jct JOURNAL OF COATINGS TECHNOLOGY

JCTAX 63 (803) 1-96 (1991)

December 1991

A Soil Resistant Treatment For Low Gloss Coatings


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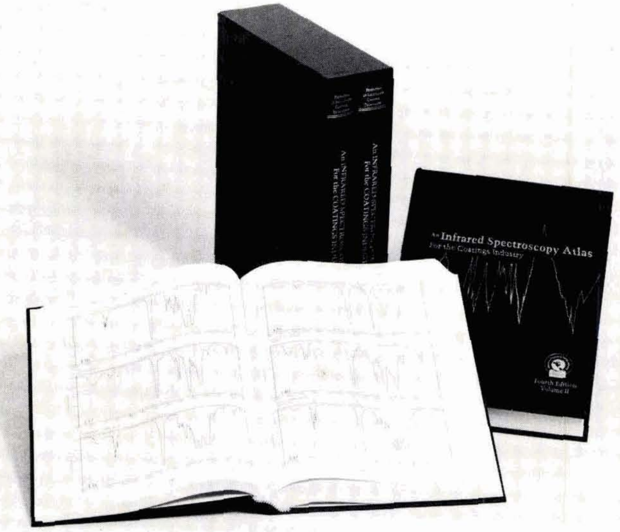

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JOURNAL OF COATINGS TECHNOLOGY

GUIDE FOR AUTHORS

GENERAL

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

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 All manuscripts will be assumed to be previously unpublished writing of the authors, not under consideration for publication elsewhere.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

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

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

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...for the Journal

Four complete copies should be sent to the Editor, JOURNAL OF COATINGS TECHNOLOGY, 492 Norristown Rd., Blue Bell, PA 19422-2350. The cover letter should address copyright, clearance, and release issues discussed above and should specify paper category: *Original Research, Reviews, Open Forum*, or *Back to Basics*.

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. . . by Constituent Societies For Annual Meeting Presentation

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

. . . for Roon Foundation Award Competition

Ten complete copies of the manuscript are required, and should be submitted to the Chairman of the 1991 Roon Awards Committee, George R. Pilcher, Akzo Coatings, Inc., P.O. Box 147, Columbus, OH 43216. (For complete details, see "Roon Awards" section of the JOURNAL in January 1991 issue.)

MANUSCRIPT PREPARATION

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

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

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

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

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

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

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

Manuscripts should be typed with double spacing on one side of $8^{1}/_{2}$ x 11 inch (22 x 28 cm) paper, with at least one-inch (2.5 cm) margins on all four sides. All paragraphs should be indented five spaces, and all pages should be numbered at the top center, or upper right corner.

Title

The title should be as brief and informative as possible. Selection of titles that are key word-indexable is a helpful and recommended practice.

Authors' Biographies and Photographs

Give complete names, company or institutional affiliations, and brief biographical sketches of all authors. If available, submit a 5 x 7 inch (13 x 18 cm) black-and-white photograph with glossy or smooth high sheen surface, for each author. See later section on photographs for further details.

Abstracts

A 75 -100 word abstract must be part of the manuscript, and should be a concise description of the key findings or teachings of the work described in the paper. The abstract should not repeat the title or include reference numbers, nor should it duplicate the Conclusion or Summary.

Text

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

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

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

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

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

Metric System

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

Tables, Graphs, and Drawings

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

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

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

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

Photographs

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

Color prints and slides are unacceptable.

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

Nomenclature

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

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

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

Equations

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

Summary

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

Acknowledgment

If used, it should follow the summary.

References

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

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

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

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

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

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

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Comment

Holiday Spirits

Late at night, when all the computer screens are darkened and the copiers are quiet, a faint glow can be seen through the windows at Federation headquarters. It is rumored that, during this holiday season, eerie specters roam through the hallways at 492 Norristown Road. Any unsuspecting person still at the office after nightfall risks an encounter with not only one, or two, but three of these inexplicable guests.

The ''Spirit of the Federation's Past'' is the first to appear. A lively soul, his presence harkens back to a day when an interest in combining good fellowship with good business resulted in the formation of local ''paint production clubs.'' Such groups eventually joined together to form a national organization dedicated to serving the coatings industry—the Federation of Paint and Varnish Production Clubs. Since that time, the Federation has grown to encompass over 7000 members in 26 Constituent Societies. A number of years have passed since its formation—the organization is now known as the Federation of Societies for Coatings Technology. But, as the presence of this spirit reminds us, the intentions of the group remain the same—to provide a forum for the discussion of shared problems, to cooperate at finding solutions to these problems, and to educate the members of the industry. With this message conveyed, the phantom fades and disappears.

As the night continues, the ''Spirit of the Federation's Present'' slowly takes shape. The aura surrounding this specter glows brightly as she proudly considers the association's recent accomplishments. Record books signal the success of the 1991 Annual Meeting and Paint Industries' Show held in Toronto. The Membership Directory reveals that membership figures are holding steady despite many changes in the industry. Suddenly, two large books seem to levitate right before the eyes of the startled observer. The culmination of three years of work, the new *Infrared Spectroscopy Atlas for the Coatings Industry* contains over 2500 spectra. Revised Federation By-Laws reflect the recent changes in committee organization designed to provide even greater focus on meeting the needs of FSCT members.

As the spirit reveals the current state of the industry, though, the aura burns less brightly. These are difficult times, with many challenges facing the world of coatings. The resolutions to these problems are less evident, and the observer waits with a dreadful anticipation for the final apparition—the ''Spirit of the Federation's Future.''

Although its appearance is more amorphous than the others, this spirit is able to convey great strength and power. With a dramatic sweep of its arm, it beckons to a hallway which seems to branch in two directions. One path is darkened, hinting at what could occur if problems are not addressed and creative solutions not provided. The other reveals a smooth path which can be obtained, but it requires effective leadership and skillful maneuvering.

As the sun rises, the phantoms disappear. Yet the diverging pathway still remains. Drawing on the strength of its past and its contributions of the present, the Federation will strive to provide the direction needed to address the challenges which await.

Patricia D. Viola

Patricia D. Viola,
Editor

Abstracts of Papers in This Issue

A SOIL RESISTANT TREATMENT FOR LOW GLOSS COATINGS—D.L. Gauntt et al.

Journal of Coatings Technology, 63, No. 803, 25 (Dec. 1991)

A treatment has been developed for low gloss paint surfaces, which retards soil adhesion and improves paint cleanability. The treatment consists of an aqueous solution containing colloidal silica. It is believed that the physical presence of the silica on the paint surface and its permanent charge prevent strong adhesion between particulate soils and the paint. Laboratory tests have illustrated the durability of the treatment after exposure to salt spray, fuel, hydraulic fluid, coolant, and nonabrasive cleaners. Accelerated weathering tests have produced slight degradation of the treatment and some cations can produce minor color changes. However, the actual effect of the weathering and water quality on a treated surface are insignificant compared to the extensive color changes of untreated paint surfaces which have been soiled. Preliminary field tests on fleet aircraft have yielded promising results.

ELECTROSTATIC PAINTING OF PLASTICS I: ELECTRICAL PROPERTIES OF PLASTICS AND PRIMERS—D.P. Garner and A.A. Elmoursi

Journal of Coatings Technology, 63, No. 803, 33 (Dec. 1991)

To better understand the problems associated with the electrostatic painting of plastics, we examined the ability of reaction injection molded polyurethane/polyureas, thermoplastic olefins, aromatic nylon blends, thermoplastic urethanes, polycarbonate blends, and nylon/polyphenyleneoxide blends to dissipate charge. Six conductive primers (based on different resin chemistries) were also examined. Bulk and surface resistivities of the plastics were determined under dry, ambient, humid, and wet conditions. In general, the more polar the plastic, the greater the decrease in resistivity on going from dry to wet conditions. Bulk and surface resistivities were determined for the conductive primers under dry, ambient, and wet conditions. The bulk and surface resistivities of the conductive primers were approximately the same under all conditions.

FORMULATING STABLE LATEX PAINTS WITH ZINC OXIDE—I.V. Mattei, R. Martorano, and E.A. Johnson

Journal of Coatings Technology, 63, No. 803, 39 (Dec. 1991)

The stability of architectural latex paints containing zinc oxide was examined in terms of the influence each formulation component had on the stability of the formulation. This study examines the effect of dispersant selection, titanium dioxide grade, extenders, and binder, as well as formulation parameters such as pH, initial viscosity, pigment volume content, and percent volume solids. While typical single component effects were observed, interaction effects between components were found to be equally important in determining the stability of the formulation.

