ranch, Denver, CO 80217.

Test Panel

A black and white metal test panel designed for determining the hiding power of powder coatings is described in a newly released data sheet. The panel is described as being receptive to electrostatic spray application and as showing no distortion or discoloration. Samples and literature may be obtained from The Leneta Co., P.O. Box 576, Ho-Ho-Kus, NJ 07423.

Convenient Container

Literature describing a new, easy-to-handle 50 lb drum now being used for packing Cosan P fungicide is now available. The container is easier to store and is the first use of a small drum for packing this type of dry product. For more information, contact Cosan Chemical Corp., 400 14th St., Carlstadt, NJ.

Phenolics

Product information bulletins on two phenolics for coatings used in drum, pail and can lining applications have been issued recently. A 4-page bulletin, F-47489, describes a phenolic resin which can be used to formulate thermosetting solvent-based or powder systems. A 6-page brochure, F-47415, covers a phenolic resin developed for formulating crosslinkable water-borne coatings systems. Each brochure contains a table of typical properties, a table indicating compatibility with other polymers, and a discussion of food additive status. Copies can be obtained from Union Carbide Corp., Coatings Materials Div., Dept. JLS, 270 Park Ave., New York, NY 10017.

Ketone Solvents

Meeting the challenge of formulating coatings with ketone solvents is the topic of a new informational brochure. This 8-page guide addresses the problems of meeting stricter EPA solvent emissions standards while keeping costs in line. Included are tables and graphs to illustrate the maximum amounts of solvents allowed by current guidelines, as well as comparative data on ketones and esters, and a complete listing of properties of ketone solvents. For a copy of "Shell Ketone Solvents for Economical Low-Emission Coatings Systems," write Shell Chemical Co., Manager, Solvents Communications, One Shell Plaza, Houston, TX 77002.

Low Energy Curing

Literature is now available which describes a catalyzed polyester/epoxy coating. This brochure covers typical applications of these low energy curing coatings, as well as the results of chemical and stain resistance tests. For more information, contact Progress Paint Mfg. Co., Inc., Industrial Coatings Div., P.O. Box 33188, Louisville, KY 40232.

Polyurethane Coatings

A revised technical bulletin on coatings for finishing plastics is now available. The six-page brochure includes discussion of typical properties, spray equipment chart information, and performance characteristics. Bulletin DS10-7058 can be obtained by writing to Hughson Chemicals, Lord Corp., 2000 W. Grandview Blvd., P.O. Box 1099, Erie, PA 16512.

Industry Survey

"The Paint Industry Today: World Trends," a comprehensive and concise survey of the paint industry throughout the world, has recently been published by the Paint Research Association. Written by Shun'ichi Nakanishi and translated from Japanese, the article includes industry information from the Far East, including the People's Republic of China, the Near and Middle East, Brazil, Africa and Oceania, and Eastern and Western Europe. For additional information, contact Mrs. Caroline Veitch, Publications Coordinator, Information Dept., Paint Research Association, Waldegrave Rd., Teddington, Middlesex TW11 8LD England.

"Standard for Metric Practice"

This latest edition of a comprehensive guide for application of the International System of Units (SI) consists of 42 pages of up-to-date information including a listing of non-SI units recognized for use with SI units and a list of conversion factors. Publication 06-503807-41 is available from American Society for Testing and Materials, Sales Service Dept., 1916 Race St., Philadelphia, PA 19103.

Polyurethanes

Information is now available which describes clear liquid plastic polyurethanes available in spray cans. For more information, contact Bernard Tucker, Trade Sales Manager, McCloskey Varnish Co., 7600 State Rd., Philadelphia, PA 19136.

Pump Catalog

A 16-page, condensed, fully illustrated, rotary pump catalog includes revised pump features, specifications, drive arrangements, pump size selection diagrams, performance curves, and a list of liquids and the markets in which they are used. Internal and external gear pump lines are shown and described. For a copy of Bulletin 80-S, contact Viking Pump Div., Houdaille Industries, Inc., Cedar Falls, IA 50613.

Coating Thickness Gauge

In literature now available, this small portable instrument, operated from a 9 volt battery with the option of an AC adaptor, is described. There is one scale of 0-20 mils which also reads in metric units of 0-500 microns. Measurement can be made of all nonmagnetic coatings such as electroplating and paint on a steel base. The probe is of the constant pressure single contact type fitted with a V slot for measurement on cylindrical objects. To obtain additional information, contact Surfatest, Inc., Suite 224, Airport Executive Center, 5700 Thurston Ave., Virginia Beach, VA 23455.

Costing for Industrial Paint Finishing

A new, 152-page manual prepared for the Paint Research Association by Value Control Ltd. is now available. The manual identifies capital and operating costs for each stage of all commonly used industrial finishing processes and sets up a framework enabling managements to calculate unit costs for various types of articles and volumes of production. The publication can be obtained from the Paint Research Association, Waldegrave Rd., Teddington, Middlesex, TW11 8LD, England.

Heat Pumps

A brochure on water-source heat pumps for recycling heat energy in manufacturing plants is now available. The 6-page bulletin includes three case histories, as well as descriptions of operating and construction features. For a copy of ENER 1-130, contact American Air Filter Co., 215 Central Ave., Louisville, KY 40277.

RH Control

A device which automatically senses and controls relative humidity, for use in paint booths, spray coating systems, and environmental test chambers, is described in newly released literature. For more information, contact Kathy Repko, Zorelco Ltd., P.O. Box 4444, Dept. Q-7, Cleveland, OH 44125.

Amorphous Silica

A new brochure gives complete details on a filler-extender, natural-occurring amorphous silica. The brochure offers technical information, including specifications, several of the surface treatments available, and performance test data. Write for Bulletin # 204 from Illinois Minerals Co., 2035 Washington Ave., Cairo, IL 62914.

Epoxy Coating Systems

Three heavy duty epoxy coating systems intended to provide excellent resistance to chipping, abrasion, chemicals and corrosion in severe exposures and water immersion applications are described in a new eight-page bulletin. For additonal information, request Publication # 7431 from Rust-Oleum Corp., 11 Hawthorn Pkwy., Vernon Hills, IL 60061.

Titration System

A fully automatic titration system which provides a direct digital readout of water content without calculation is the subject of recently issued literature. This system combines solid-state computing techniques with a peristaltic metering pump. For additional information, contact Mr. Graham Gibson, Baird & Tatlock (London) Ltd., P.O. Box 1, Romford RM1 1HA, England.

IR Spectrophotometers

A two-page, four-color pamphlet which summarizes an entire line of infrared spectrophotometers is now available. Specifications and wavelength ranges of 12 instrument are illustrated. For a copy of Order No. L-51F, write the Perkin-Elmer Corp., Main Ave., Mail Station 12, Norwalk, CT 06856.

Mill Classifier

A new mill classifier, effective for fine grinding and for classifying heat sensitive materials at relatively high volumes, is described in recent literature. To obtain more information, write D. Hurowitz, Alpine American Corp., 5 Michigan Dr., Natick, MA 01760.

Wet Adhesion Monomer

In technical literature now available, a new wet adhesion monomer is discussed. It is designed to improve wet adhesion in paints and is a 90% active clear liquid containing both allylic and ureido functionalities. Samples and technical information are available from Alcolac, Inc., A. Peterkofsky, 3440 Fairfield Rd., Baltimore, MD 21226.

Small Media Mill

A brochure describing a new small media mill has recently been published. This brochure contains complete technical data, dimensions, and operating characteristics on the continuous throughput, high-speed, horizontal small media mill for wet grinding and dispersion of suspensions. Copies of the brochure may be obtained from Chicago Boiler Co., Dept. RN, 1965 Clybourn Ave., Chicago, IL 60614.

pH Monitoring System

A new on-line monitoring system for application in municipal water and waste treatment, industrial waste treatment, cooling towers, reverse osmosis units, rinse tanks, and plating baths is the subject of recently prepared literature. Through an exclusive remote power alarm module, the monitor becomes an on/off pH controller for acid waste neutralization prior to dumping effluent into public waterways. For additional information contact Beckman Instruments, Inc., Technical Information Section, Process Instruments Div., 2500 Harbor Blvd., Fullerton, CA 92634.

Coatings Products

A 16-page brochure, "Products for the Coatings Industry," describes products and the applicability of each for various markets, including trade sale paints, industrial finishes, automotive primers, marine paints, caulks and sealants, specialty coatings, and traffic paints. Also listed are U.S. and Canadian distributors, as well as a summary of technical literature, data sheets, and formulary information. For additional information, write the Minerals & Chemicals Div., Engelhard Minerals & Chemicals Corp., Menlo Park, Edison, NJ 08817.