Papers Appearing in the January JOURNAL OF COATINGS TECHNOLOGY

"Possible Reaction Pathways for Self-Condensation of Melamine Resins: Reversibility of Methylene Bridge Formation"—Frank N. Jones and Upasiri Samaraweera, of Eastern Michigan University

"A Novel Design Strategy for Blocked Isocyanates to Enhance Their Reactivity with Alcohols. Oxime Blocking Agents which Undergo Intramolecular Cyclization"—J. Wells Carter, of Union Carbide and S. Peter Pappas, of North Dakota State University

"A Systems Approach to Rheology Control"—Paul R. Howard, Edward L. Leasure, Stephen T. Rosier, and Edward J. Schaller, of Rohm and Haas Co.

"Changes in Hiding During Latex Film Formation: Part III. Effect of Coalescent Level and Latex Properties"—Cleveland Society for Coatings Technology Technical Committee

Resumenes de Artículos en este Número

UN TRATAMIENTO RESISTENTE AL ENSUCIAMIENTO PARA RECUBRIMIENTOS DE BAJO BRILLO—D.L. Gauntt et al.

Journal of Coatings Technology, 63, No. 803, 25 (Dec. 1991)

Se ha desarrollado un tratamiento para superficies de pintura de bajo brillo, el cuál retarda la adhesión de la suciedad y mejora la facilidad de limpieza de la pintura. El tratamiento consiste de una solución acuosa que contiene silica coloidal. Se cree que la presencia fisica de la silica en la superficie de la pintura y su carga permanente previene una fuerte adhesión entre las particulas de suciedad y la pintura. Pruebas de laboratorio han ilustrado la durabilidad del tratamiento después de la exposición a la niebla salina, combustible, fluido hidráulico, refrigerantes y limpiadores no abrasivos. Pruebas de intemperismo aceleradas produjeron una ligera degradación del tratamiento y algunos cationes pueden producir cambios de color pequeños. Sin embargo, el efecto actual del intemperismo y la calidad del agua en una superficie tratada son insignificantes comparados con los grandes cambios de color de las superficies de pintura sin tratar, las cuales han sido ensuciadas. Pruebas preliminares de campo en una flota de aviones han proporcionado resultados prometedores.

PINTADO ELECTROSTATICO DE PLASTICOS I: PROPIEDADES ELECTRICAS DE LOS PLASTICOS Y LOS PRIMERS—D.P. Garner and A.A. Elmoursi

Journal of Coatings Technology, 63, No. 803, 33 (Dec. 1991)

Para entender mejor los problemas asociados con el pintado electrostático de plásticos. Hemos examinado la capacidad de disipar cargas del moldeo por reacción-inyección (RIM) de poliuretano termoplástico, aleaciones de policarbonato, y aleaciones de nylon/polioxido de fenileno. También se examinaron seis primers conductores (basados en diferentes resinas de diferente estructura química). Las resistividades superficial y de contracción de los plásticos se determinaron bajo condiciones ambiente, de secado, de humedad y de mojado. En general, los plásticos son más polares, y el más grande decremento de la resistividad va de condiciones de secado a condiciones de mojado. Se determinaron las resistividades superficiales y de contracción de los primeros conductores bajo condiciones de secado, ambiente y de mojado. Las resistividades superficial y de contracción de los primers conductores fueron aproximadamente las mismas bajo todas las condiciones.

FORMULANDO PINTURAS ESTABLES DE LATEX CON OXIDO DE ZINC—I.V. Mattei, R. Martorano, and E.A. Johnson

Journal of Coatings Technology, 63, No. 803, 39 (Dec. 1991)

Se examinó la estabilidad de pinturas arquitectónicas base latex conteniendo oxido de zinc en términos de la influencia que tiene cada componente de la formulación sobre la estabilidad de la pintura en si. Este estudio examina el efecto de la selección del dispersante, del grado de bióxido de titanio, de los extendedores y ligantes, al igual que los parámetros de formulación tales como el pH, viscosidad inicial, contenido de pigmento en volumen y porcentaje de sólidos en volumen. Mientras se observaban los efectos tipicos de cada uno de los componentes, se encontró que los efectos de interacción entre los componentes son igualmente importantes para determinar la estabilidad de la formulación.

Federation News

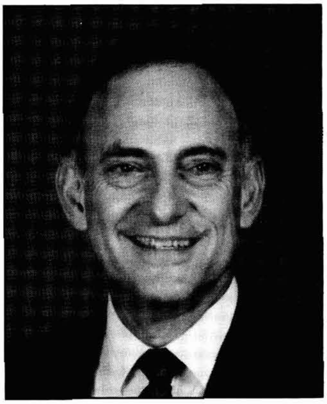
William F. Holmes, of Dallas Society, Elected 70th President Of the Federation, at Annual Meeting in Toronto, Ont., Canada

William F. Holmes, Vice President—Technology, National Pigments & Chemicals, Inc., Garland, TX, became the 70th President of the Federation of Societies for Coatings Technology on November 6, at the Federation's Annual Meeting in Toronto, Ont., Canada.

Colin D. Penny, of Hampton Paint Mfg. Company, Hampton, VA, was named President-Elect, and John A. Lanning, Product Quality Manager, Porter Paints, a Division of Courtaulds Coatings Inc., Louisville, KY, was elected Secretary-Treasurer.

President Holmes

Mr. Holmes most recently served as President-Elect of the Federation. He was Secretary-Treasurer of the Federation (1989-90), and has been a member of the Executive Committee since 1989. A member of the Board of Directors since 1987, Mr. Holmes was the Dallas Society Representative to the Board from 1973-76. He is a member of the Finance Committee, and has served as Chairman of the Annual Meeting Host, Membership, and Technical Advisory Committees. In addition, Mr. Holmes was a Trustee of the Coatings Industry Education Fund and a member of the A.F. Voss/*American Paint Journal* Awards, Annual Meeting Program, Educational, Nominating, and Professional Development Committees.



W.F. Holmes

Mr. Holmes is a Past-President of the Dallas Society (1979-80) and has served on the Society's Technical Committee.

He was graduated from Texas Tech University and has served the coatings industry for 35 years.

President-Elect Penny

Mr. Penny has been a member of the Board of Directors since 1989. He serves as a member of the Finance Committee, was Secretary-Treasurer of the Coatings Industry Education Fund, and is an Ex-Officio member of the Professional Development Committee. Mr. Penny has served as Chairman of the Planning, Technical Advisory, and Paint Show Exhibits' Awards Committees, and was a member of the Ad-Hoc Building Committee. Also, he was the Federation delegate to the Scientific Committee (NPCA).

Mr. Penny is a Past-President of the Baltimore Society (1974-75) and, in 1976, was presented the Herman H. Shuger Memorial Award of the Baltimore Coatings Industry Awards Council. In addition, he has served as Chairman of the Educational Committee of the Baltimore Society.

Mr. Penny is a graduate of Bristol College of Technology in England. Active in the coatings industry for 44 years, he has been a member of the Oil and Colour Chemists' Association since 1952, and is a Past-President of the Washington Paint Technical Group.

Secretary-Treasurer Lanning

Mr. Lanning has been a member of the Board of Directors since 1989, and served on the Board as a Member-at-Large from 1985-87. He is Chairman of the Annual Meeting Program Committee, and a Past-Chairman of the Paint Show Exhibits' Awards and Society Speaker Awards Committees.

Mr. Lanning is a Past-President of the Louisville Society (1983-84) and received the Society's Outstanding Service Award in 1990. In addition, he was a member of the Membership and Technical Committees.

Graduated from the University of Louisville, Mr. Lanning has been a member of the coatings industry for 25 years.

Executive Committee

Joseph D. Giusto, Vice President—Operations, Lenmar, Inc., Baltimore, MD, has been elected for a three-year term on the Federation Executive Committee. A member of the Executive Committee since 1990, Mr. Giusto has served as the Baltimore Society Representative to the Board of Directors since 1985.

He was President of the Baltimore Society (1983-84) and has served as Chairman of the Membership and Nominating Committees. Mr. Giusto received Society Merit Citations in 1983 and 1985, and was awarded the Herman H. Shuger Memorial Award of the Baltimore Coatings Industry Awards Council in 1986.

Educated at Johns Hopkins University, he has been a part of the coatings industry for 24 years. Mr. Giusto is a Past-President of the Baltimore Paint and Coatings Association.

Board of Directors

James E. Geiger, Consultant, Sun Coatings, Inc., Largo, FL, a Past-President of the Federation (1988-89), has been elected for a two-year term on the Board of Directors. Mr. Geiger was Chairman of the Liaison Committee (1990-91), and serves on the Finance Committee. He was a member of the Executive Committee from 1986-90, and was a Member-at-Large on the Board of Directors from 1984-86. Mr. Geiger has also served as Chairman of the Ad-Hoc Building, Annual Meeting Host, and Finance Committees; as a member of the Educational, Investment, and Professional Development Committees; and as a Trustee of the Coatings Industry Education Fund.

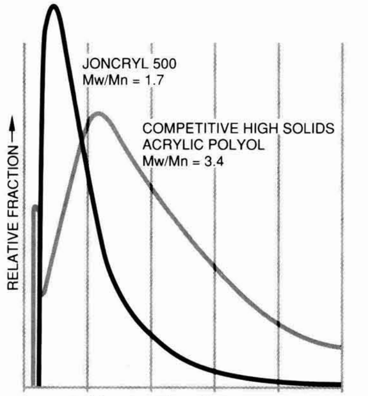
An Honorary Member of the Southern Society, he served as Society President (1984-85), and was Chairman of the Finance and Nominating Committees.

Mr. Geiger was graduated from Northern Illinois University and is a member of the University of Southern Mississippi Industrial Advisory Committee. He has been a member of the coatings industry for 33 years.

Elected to serve two-year terms as Members-at-Large on the Board of Directors are Orville E. Brown, Technical Director, Porter International, a Division of

(Continued on page 12)


Route


JONCRYL 500
Mw/Mn = 1.7
COMPETITIVE HIGH SOLIDS
ACRYLIC POLYOL
Mw/Mn = 3.4
RELATIVE FRACTION ⟶
0
5,000
10,000
15,000
20,000
25,000
MOLECULAR WEIGHT

1991-92 Committee Chairmen Appointed by President Holmes

Chairmen of 31 committees of the Federation of Societies for Coatings Technology for 1991-92 have been named by President William Holmes. A complete roster of all committees will be published in the 1992 FSCT Year Book.

An asterisk (*) indicates re-appointment for 1991-92.

A.F. Voss/American Paint & Coatings Journal Awards—Ronald R. Brown, of Unocal Chemicals Div., Charlotte, NC.

Annual Meeting Host—Ted Fuhs, of Tru-Test Manufacturing Co., Cary, IL.

Annual Meeting Program—John Lanning, of Courtaulds Coatings Inc., Porter Paint Div.

Armin J. Bruning Award—Robert T. Marcus, of PPG Industries, Inc., Allison Park, PA.*

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

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

Educational—Donald Boyd, of PPG Industries, Inc., Allison Park, PA.*

Environmental Affairs—Sidney Rubin, of Empire State Varnish Co., Inc., Brooklyn, NY.*

Finance—Kurt F. Weitz, Toronto, Ont., Canada.

George Baugh Heckel Award—Howard Jerome, of Mozel Equipment Co., St. Louis, MO.

Inter-Society Color Council—Ralph Stanziola, Neshanic Station, NJ.*

Liaison—John C. Ballard, of Burgess Pigment Co., Sandersville, GA.

Manufacturing—Anne Probizanski, of Ampro Technologies, Riverside, CA.*

Joseph J. Mattiello Lecture—G. Dale Cheever, of General Motors Research Laboratories, Warren, MI.

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

Memorial—A. Clarke Boyce, Oakville, Ont., Canada.*

Nominating—Kurt F. Weitz.

Paint Industries' Show—Richard E. Max, of Zarco Industries, Chicago, IL.

Planning—John J. Oates, Midland Park, NJ.*

Professional Development—Roger Woodhull, of California Products Corp., Cambridge, MA.*

Publications—Thomas J. Miranda, of Consolidated Research, Mt. Prospect, IL.*

Roon Awards—Richard Himics, of Daniel Products Co., Jersey City, NJ.

Society Secretaries Awards—Peter C. Kuzma, of VIP Products Corp., Philadelphia, PA.

Society Speakers Awards—Robert McD. Barrett, of B.I.P. Chemicals Ltd., Warley, West Midlands, England.

Technical Advisory—Gail Pollano, of ICI Resins U.S., Wilmington, MA.*

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

Delegates to Other Organizations

National Association of Corrosion Engineers (NACE)—Jay Austin.*

National Paint & Coatings Association Scientific Committee (NPCA)—Gail Pollano.*

NPCA and Governmental Agencies—Sidney Rubin.*

IUPAC—Graham C. Miles, of PPG Industries (UK) Ltd., Birmingham, England.*

Steel Structures Paint Council (SSPC)—Jay Austin.*

Student-Authored Manuscript Entries Invited For 1992 A.L. Hendry Award Competition

Prospective student authors are invited to submit manuscript entries in the 1992 Southern Society Alfred L. Hendry award competition.

The Award is a $1000 cash prize for the best paper on some aspect of coatings technology, authored by an undergraduate student currently enrolled in a college program.

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

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

Those wishing to enter the competition must send a letter of intent, along with the title of the proposed paper, and a brief abstract, by March 16, 1992, to: Hendry Award Competition, c/o FSCT, 492 Norristown Rd., Blue Bell, PA 19422-2350. Deadline for receipt of manuscripts is July 1.

Presentation of the Award will be at the 1992 FSCT Annual Meeting in Chicago, IL, October 21-23.

The Award, sponsored by the Southern Society for Coatings Technology, commemorates the industry contributions of the late Alfred L. Hendry, President of A.L. Hendry & Co., Tampa, FL, and a Past-President of the Southern Society.

Bill Holmes Elected President of FSCT

Continued from page 10

Courtaulds Coatings Inc., Louisville, KY, and J. "Dick" Mullen, President, G-3 Industries, Aurora, CO.

Mr. Brown is a member of the Corrosion Committee, and served as Chairman of the FSCT's 1991 Spring Seminar Program.

He is a Past-President of the Philadelphia Society (1989-90), and was Chairman of the Society's Investment Committee. Also, Mr. Brown has served as Secretary of the Chicago Society (1982-83). In addition, he is a member of the American Chemical Society, ASTM, and the Steel Structures Painting Council.

He received a B.S. Degree from Friends University, in Wichita, KS, and holds an M.S. Degree from the University of Denver. Mr. Brown has been part of the coatings industry for 25 years.

Mr. Mullen is a member of the Environmental Affairs Committee and has served on the Educational Committee. He was the Rocky Mountain Society Representative to the Board of Directors from 1976-80.

Mr. Mullen served twice as President of the Rocky Mountain Society (1975-76 and 1990-91), and was a member of the Society's Educational, Membership, and Technical Committees. Also, in 1980, he was presented the Gold Nugget Award for outstanding contributions to the Rocky Mountain Society and for the advancement of the coatings industry.

Mr. Mullen was graduated from the University of Denver and has been active in the coatings field for 34 years.

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No purchase necessary. Limit one entry per person. No photocopied entries. Employees of Miles Inc. and their families not eligible. Entries must be received by 2/15/92.

Five Industry Statesmen Honored at NPCA Annual Meeting

The National Paint and Coatings Association (NPCA), Washington, D.C., honored five individuals with Industry Statesman Awards during their 104th Annual Meeting held in San Francisco, CA, on October 21-23. The awards are given in recognition and appreciation of the recipient's long and devoted service to the paint and coatings industry.

Those individuals honored by the association were:

Robert J. Chaudoin, Senior Vice President and Treasurer of Kurfees Coatings, Inc., Louisville, KY. Mr. Chaudoin joined Kurfees in 1966 and has been active in the paint and coatings industry for 25 years. He has been a member of NPCA's Management Information Committee for over 15 years.

John S. Dumble, recently retired President of The Glidden Company, Strongsville, OH. Mr. Dumble began his career with Glidden in 1961 as a Sales Representative. In 1973, he was named Vice President of the company, a position he held for 10 years. Mr. Dumble served as Executive Vice President of Glidden for one year, before becoming President of the company in 1984. Since 1974, he had been a member of various NPCA Committees, including the Budget and Finance, Joint Paint Industry Coordinating, and Executive Committees. Mr. Dumble served on the Trade Sales Steering Committee for 10 years, and was Chairman of the Committee for two years. He was a member of the NPCA Board of Directors from 1985 to 1991, and held the positions of Treasurer and Vice President, respectively.