Double-Arm Mixers

A broad line of "mix-matched" double-arm mixers are described in a newly-produced 24-page brochure. This two-color catalog details a selection of design features and options, including comparison of tangential or overlapping mixing action, optimum uses of five different agitator blades, types of drives, discharge valves, and basic envelope dimensions. For a copy of Bulletin 700-A, write Day Mixing, Div. of LeBlond, Inc., 4932 Beech St., Cincinnati, OH 45212.

Benzyldimethylamine

Current and potential applications of benzyldimethylamine, a polymerization catalyst for epoxy resins, polyesters, polyethers, and polyurethanes, are discussed in a recently published technical bulletin. Also included are specifications, properties, and safe handling information. For Technical Bulletin 165, write Sherwin Williams Chemicals, Publications Dept., 10909 S. Cottage Grove Ave., Chicago, IL 60628.

NACE Corrosion Engineer's Reference Book

This new publication is a compilation of carefully researched information, presented as tables, graphs, and charts which give the physical, mechanical, chemical, and performance properties of materials in certain environments and industries. The hard bound, 235-page book includes a complete glossary, conversion tables, physical and chemical data, corrosion data, engineering data, chapters on metals and alloys and nonmetallic materials and coatings, and a complete list of pertinent NACE and ASTM Standards. The price is $25.00 for NACE members and $30.00 for nonmembers. To obtain more information, write to National Association of Corrosion Engineers, P.O. Box 218340, Houston, TX 77218.

Book Review

ADHESION MEASUREMENT OF THIN FILMS, THICK FILMS, AND BULK COATINGS

Edited by
K.L. Mittal

Published by
American Society for Testing and Materials
Philadelphia, PA
1978 (410 pages) $39.25

Reviewed by
C.A. Kumins
Sherwin-Williams Co.
Cleveland, Ohio

This book includes the papers presented at the symposium entitled "Adhesion Measurement of Thin Films, Thick Films, and Bulk Coatings" held at the ASTM headquarters in Philadelphia on November 2-4, 1976. The first section deals with erudite discussions on the various facets of the phenomena generally associated with adhesion, e.g., surface chemistry and physics, interfacial energies and fracture mechanics. These areas are very adequately analyzed by well-known experts in the field. They review for the reader the fundamental background of the subject.

Subsequent sections are concerned with specialized techniques for measurement of thick and thin films. While some manuscripts consider substrates on which organic coatings have been deposited, many describe systems involving the adhesion of ceramic materials, electrodeposited metals, electronic components, flame sprayed coatings and the like.

The methods used for measurement of adhesives run the gamut of the well known scratch, tensile pull and peel tests in their various specimen configurations as well as such exotic and unique techniques involving laser spallation, ultrasonic vibration amplifiers and electromagnetics.

There are some detailed mathematical analyses in the "scratch test" papers which are of interest. They indicate that there are more basic complexities associated with the usually considered simple test than is generally recognized.

This little volume is highly recommended to those concerned with adhesion problems and other interested persons. The summary of the present opinions of some of the experts in the field and the opportunity to become acquainted with the mensuration techniques used by those who work with materials other than organic coatings and adhesives are valuable. The imaginative approaches are stimulating.

The reviewer wishes to register a relatively minor complaint because so little attention is placed on the role of water in the adhesion phenomenon. After all, most joints are prepared and exposed in the ambient moisture containing atmosphere. The ability of the water molecules to displace a previously adsorbed moiety plays a very important part in ultimate joint strength and durability.

Letters to the Editor

Authors Support 'Plastic Pigment' Concept

TO THE EDITOR:

Mr. Steig's questions [*JCT, Aug. 1980, p. 86*] concerning the validity of considering polystyrene beads as "pigment" in PVC calculations deserve further discussion. The glass transition of polystyrene occurs at approximately 100°C. Consequently, polystyrene latex does not form a film at ambient temperatures. Therefore, we adopted the convention of treating polystyrene latex as pigment in PVC calculations and subsequently coined the terminology "plastic pigment." It seems inconsistent to consider nonfilm-forming ingredients as part of the vehicle system regardless of the chemical nature of these ingredients. It is our opinion that to do so would be in violation of the concept of paint binder. After all, what is a binder with binder index equal to zero? Binder index of zero implies a binder with no binding properties which is a totally inconsistent play on words and concepts.

Evidently, Mr. Steig has misinterpreted the options available to paint formulators for adjusting the cost/performance balance when using plastic pigment. Our published work states that cost can be reduced while maintaining quality and we present experimental evidence to support this statement. Further, we have observed that quality can be improved without a corresponding increase in cost. Consequently, it is our experience that using plastic pigment results in a valuable contribution to quality as well as to company profitability.

We are sure that Mr. Steig would not object to the use of new technology that results in either maintaining or improving quality while improving paint company profitability.

ALEXANDER RAMIG, JR.,
F. LOUIS FLOYD
Glidden Coatings and Resins
Div. of SCM Corp.

Coming Events

FEDERATION MEETINGS

(Oct. 28)—Federation Board of Directors Meeting. Hyatt Regency Hotel, Atlanta, Ga. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, Pa. 19107).

(Oct. 29–31)—58th Annual Meeting and 45th Paint Industries' Show. Atlanta Civic Center, Atlanta, Ga. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, Pa. 19107).

(Mar. 24–26)—"Symposium on Color and Appearance Instrumentation." Executive West, Louisville, KY. Jointly sponsored by Federation of Societies for Coatings Technology, Manufacturers Council on Color and Appearance, and Inter-Society Color Council. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, Pa. 19107).

(May 14–15)—Spring Meetings. Society Officers on 14th; Board of Directors on 15th. Hilton Hotel, Denver, CO. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Oct. 28–30)—59th Annual Meeting and 46th Paint Industries' Show. Cobo Hall, Detroit, MI. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

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(Apr. 29–30)—Spring Meetings. Society Officers on 29th; Board of Directors on 30th. Boston, MA. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

(Nov. 3–5)—60th Annual Meeting and 47th Paint Industries' Show. Sheraton Washington Hotel, Washington, D.C. (FSCT, 1315 Walnut St., Suite 832, Philadelphia, PA 19107).

PAINT RESEARCH INSTITUTE MEETING

(May 4–5)—Paint Research Institute Symposium on "Stability and Stabilization of Coatings Systems," Battelle Memorial Institute, Columbus, Ohio. (Dr. Raymond R. Myers, Chemistry Dept., Kent State University, Kent, Ohio 44242).

SPECIAL SOCIETY MEETINGS

(Oct. 2)—Chicago Society's Management Development Seminar, "The Money Value of Time." Fountain Blue, Des Plaines, IL. (George Irby, Rohm and Haas Co., 5750 W. Jarvis Ave., Niles, IL 60648).

(Oct. 7)—Cleveland Society Manufacturing Committee Symposium, "Formulation for and Utilization of Pigment Dispersion Equipment." Cleveland Engineering and Scientific Center, Cleveland, Ohio. (G. Dubey, Cambridge Coatings, Inc., 5461 Dunham Rd., Cleveland, Ohio 44137).

(Mar. 4–6)—Western Coatings Societies Symposium and Show. Disneyland Hotel, Anaheim, CA. (Richard C. Sutherland, E.T. Horn, Co., 16141 Heron Ave., La Mirada, CA 90638.)

(Mar. 11–13)—Southern Society. 45th Annual Meeting. Plaza South Hotel, Birmingham, AL (Peter F. Decker, Union Carbide Corp., 17 Executive Park Drive, N.E. Atlanta, GA 30359).

(Mar. 24–25)—Cleveland Society 24th Annual Conference, "Advances in Coatings Technology." Baldwin-Wallace College, Berea, OH. (George R. Pilcher, Sherwin-Williams Co., 601 Canal Rd., Cleveland, OH 44113.)

(May 1-2)—Pacific Northwest Society. Annual Symposium. Washington Plaza Hotel, Seattle, WA.

(May 9)—Montreal Society. Fiftieth Anniversary dinner-dance, Montreal Que.

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(Mar. 10-12)—Southern Society Annual Meeting. Savannah, Ga.

(Apr. 22-24)—Southwestern Paint Convention. Shamrock Hilton Hotel, Houston, TX.

(May 6-8)—Pacific Northwest Society. Annual Symposium. Vancouver, B.C.

OTHER ORGANIZATIONS

(Oct. 5-8)—Society of Plastics Engineers and Fire Retardant Chemicals Association Joint Conference on "Flammability in Building and Construction—Today and Tomorrow." Ponte Bedra Club, Ponte Vedra Beach, FL. (Fire Retardant Chemicals Assoc., 265 Post Road West, Westport, CT 06880).