Harry Feinberg, Chairman of Duron, Inc., Beltsville, MD. Mr. Feinberg has been associated with the paint and coatings industry for 60 years. He began his career in the industry in 1931 as a Laboratory Assistant with H.B. Davis Company, and was named Technical Director in 1945. In 1949, he purchased Duron Paint Manufacturing Company. Mr. Feinberg became a member of the Baltimore Paint and Varnish Production Club in 1932, and in 1939 he served as Club President. In 1961, he was the recipient of the Herman H. Shuger Memorial Award of the Baltimore Coatings Industry Awards Council. Mr. Feinberg served as President of the Baltimore Paint and Coatings Association in 1967. He was a member of the NPCA Budget and Finance Committee in 1989, and served on the Trade Sales Steering Committee for 16 years. Mr. Feinberg sat on the NPCA Board of Directors from 1983 to 1985 and from 1988 to 1989.

Michael C. Quaid, Executive Vice President of Benjamin Moore and Company, Newark, NJ. Mr. Quaid joined Benjamin Moore in 1953 as a Credit Manager. From 1963 to 1978, he was an active member of the New York Paint and Coatings Association (NYPCA), having served on various committees. In 1976, Mr. Quaid served as President of the NYPCA. He has been a member of NPCA's Architectural Coatings Committee for the last 10 years, having served as Chairman of the committee in 1990.

J. Robert Pickering, retired Chairman and Chief Executive Officer of Lilly Industrial Coatings, Inc., High Point, NC. Mr. Pickering has been with Lilly for over 30 years. He began his career with Lilly in 1951 working in the laboratory. He steadily worked in levels of increasing responsibility until, in 1983, Mr. Pickering was named Chief Executive Officer. In 1988, he was the recipient of the George Baugh Heckel Award, NPCA's highest honor. Mr. Pickering also served as President of NPCA in 1988. From 1975 to 1977, he was Chairman of the Joint Coatings-Forest Products Industry Steering Committee. Mr. Pickering also was a member of NPCA's Scientific, Manufacturing, Joint Paint Industry Coordinating, Industrial Coatings, and Executive Committees, and Board of Directors.

Mergers & Acquisitions...

Employee Group Purchases E.T. Horn Company

An E.T. Horn Management/Employee Group has completed the purchase of E.T. Horn Company, La Mirada, CA, from Van Ommeren Ceteco, the Netherlands.

E.T. Horn is a distributor of specialty chemical raw materials with offices in La Mirada and Oakland, CA, and warehouse stocks in California, Oregon, and Washington.

Assuming management duties for the new organization are: Chairman—Gene E. Alley; President—Patrick J. Marantette; and Executive Vice President—James F. Calkin.

Laporte plc Acquires Southern Clay Products Inc.

Laporte plc has purchased Southern Clay Products Inc., a subsidiary of E.C.C. America Inc., Atlanta, GA, from ECC International.

Southern Clay Products will continue operations under their current name. Through this acquisition, Southern Clay Products will be responsible for market development and sales of Laporte's highly purified synthetic hectorite, Laponite® along with their current Gelwhite®, Claytone®, and Bentolite® rheological additive lines.

BASF Coatings Enters Joint Agreement with Nippon Oil & Fats

The BASF Coatings Division, Troy, MI, has announced that it has entered into a joint agreement with Nippon Oil & Fats Company (NOF), Yokohama, Japan, for the cross-licensing of automotive OEM coatings technologies.

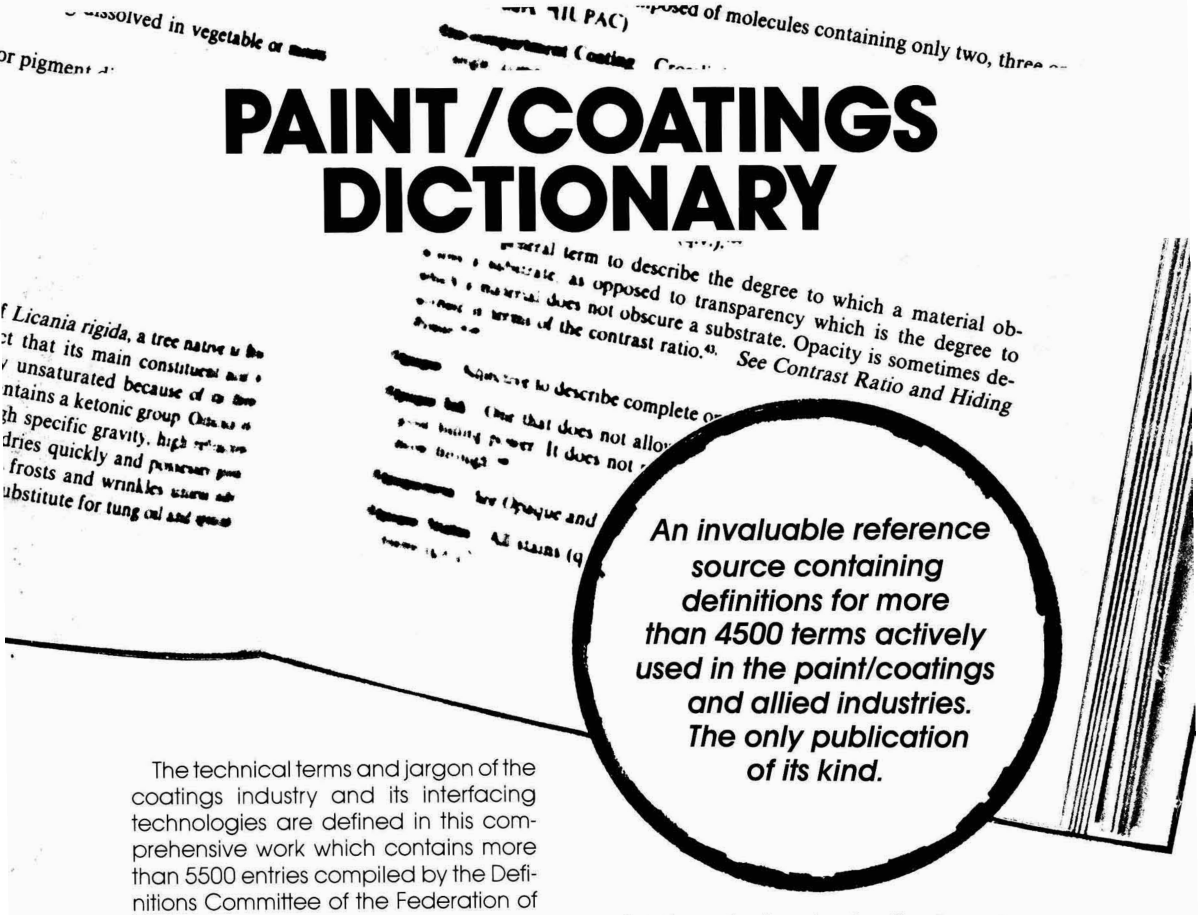
The agreement forms the basis for R&D collaboration between the two companies and for collaboration in international marketing as well.

A result of the venture will be the establishment of a new technology center, BASF Nichiyu Coating R&D Ltd., in Totsuka, Japan. The center will employ more than 40 scientists whose work will include the amalgamation of Japanese, European, and North American coatings technologies, and the development of new products for automotive coatings.

BASF will contribute water-based coatings systems and their Cathoguard electrocoat technology. NOF will supply technologies for scratch-resistant transparent coatings, coatings for plastics applications, special extenders, and other high-solids systems.

The joint venture will also support activity in new automotive color design.

The agreement's objectives include the marketing of NOF and BASF technologies within Japan by NOF and the marketing of those technologies outside Japan by BASF.



PAINT/COATINGS DICTIONARY

f *Licania rigida*, a tree native
unsaturated because
ntains a ketonic group
h specific gravity
dries quickly and
frosts and wrinkles
ubstitute for tung oil and

term to describe the degree to which a material obscure a substrate, as opposed to transparency which is the degree to which a material does not obscure a substrate. Opacity is sometimes defined in terms of the contrast ratio.[43] *See Contrast Ratio and Hiding*

An invaluable reference source containing definitions for more than 4500 terms actively used in the paint/coatings and allied industries. The only publication of its kind.