(Oct. 5-10)—National Association of Corrosion Engineers Symposium, "NACE Corrosion Prevention by Cathodic Protection Course." Holiday Inn-McCloud Trail South, Calgary, Alberta, Canada. (Education Dept., NACE Headquarters, P.O. Box 218430, Houston, TX 77218.)

(Oct. 5-10)—NACE Symposium, "NACE Basic Corrosion," "Corrosion Prevention by Cathodic Protection," and "Corrosion Prevention by Coatings" Courses. Holiday Inn-Airport North, Newark, NJ. (Education Dept., NACE Headquarters, P.O. Box 218430, Houston, TX 77218.)

(Oct. 7-9)—AFP/SME "Liquid Coatings Conference." Conrad Hilton Hotel, Chicago, IL. (Susan Buhr, Society of Manufacturing Engineers, One SME Dr., P.O. Box 930, Dearborn, MI 48128).

(Oct. 13-15)—Society of Plastics Engineers National Technical Conference, "Coloring of Plastics; Update of 'The Law and You'." RETEC sponsored by the Baltimore Section and Color and Appearance Div., Baltimore Hilton Hotel, Baltimore, Md. (Robert C. Foley, Society of Plastics Engineers, 656 W. Putnam Ave., Greenwich, Conn. 06830.)

(Oct. 13-17)—"High Performance Coating Procedures," Monterey, Mexico. (Institute of Applied Technology, Jean L. Kaplan, 1200 - 17th St., N.W., Suite 406, Washington, D.C. 20036.)

(Oct. 14-16)—Seventh Annual Conference on Energy, "Energy Future: Prophets, Profits & Policies!" University of Missouri-Rolla/Department of Natural Resources. (Dr. J. Morgan, Conference Director, 122 Electrical Engineering, University of Missouri-Rolla, Rolla, MO 65401.)

(Oct. 17-19)—University of Waterloo Short Course, "Developments in Polymer Technology." Hotel Toronto, Canada (Prof. A. Rudin, Dept. of Chemistry, University of Waterloo, Waterloo, Ontario, Canada).

(Oct. 19-24)—National Association of Corrosion Engineers Symposium, "NACE Basic Corrosion Course," "Corrosion Prevention by Cathodic Protection," "Corrosion Prevention by Coatings," and "Corrosion Prevention in Oil and Gas Production" Courses. Holiday Inn-DFW Airport North, Dallas, TX. (Education Dept., NACE Headquarters, P.O. Box 218430, Houston, TX 77218.)

(Oct. 26-28)—"Women in Coatings—Meeting the Challenges," Univ. of Missouri—Rolla Short Course. Holiday Inn Downtown, Atlanta, GA. (Norma Fleming, Continuing Education, University of Missouri—Rolla, Rolla, MO 65401).

(Oct. 26-31)—National Association of Corrosion Engineers Symposium, "NACE Basic Corrosion," "Corrosion Prevention by Cathodic Protection," and "Corrosion Prevention by Coatings" Courses. Holiday Inn North, Tuscon, AZ. (Education Dept., NACE Headquarters, P.O. Box 218430, Houston, TX 77218.)

(Oct. 27-29)—93rd Annual Meeting, National Paint and Coatings Association, Atlanta Hilton Hotel, Atlanta, Ga. (Karen Bradley, NPCA, 1500 Rhode Island Ave., N.W., Washington, D.C.

(Nov. 5-6)—Third Resins & Pigments Exhibition. Hotel Nikko, Dusseldorf, Germany.

(Nov. 7-9)—University of Waterloo Short Course, "Engineering Aspects of Polymer Systems." Hotel Toronto, Canada (Prof. A. Rudin, Dept. of Chemistry, University of Waterloo, Waterloo, Ontario, Canada).

(Nov. 10-14)—"High Performance Coating Procedures," Houston, Tex. (Institute of Applied Technology, Jean L. Kaplan, 1200 - 17th St., N.W., Suite 406, Washington, D.C. 20036.)

(Nov. 10-21)—Paint Short Courses at University of Missouri-Rolla. Refresher Course for Maintenance Engineers, Contractors, and Painting Inspectors—Nov. 10-14; Job Estimating Workshop for Painting Contractors—Nov. 17-21. (Norma Fleming, Continuing Education, University of Missouri-Rolla, 501 W. 11th St., Rolla, MO.)

(Nov. 11-13)—4th International Conference of Paint Research Association, Excelsior Hotel, London Heathrow Airport. (PRA, Waldegrave Rd., Teddington, Middlesex TW11 8LD, England.)

(Nov. 17-Dec. 17)—Short Courses for the Chemical and Process Industries, The Center for Professional Advancement. "Water-Borne Industrial Coatings: Application"—Nov. 17-18; "Water-Borne Industrial Coatings: Chemistry and Formulation"—Nov. 19-20; "Organic Coatings Technology"—Dec. 3-5 and 15-17. Sheraton Motor Inn, East Brunswick, NJ (Rosanne Razzano, Dept. NR, The Center for Professional Advancement, P.O. Box H, East Brunswick, NJ 08816.)

(Nov. 19-21)—3rd Annual Western Plastics Exposition. Anaheim Convention Center, Anaheim, Calif. (Western Plastics Exposition, 1625 17th St., Santa Monica, CA 90404.)

(Nov. 21-23)—Annual National Decorating Products Association Convention and Show, H. Roe Bartle Convention Center, Kansas City, Mo. (NDPA, 9334 Dielman Industrial Dr., St. Louis, Mo. 63132.)

(Dec. 9-11)—Plant Engineering and Maintenance Show and Conference/West. Convention Center, Anaheim, CA. (Clapp & Poliak, Inc., 245 Park Ave., New York)

(Jan. 21)—ASTM Symposium, "Regiments for Predicting Permanence of Decorative and Protective Surfaces." Orlando, FL. (Symposium Chairman Garmond Schurr, Sherwin-Williams Co., 10909 S. Cottage Grove Ave., Chicago, IL 60628).

(Feb. 9-11)—Inter-Society Color Council. Williamsburg Conference, Williamsburg, VA. (Dr. Fred W. Billmeyer, Secretary, ISCC, Rensselaer Polytechnic Institute, Troy, NY 12181.)

(Apr. 6-10)—National Association of Corrosion Engineers "Corrosion/81." Sheraton-Centre and Hotel Toronto, Toronto, Ontario, Canada. (Conference Coordinator, NACE, P.O. Box 218340, Houston, TX 77218).

(Apr. 27-28)—Inter-Society Color Council Annual Meeting. Roosevelt Hotel, NY. (Dr. Fred W. Billmeyer, Secretary, ISCC, Rensselaer Polytechnic Institute, Troy, NY 12181.)

(Apr. 28-30)—OCCA-32. Oil and Colour Chemists' Association 32nd Annual Technical Exhibition. Alexandra Palace, London, England. (The Director and Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HAO 2SF, England.)

(June 14-17)—Dry Color Manufacturers' Association Annual Meeting. The Greenbriar, White Sulphur Springs, WV. (P.L. Lehr, DCMA, Suite 100, 1117 North 19th St., Arlington, (Rosslyn) VA 22209.)

(June 17-20)—Oil and Colour Chemists' Association Conference, "Alternative Technologies in Coatings." Stratford Hilton Hotel, Stratford-on-Avon, England. (The Director and Secretary, OCCA, Priory House, 967 Harrow Rd., Wembley, Middlesex HA0 2SF, England.)

(Sept. 13-16)—Canadian Paint Manufacturers Association. Four Seasons Hotel, Vancouver, B.C. (Lydia Palazzi, Canadian Paint Manufacturers Assn., 2050 Mansfield, Montreal, Que., Canada H3A 1Y9.)

(Sept. 20-25)—4th Congress of the Association Internationale de la Colueur, "COLOR 81." International Congress Centre (ICC), Berlin (West), Germany. (Prof. Dr. Heinz Terstiege, (AIC COLOR 81), Bundesanstalt fur Materialprufung (BAM), Unter den Eichen 87, D-1000 Berlin 45, Federal Republic of Germany).

Advertisers Index

'Humbug' from Hillman

Some months ago at a Publications Committee meeting for the JCT, this big-mouth ventured the opinion that (as I have hinted in the past) the reading matter in this eminent magazine has tended to be somewhat ponderous and to the less erudite—somewhat obscure. I suggested, therefore, that it might be a delightful surprise to occasionally find a light comment and an amusing thought in its pages.