The technical terms and jargon of the coatings industry and its interfacing technologies are defined in this comprehensive work which contains more than 5500 entries compiled by the Definitions Committee of the Federation of Societies for Coatings Technology. Over 4500 terms are defined, and more than 1000 additional entries are synonyms cross-referenced to the defined terms.

The broad scope of terms included reflects the obvious usefulness of the dictionary to a wide audience, ranging from the layman, to artists and artisans, to technicians in all the coatings-related fields.

A unique feature is classification of terms into one or more of 73 categories, which have been number coded and appear as superscripts following each definition. The terms are listed in their appropriate categories, making up a thesaurus which comprises the second section of the dictionary.

An extensive bibliography of more than 600 references forms the third section.

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PACIFIC NORTHWEST PAINTMAKING

December 1991

IN BALANCE WITH NATURE

In the beginning
There was Earth, beautiful and wild;
And then man came to dwell.
At first he lived like other animals
Feeding himself on creatures and plants around him
And this was called "In Balance with Nature."
Soon man multiplied,
He grew tired of ceaseless hunting for food.
He built homes and villages
Wild animals and plants were domesticated.
Some men became Farmers so that others might become Industrialists, Artists, and Doctors,
And this was called Society.
Man and Society progressed.
With his God-given ingenuity man learned to feed, clothe, protect, and transport himself more efficiently so he might enjoy Life.
He built cars, houses on top of each other, and nylon,
And life became more enjoyable.
The men called Farmers became efficient,
A single Farmer grew food for 28 Industrialists, Artists, and Doctors.
And Writers, Engineers, and Teachers as well.
To protect his crops and animals, the Farmer produced substances to repel or destroy insects, diseases, and weeds,
These were called Pesticides.
Similar human substances were made by Doctors to protect humans,
These were called medicine.
The Age of Science had arrived and with it came a better diet and longer, happier lives for more members of Society.
So it came to pass that certain well fed members of Society
Disapproved of the Farmer using Science.
They spoke harshly of his techniques for feeding, protecting, and preserving plants and animals.
They deplored his upsetting the Balance of Nature.
They longed for the 'Good Old Days'
And this had an emotional appeal to the rest of Society.
By this time the Farmers had become so efficient, Society gave them
A new title: Unimportant Minority.
Because Society could not ever imagine a shortage of food,
Laws were passed abolishing pesticides, fertilizers, and preservatives
Insects, diseases, and weeds flourished.
Crops and animals died, food became scarce.
To survive, Industrialists, Artists, and Doctors were forced to grow their own food.
People and governments fought wars to gain more agricultural land.
Millions of people were exterminated,
The remaining few lived like animals
Feeding themselves on creatures and plants around them,
And this was called "In Balance with Nature."

—Written by the late Dr. John Carew,
Submitted by Daryl Smith
President, Troy Chemical Corporation

It would appear that the agricultural and paint industries have a lot in common—aren't we going through a similar situation right now?

INCORPORATING WATER-SOLUBLE CELLULOSE ETHERS IN LATEX PAINTS: TRADITIONAL AND NOVEL METHODS

Despite their relatively low usage level in latex paints, water-soluble ethers of cellulose like hydroxyethylcellulose (HEC) play vital roles as additives. These include viscosifying the grind for faster pigment dispersion during manufacture; suspending pigment and preventing liquid separation during storage; and improving film build, leveling, sag, and spatter-resistance during application. This article will briefly critique the traditional methods of incorporating these products in latex paints plus a new approach utilizing unique liquid suspensions.

Traditional Methods

Cellulose ethers have been traditionally incorporated in one or more of the following ways:

Dry addition to the make-up water early in the pigment grind,

As an *aqueous solution* at the beginning or end of the let-down, or

By *pre-slurrying* them in a glycol or coalescent and post-adding them to the finished paint.

Dry addition to the grind works well if certain pH and time conditions are met. Most paint-grade cellulose ethers are coated with a temporary surface treatment which is removed in normally 5-25 minutes at neutral pH. The treatment is rapidly removed at pH 8 or higher. Under acidic conditions, hydration will not occur for one to two hours depending upon the treatment level and specific pH of the water.

A common mistake is to add the dry thickener to water which is already alkaline due to either dissolved minerals or certain paint ingredients like dispersants, selected extender pigments and preservatives, or aqueous ammonia. This causes immediate swelling of the thickener particles. Without adequate agitation this can lead to the formation of gel-coated dry agglomerates which require prolonged mixing times to break down and dissolve. The successful use of this addition technique involves first dispersing the cellulose ether thoroughly using good agitation, followed by the addition of alkaline ingredients which will then cause rapid hydration of each particle. Stirring should continue for another 20-30 minutes to insure that solution is complete.

These same comments apply in the case of preparing aqueous solutions for addition to the let-down. Namely, dispersion must precede dissolution. Common problems similarly involve adding the dry thickener to alkaline water with inadequate stirring or failure to stir the solution long enough to produce complete solution.

The third approach of slurrying the cellulose ether can be done in water, but is best done in a water-miscible nonsolvent like ethylene or propylene glycol. If the glycol is reasonably "dry," slurries can be kept up to 30 minutes prior to addition. For longer hold times, coalescing solvents with some water solubility are preferred. In either case, thickener solids should be kept in the 10-15 wt% range, and the slurry should be added as quickly as possible once the dry thickener has been completely wetted out. Stirring should be continued for at least 30 minutes or more to insure complete solution of the thickener. Post-addition of dry thickener to a finished paint is *not* recommended since latex particles in the let-down tend to coat those of the thickener, hindering wetting and dispersion.

FPS: A Novel Approach

An increasingly popular new approach with some types of conventional HEC and hydrophobically-modified HEC involves purchasing and incorporating the thickener as a *fluidized polymer suspension* or "FPS." These products are 20-25 wt% solids suspensions of the thickener in a proprietary, nonorganic medium. They can be added at virtually any stage of manufacture. FPS products shorten addition time due to their liquid form and rapid hydration. This unique liquid form also eliminates dusting and bag disposal problems, while a preservative system permits them to be stored for months before use.

—Warren Vanderslice,
Aqualon Company

CONTROLLING BIOLOGICAL CONTAMINATION IN COATINGS MANUFACTURING PROCESSES

As the ban on heavy metal-based biocides widens, coatings manufacturers throughout the country face problems during the transition to nonmetallic biocides. This transition requires a clear understanding of the alternative biocides and how to use them. Improper formulation techniques, usage levels, and/or poor paint hygiene can affect production through microbiological contamination.

Knowing how contaminants enter a paint is the first step in combating microorganisms in coatings plants. Microorganisms can be introduced in the following ways:

Raw Materials—Bacteria and fungi contaminate paint components such as latex resins, defoamers, surfactants, organic bodying agents, and aqueous pigment dispersions.

Plant Equipment—Paint film builds in mixing equipment, storage tanks, and lines and can create environments in which microorganisms will grow and flourish.

Water—A number of plants use well water or deionized water which can be the source of microorganisms.

Air—Exposing materials to the atmosphere can introduce microorganisms.

Dangers of Contamination

Proper procedures to protect raw materials from exposure to contaminants are not difficult to implement, but are generally not regularly practiced in the paint industry. Manufacturers who store raw materials in closed containers and who clean equipment thoroughly on a routine schedule will dramatically reduce the potential for microbiological problems.

Microorganisms adversely affect coatings in a variety of ways. The problems which can be traced to contamination include:

Viscosity Loss—This is the most common problem associated with microbiological contamination. The microorganisms destroy the structure of the binder in the coating, reducing it to water-thin consistency.

Putrefaction—Microorganisms can cause foul odors similar to sour milk. These odors may be difficult or impossible to mask or neutralize.

Gas Release—Microbiological activity releases carbon dioxide gas which causes air pressure inside the can to increase. In severe instances, it will blow off the lid, often with a violent explosion.

Visible Growth—This usually occurs after a can of paint has been partially used and the remainder stored for a period of time. When re-opened, mold is clearly evident, often resulting in a product return.

The following three groups of microorganisms cause problems in coatings systems:

Bacteria—Can cause viscosity loss, odors, and gas production. These organisms multiply and grow at a geometric rate resulting in severe contamination in a short time.

Fungi—Are a higher form of life than bacteria and generate more enzymes than bacteria. The primary problem associated with fungi is viscosity loss.

Yeast—Favors growth in a polyvinyl acetate emulsion. It releases large quantities of carbon dioxide which will cause the air pressure to build up inside cans. Yeast probably will not affect viscosity nor will odor be a problem.

Observations

Testing of mercurial and nonmercurial preservatives has produced a number of observations relative to their performance.

Viscosity loss can occur in several ways, depending on the specific coatings system and the microorganisms involved in the contamination. It can happen immediately and totally, or viscosity can deteriorate gradually. Also, viscosity can remain stable for several months, then suddenly drop to water-thin consistency.

Some nonmetallic biocides will protect the liquid coatings in the can, but do not perform well in the wet film deposited on the sides of mixing vats and

(Continued on next page.)

(Continued from previous page.)

filling equipment. This requires that periodic equipment sterilization be conducted to minimize the development of microorganisms that could be introduced to various coatings systems. Tests have shown that many sterilizing agents commonly used in paint plants, such as formaldehyde and bleach, are not effective in eliminating microorganism contamination.

Sterilizers designed for use in the coatings industry can be highly diluted (100:1 concentration) and be more effective in eliminating microbiological contamination.

Evaluating In-Can Preservatives

A number of factors must be weighed in determining what preservative system to use in any coatings system. The preservative system must be compatible and not cause flocculation, yellowing, or other adverse reactions with the ingredients of the formulation.

Establishing shelf storage efficiency involves evaluating the preservative's performance after various elapsed storage times. In determining the point of addition, it is necessary to determine which step in the manufacturing process will maximize the effectiveness of the preservative.

Determine the Most Efficient Steps

Manufacturers must know which of the materials they use are subject to spoilage and take preventive action. They also need a knowledge of what manufacturing steps are most subject to contamination. Production samples should be tested regularly to insure that the preservatives are continuing to be effective in the formulation. Biocide suppliers should be able to provide customer support in the microbiology area in order to ensure effective protection.

Unless coatings manufacturers pay careful attention to plant hygiene during conversion from mercurial to nonmercurial preservatives and implement a regular maintenance program, serious consequences, in the form of contaminated products, will eventually occur. Too often, manufacturers assume that all preservatives will provide the same levels of protection. When they change from mercurial to nonmercurial biocides, they often neglect the proper maintenance of equipment. This leads to contamination.

Use levels for nonmetallic biocides are different from mercurial products. Complete protection requires a biocide package containing a bactericide and a fungicide. An effective transition requires an investment in planning, testing, and evaluation.

The potential costs of contamination are measured in unusable product, lost time, returns, and restocking charges. An investment in complete microbiological testing and protection is small by comparison. The technology to economically and efficiently control contamination is readily available and can be easily incorporated into coating systems.

Because biocides are among the most hazardous of raw materials used in the paint industry, a review of product literature and material safety data sheets should be undertaken before using.

— *W. Machemer*
Troy Chemical Corporation

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REMEMBER

Injuries, even minor ones like cuts and grazes, can get worse if not properly attended to straight away. The first aiders and factory nurses are trained to treat injuries and you should not attempt to do it yourself – you could do more harm than good.

It is also important that you tell your supervisor about any accident or injury as soon as possible so that it can be investigated. Otherwise, the same thing could happen again – with worse results.

HOW YOU CAN CUT WASTE

When a paint plant makes waste it loses four ways.

First, paint waste damages the environment. If we dispose of the waste carefully, we can cut that damage down. But there would be less damage if we never make the waste in the first place.

Second, waste costs a lot. Even the cheapest way of getting rid of dirty solvent costs about $50 a drum. Then you have to add in the cost of the solvent, the cost of the paint that was cleaned up, the drum, and the time. In total, that drum of dirty solvent will cost somewhere between $170 and $260.

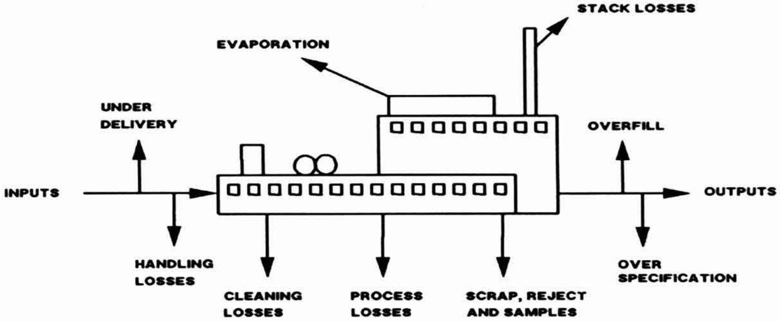
Third, waste and bad quality go hand in hand. Scrap and rework are forms of waste. Added to that, the same careful workmanship and good formulations that make good product also avoid waste.

Finally, we can see that waste causes high costs, poor quality, and environmental problems. A company with poor quality can't hold its customers. If its costs are high, it can't make money. If it creates a lot of waste, it will come under pressure from the community and the law. To put it simply, companies that make waste won't be around for very long. Jobs with those companies aren't secure.

The key to cutting waste is to prevent it from happening. That means recognizing the places where waste starts, then changing the way we work to stop making that waste. We need to change the way we look at every job so we can see the waste. Remember that every drop of material that isn't sold to the customer is waste.

The picture of the factory shows the kinds of waste you will see in a paint plant.

PHYSICAL MATERIAL LOSSES



Most of these losses are easy to understand. Under delivery is simply not getting what you pay for. Fifty-pound bags may only have 49.7 pounds in them. Handling loss covers damaged bags and resin left in "empty" drums. Process losses are things like the millbase left in a sandgrinder at the end of a batch, or the paint in the bag when you change filters. The cleaning losses are the solvent and labor that you use to clean equipment. Overfill is simply putting too much in the can, pail, or drum.

If you work in the factory, you are in the best position to work on process, cleaning, and handling losses. You are also in control of overfill, and have a major effect on scrap and rework.

Here are six things you can do to cut waste.

(1) Lower handling losses by draining drums well. This is especially important with resin or rework drums. If you want to know how much is left in a drum, weigh it. Empty resin drums usually weigh 41 pounds. Anything over that is waste. With some very heavy resins it is worth putting a gallon of batch solvent in the drum, leaving it to sit for 30 minutes, and stirring or shaking a couple of times. That will get most of the resin out.

(2) Reduce process losses by making sure you get all the batch out of the equipment. Scrape down tanks as they drain. Return the paint in filter bags to

(Continued on next page.)

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(Continued from previous page.)

the batch when changing filters. (The paint in the bag is normal, unfiltered product). Drain any pipelines and hoses carefully. The primary objective is not to hurry. Remember, in many paint plants waste costs more than labor. Putting in some extra time to cut waste makes good business sense as well as good environmental sense.

(3) Be careful when cleaning. Make sure that all the good product is out of tank or mill before you start to clean. Then use the least amount of solvent, and use the right solvent. MEK cleans well but costs more than $3 a gallon. It is also more dangerous than some other solvents.

You can get things cleaner by washing twice with one gallon of solvent per wash than by washing once with five gallons of solvent. Cleanup will cost less, and you will make much less hazardous waste.

(4) Help eliminate scrap and rework by making batches exactly according to formula, even if you know the formula is suspect. Weigh or meter all the materials. Follow the batch card instructions. Then, when there is a problem, the lab will know it is the formula or material. They will know where to start their investigation. There will be no chance that "production messed it up" is the real answer.

(5) Don't ever fill anything by eye. Use a filling machine or weighing scales. If you use a filling machine, find out the right way to set it up so it gives the correct average fill. Then check weigh enough containers.

(6) Keep samples small. Ask the lab how much they need. Don't bring them a pint when they need an ounce.

These are a few waste reducing ideas. If you want to know more about cutting waste, call Orr & Boss at (519) 542-1416. We will be glad to send you a free copy of our book, *101 Waste Busting Tips*.

—Dr. Charles Rooney,
Orr & Boss

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On November 3, I was very pleased to be presented with the Women in Coatings Communications Award for the publication of this *Pacific Northwest Paintmaking* Newsletter. The presentation took place at the Women in Coatings meeting held during the 1991 Annual Meeting and Paint Show, in Toronto, Ont., Canada.

I would like to express my sincere thanks to all the authors who have submitted articles for publication and to those who have helped in other ways to make this publication a success.

—Valerie M. Braund,
Editor

The Pacific Northwest Paintmaking (PNP) is intended for the exchange of ideas on safety and manufacturing. First published and distributed independently by the Manufacturing Committee of the Pacific Northwest Society for Coatings Technology, the newsletter will be published periodically in the JCT. The editors would like your participation. Send your comments, ideas, safety or manufacturing tips, and articles to: PNP Editor, Valerie Braund, General Paint, 950 Raymur Ave., Vancouver, B.C., Canada V6A 3L5.