As always happens in such situations, I was promptly awarded the responsibility for a column that was to be devoted to the lighter side. As I don't see myself as a funny person or even an amusing one, I protested that my desire to be amused reflects no ability to amuse others—as you will see. Like so many others of you out there in readership land, I try desperately to remember jokes to tell at the next customer luncheon and after 15 minutes, can't remember the punch line.

My protests were of little avail and the members of the committee assured me that I would be fed ample funny material. So far, I've been on a starvation diet. The only funny thing we've had to offer in the JCT is Frank Borrelle's picture.

So—now I had a column to edit with no material and no title. Without any material I decided to devote myself to the frustrating job of finding a heading and a column that could be considered "funny." While reading through the H's in that fascinating volume originally written by Webster, I came upon "Humbug." Definition 3 says—"Drivel, Nonsense." Thus, the title!

No sooner had I made the decision to explore the possibility of that as a lead line, along came a contribution of sorts from the aforementioned funny person—Frank Borrelle. I must say that it is more appropriate than hilarious. I would like to credit (?) the original author but somehow the name fortunately got lost in its route to a nameless friend of Sid Lauren, of Coatings Research, who sent it on to Frank.

Before I end this first attempt at a column and perhaps my writing career with this analytical masterpiece, I dare my readers to send me funny stuff for I will unhesitatingly feature the contributor's name. —*Herb Hillman*

A Key to Help You Understand Scientific Literature

When the author writes . . .
"IT HAS LONG BEEN KNOWN THAT" . . .
He really means . . .
(I can't be bothered to look up the original article)

"OF GREAT THEORETICAL AND PRACTICAL IMPORTANCE" . . . (Interesting to me)

"THREE OF THE SAMPLES WERE CHOSEN FOR FURTHER STUDY" . . . (We couldn't make any sense out of the others)

"HANDLED WITH EXTREME CARE DURING THE EXPERIMENTS" . . . (Not dropped on the floor)

"TYPICAL RESULTS ARE SHOWN . . . (The best results are shown)

"CORRECT WITHIN AN ORDER OF MAGNITUDE" . . . (Wrong)

"PRESUMABLY AT LONGER TIMES" . . . (I didn't take the time to pursue it past five minutes)

"THE MOST RELIABLE VALUES ARE THOSE OF JONES" . . . (He was a student of mine)

"IT IS BELIEVED THAT" . . . (I think it's true)

"IT IS GENERALLY BELIEVED THAT" . . . (A couple of other guys think so too)

"IT MIGHT BE ARGUED THAT" . . . (I have thought of such a great answer to this argument that I will now raise it, even though it's not important)

"IT IS CLEAR THAT MUCH ADDITIONAL WORK WILL BE REQUIRED BEFORE COMPLETE UNDERSTANDING OF THIS PHENOMENON IS ACHIEVED" . . . (I don't understand our results)

"IT IS HOPED THAT THIS WORK WILL STIMULATE FURTHER WORK IN THE FIELD" . . . (This paper isn't very good, but neither are any of the others on this miserable subject)

"THANKS ARE DUE TO JOE GLOTZ FOR ASSISTANCE WITH THE EXPERIMENT AND TO JANE DOE FOR VALUABLE DISCUSSIONS" . . . (Glotz did the work and Doe explained to me what it meant)

As you can tell from the above, Herb is quite anxious to continue with this monumental effort. All readers' contributions will be considered and any bringing a smile (yes, Herb does smile—we saw one once) will be accepted. All frustrated humorists are encouraged to send their submissions to: Herb Hillman, F.O. Pierce Co., 2–33 50th Ave., Long Island City, NY 11101—Ed.

Shining Examples:

Reynolds Aluminum Pigments put more glow into your metallics.

If the new cars look especially rich in their finishes, with a higher gloss and a softer-glowing color, there's a good reason. So many of them are finished in metallics made with Reynolds Stain Resistant Aluminum Pigments.

Reynolds has extremely rigid controls on particle size and uniformity for its non-leafing pastes. And these controls give you lower seed levels, better reflectivity and brightness.

In effect, the Reynolds Pigments add depth and eye appeal by maintaining maximum gloss in both straight metallic and polychromatic coatings. They don't mask the colors; they enhance them. There's a big family of these Reynolds Stain Resistant Pigments, including coarse, fine and medium particle sizes. And any one of them might be the answer to your more perfect finish.

For details and technical data, write to Reynolds Metals Company, Post Office Box 35030-PD, Louisville, KY 40232.

REYNOLDS ALUMINUM PIGMENTS
For Quality Coatings