Regulatory UPDATE

DECEMBER 1991

This digest of current regulatory activity pertinent to the coatings industry is published to inform readers of actions which could affect them and their firms, and is designed to provide sufficient data to enable those interested to seek additional information. Material is supplied by National Paint and Coatings Association, Washington, D.C. and edited by members of the FSCT Environmental Arrairs Committee.

Environmental Protection Agency
October 21, 1991–56 FR 53562
Semiannual Regulatory Agenda
Action: Notice

The U.S. Environmental Protection Agency (EPA) has published in the Federal Register its semiannual regulatory agenda for the upcoming year. The purpose of the Agenda is to inform interested parties of the progress of EPA regulations. To be placed on the mailing list for further agendas, please contact Bridgette Dent, Regulation Development Branch, EPA, PM-2234, Washington, D.C. 20460, (202) 382-5475.

The Toxic Substances and Control Act (TSCA)

PROPOSED RULE STAGE

1. Addition of Air Toxics to Toxic Release Inventory (TRI).
2. Toxic Chemical "Peak Release" Reporting Rule (Revision).
3. Responses to Petitions Received to Add or Delete Chemicals from the List of Toxic Chemicals Under Section 313 of SARA.
4. Policy Statement Implementing the Prior Informed Consent Procedures for the Export/Import of Industrial Chemicals.
5. Follow-up Rules on Existing Chemicals.
6. Premanufacture Notification (PMN) Rule Amendments.
7. Regulatory Investigation Under TSCA to Reduce Lead Consumption and Use.
8. Regulatory Investigation of Formaldehyde.
9. Polychlorinated Biphenyls (PCBs) Disposal Amendments.
10. Environmental Hazard Communication Rule.
11. Amendment to the TSCA Section 8(a) Comprehensive Assessment Information Rule (CAIR).
12. Proposed Follow-Up Rule on Existing Chemicals.

FINAL RULE STAGE

1. TSCA Section 4(a) Policy Definition and Extension of Comment Period.
2. Polychlorinated Biphenyls (PBCs): Application for Exemptions from the Ban on Manufacturing, Processing, and Distribution.
3. Procedures and Criteria for Termination of PCBs Disposal Permits.
4. PCBs: Wet Weight/Dry Weight Clarification.
5. Section 8(a) Preliminary Assessment Information Rules.
6. Section 8(d) Health and Safety Data Reporting Rules.
7. Export Notification Requirements; Changes to Reporting Requirements.

COMPLETED ACTIONS

1. Section 313 Sunset Review Amendments.
2. Regulatory Investigation of Chlorinated Solvents.

Clean Water Act

PRERULE STAGE

1. Water Quality Standards for Toxic Pollutants.
2. Implementation of Section 403 of the Federal Water Pollution Control Act.

PROPOSED RULE STAGE

1. Federal NPDES Fees in States Where EPA Administers the NPDES Program.
2. Effluent Guidelines and Standards for the Pesticide Chemicals Category.
3. Effluent Guidelines and Standards for the Organic Chemicals, Plastics and Synthetic Fibers (OCPSF) Category.
4. Effluent Guidelines and Standards for the Waste Treatment Category.
5. NPDES Regulatory Revisions.
6. NPDES Permit Application Standard Form A and Short Form A (Revision).

FINAL RULE STAGE

1. Amendments to Water Quality Planning and Management Regulations.
2. NPDES Regulations: Stormwater Implementation Rule (Revision).
3. Sewage Sludge Use and Disposal Regulation.

Resource Conservation and Recovery Act (RCRA)

PRERULE STAGE

1. Land Disposal Restrictions—Phase III: Rulemaking on Newly Identified Wastes.
2. Disposal of Containerized Liquids in Hazardous Waste Landfills.
3. Materials Source Separation for Municipal Waste Landfills (MSWLFs).

PROPOSED RULE STAGE

1. Underground Storage Tanks Containing Petroleum—Financial Responsibility Requirements: Extension of the October 26, 1991 Compliance Date.
2. Land Disposal Restrictions—Phase I: Rulemaking on Contaminated Debris and Newly Identified Wastes.
3. Land Disposal Restriction—Phase II: Rulemaking on Contaminated Soil and Newly Identified Wastes.
4. Modifications to the Definition of Solid Waste and Regulations of Hazardous Waste Recycling.
5. Modification of the Hazardous Waste Recycling Regulatory Program.
6. No-Migration Variance for Prohibited Hazardous Waste Land Disposal.
7. New and Revised Testing Methods Approved for RCRA Subtitle C Hazardous Waste Testing Manual SW-846, Third Edition, Update II.
8. Identification and Listing of Hazardous Wastes—De Minimis Exemption Levels.
9. Identification and Listing of Hazardous Wastes from Chlorotoluene Production.
10. Landfill, Surface Impoundment, and Waste Pile Closures for Hazardous Waste Management Facilities.
11. Corrective Actions for Releases to Groundwater from Regulated Hazardous Waste Units.
12. Definition of Hazardous Waste Tank, Surface Impoundment, and Waste Pile (Revision).
13. Hazardous Waste Sump Requirements in Response to Rulemaking Petition (Revision).
14. Hazardous Waste Ground Water Monitoring Constituents (Phase II) and Methods.
15. Underground Storage Tanks Containing Hazardous Substances—Financial Responsibility Requirements.

FINAL RULE STAGE

1. Test Methods for Evaluating Solid Waste (Manual SW 846 Third Edition) Incorporation by Reference and Mandatory Good Laboratory Practices—Update I.
2. Hazardous Waste Management System, Amendment to Subpart C Rulemaking Petitions; Use of Groundwater Data in Delisting Decisions.
3. Liners and Leak Detection for Hazardous Waste Land Disposal Units.
4. Double Liner and Leachate Collection Systems for Hazardous Waste Land Disposal Units.
5. Emission Controls for Hazardous Waste Incinerators.
6. RCRA Subtitle C Financial Test Criteria (Revision).
7. Land Disposal Restrictions Modifications to the Standard for K061 High Zinc Category.
8. Underground Storage Tanks Containing Petroleum—Financial Responsibility Requirements: Financial Test for Self Insurance for Local Government Entities.

COMPLETED ACTIONS

1. RCRA Definition of Solid Waste (Revision).
2. Land Disposal Restrictions for Soil and Debris Containing Hazardous Wastes.
3. Technical Amendment to Final Underground Storage Tank Rules for Overfill Prevention.
4. Procedures for Issuance of and Administrative Hearings on RCRA Section 9003 (h) Corrective Action Orders for Underground Storage Tanks.

Clean Air Act

PROPOSED RULE STAGE

1. Protection of Stratospheric Ozone: Recycling.
2. Protection of Stratospheric Ozone: Phase Out.
3. Enhanced Monitoring and Compliance Certification Regulations.
4. Clarification of Best Available Control Technology Regulatory Definition.
5. National Ambient Air Quality Standards (NAAQS): Lead (Review).
6. NAAQS: Ozone (Review).
7. Criteria for Imposing Discretionary Sanctions Under Title I.
8. NESHAP: Chromium—Industrial Cooling Towers.
9. NESHAP: Chromium—Electroplating.
10. NESHAP: Hazardous Organic.
11. NESHAP: Organic Solvent Degreasing.
12. NSPS: Review of Subpart L—Secondary Lead Smelters.
13. Statement of Policy Regarding Petitions Under Section 112 of Title III of the Clean Air Act Amendments of 1990.
14. General Provisions for Major and Area Sources of Air Toxics.
15. Economic Incentive Program Rules Authorized Under Title I of CAA.
16. Protection of Stratospheric Ozone: Product Ban.
17. Protection of Stratospheric Ozone: Labeling.

FINAL RULE STAGE

1. Designation and Classification of Nonattainment Areas.
2. General Preamble—Requirements for Approval of State Implementation Plan Submittals Under the Clean Air Act Amendments of 1990.
3. Regulations for Implementing the Operating Permit Requirements of the CAA.
4. Development of a List of Source Categories and Schedule for Regulating Source Categories of Hazardous Air Pollutants Subject to Section 112 of the CAA Amendments of 1990.
5. Compliance Extensions for Early Reductions of Hazardous Air Pollutants.
6. Control Technique Guidelines.
7. Treatment, Storage, and Disposal Facility—RCRA Air Emission Standards.

COMPLETED ACTIONS

1. Approval and Promulgation of Implementation Plans; Revision of the Visibility FIP for Arizona.
2. Development of SIP Completeness Criteria.
3. Municipal Waste Combustion—Phase II (Combustors Greater than 250 tons per day).

Superfund (CERCLA)

PROPOSED RULE STAGE

1. List of Substances and Threshold Quantity.
2. Reportable Quantity Adjustments of Lead, Lead Compounds, Lead Containing Hazardous Waste Streams, and Methyl Isocyanate.
3. Designation under CERCLA and Reportable Quantity Adjustments of New Clean Air Act Hazardous Air Pollutants.
4. National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites—Proposed Update XI.
5. NPL for Uncontrolled Hazardous Waste Sites—Proposed Update XII.
6. Procedures for Reimbursement Petitions Under Section 106 (b) of CERCLA.
7. Addition of Chemicals to the List of Extremely Hazardous Substances Based on their Physical Properties.
8. Mandatory Pollution Prevention Reporting for Toxic Release Inventory (TRI).

FINAL RULE STAGE

1. Designation of Extremely Hazardous Substances as CERCLA Hazardous Substances.
2. Reportable Quantity Adjustments of Extremely Hazardous Substances.
3. Reporting Exemptions for Federally Permitted Releases of Hazardous Substances.
4. Response Claims Procedures for the Hazardous Substances Superfund.
5. Administrative Hearing Procedure for Superfund Claims.
6. Technical Assistance Grants to Groups of Individuals at Superfund Sites.
7. Administrative Hearing Procedures for Class II Penalties Under CERCLA and Emergency Planning and Community Right-To-Know Act (EPCRA).

Department of Labor
October 21, 1991—56 FR 53558
Action: Notice

The Department of Labor has announced its semiannual agenda of regulations. The agenda has been selected for review or development for the upcoming year. For further information, contact Roland G. Droitsch, Deputy Assistant Secretary for Policy, Office of the Assistant Secretary for Policy, Department of Labor, 200 Constitutional Avenue, N.W., Room S-2312, Washington D.C. 20212, (202) 523-9058.

The following regulations in the prerule, proposed rule and final rule stages are among those set forth by the Department of Labor's Occupational Safety and Health Administration.

Occupational Safety and Health Administration (OSHA)

PRERULE STAGE

1. Exposure Assessment Programs for Employees Exposed to Hazardous Chemicals.
2. Ergonomic Safety and Health Standards.

PROPOSED RULE STAGE

1. Respiratory Protection.
2. Glycol Ethers: 2-Methoxyethanol, 2-Ethoxyethanol, and Their Acetates.
3. Methylene Chloride.
4. Cadmium.
5. Recording and Reporting Occupational Injuries and Illnesses.
6. Lead in Construction.
7. Reporting of Fatalities and Multiple Hospitalizations.
8. Indoor Air Quality in the Workplace.

FINAL RULE STAGE

1. Methods of Compliance.
2. Face, Head, Eye, and Foot Protection.
3. Formaldehyde.
4. 1, 3-Butadiene.
5. Hazardous Communication.
6. Hazardous Materials (Part 1910).
7. Accreditation of Training Programs for Hazardous Waste Operations (Part 1910).

Department of Transportation
October 21, 1991—56 FR 53614
Action: Notice

The Department of Transportation (DOT) has announced its semiannual summary of current and projected rulemakings, oversight of existing regulation, and completed actions for the coming year. By publishing the Agenda, it is DOT's intention to increase public awareness of its regulatory activity. For further information, contact Neil R. Eisner, Assistant General Counsel for Regulation and Enforcement, Department of Transportation, 400 7th Street, S.W., Washington, D.C. 20590, (202) 366-4723.

DOT's Research and Special Programs Administration (RSPA) has identified the following items for regulatory activity within the coming year.

Research and Special Programs Administration (RSPA)

PRERULE STAGE

1. Improving Hazardous Materials Identification: Placarding; Reporting/Tracking; and Continually Monitored Telephone Systems (Significant Regulation).

PROPOSED RULE STAGE

1. Hazardous Materials in Intrastate Commerce (Significant Regulation).
2. Registration of Shippers and Carriers of Hazardous Materials (Significant Regulation).
3. Transportation of Hazardous Materials: Miscellaneous Amendments.

FINAL RULE STAGE

1. Training for Hazardous Materials Transportation (Significant Regulation).
2. Centralization of Formal Hearing Dockets (RSPA).
3. Amendments to the Hazardous Materials Program Procedures.

COMPLETED ACTIONS

1. Performance-Oriented Packaging Standards (Significant Regulation).
2. Requirements for Cargo Tanks: Corrections and Revisions (Significant Regulation).
3. Highway Routing Standards for Certain Types and Quantities of Hazardous Materials (Significant Regulation).

Department of Labor
Occupational Safety and Health Administration
November 7, 1991—56 FR 57036
Occupational Exposure to Methylene Chloride
Action: Proposed rule; request for comments

Based on recent data, OSHA has determined that current permissible exposure limits (PELs) to methylene chloride, do not adequately protect employee health. As a result of the determination, OSHA has proposed to amend existing regulations by reducing the existing eight-hour time-weighted average (TWA) exposure from 500 parts of methylene chloride per million parts per air (500 ppm) to 25 parts per million.

The existing ceiling limit concentration of 1,000 ppm will be deleted, and the existing short-term (five minutes in any two hours as a maximum peak concentration) exposure limit will be reduced from 2,000 ppm to 125 ppm measured as a 15-minute TWA. Other proposed provisions include additional exposure control, personal protective equipment, employee exposure monitoring, training, medical surveillance, hazard communication, regulated areas, emergency procedures, and recordkeeping.

Comments on the proposed standard are due on or before April 6, 1992, and must be submitted in quadruplicate to the Docket Office, Docket No. H-71, Room N-2634, U.S. Department of Labor, 200 Constitutional Avenue, N.W., Washington, D.C. 20210, (202) 523-7894. For further information, contact James F. Foster, OSHA Office of Public Affairs, U.S. Department of Labor, Room N-3641, 200 Constitution Avenue, N.W., Washington, D.C. 20210, (202) 523-8151.

Environmental Protection Agency
October 11, 1991—56 FR 51592
Reportable Quantity Adjustment Chlorinated Toluenes Production Wastes; CERCLA Hazardous Substances Designation
Action: Proposed rule and request for comments

The EPA has proposed amendments to existing hazardous waste management regulations under the Resource Conservation and Recovery Act (RCRA).

Section 3001 of Subtitle C of RCRA would be amended to add three wastes generated during the production of chlorinated toluenes. If promulgated, the wastes will be subject to regulation as hazardous waste under 40 CFR parts 124, 262-266, 268, 270, and 271. Because they do not meet the listing criteria under CFR part 261, wastewaters, spent carbon wastes, and wastewater treatment wastes generated during the manufacture of chlorinated toluenes will not be listed.

Regulations promulgated under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) in CFR part 302 that are related to this proposed waste listing will also be amended. EPA has proposed to designate the proposed listed wastes as CERCLA hazardous substances and would set reportable quantities applicable to these wastes.

Comments on the proposed rule will be accepted until December 10. An original and two copies should be sent to EPA RCRA Docket Clerk, Room 2427 (OS-332), U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. Comments should be identified by Docket Number F-91-LCTP-FFFFF. Comments on the CERCLA proposal should be sent in triplicate to, Emergency Response Division, Docket Clerk (OS-245), Attn: Docket No. RQ, Room 2427, U.S. EPA, 401 M Street, S.W., Washington, D.C. 20460. For further information, contact the RCRA/Superfund Hotline at (800) 424-9346 or (703) 920-9810. For technical information on the RCRA hazardous waste listings, contact Ambika Bathija, Office of Solid Waste, U.S. EPA, (202) 260-4770. For technical information on CERCLA proposal, contact Ivette Vega, Response Standards and Criteria Branch, Emergency Response Division, U.S. EPA, (202) 260-2190.

Lead—Under new legislation passed by the House Subcommittee on Health and the Environment, home sellers would have to disclose known lead paint hazards to prospective purchasers. The Lead Contamination Control Act of 1991 (H.R. 2840), sponsored by the Subcommittee Chairman, Henry Waxman (D-CA), covers several lead exposure issues including lead paint, lead in plumbing systems, and lead in food containers.

The original bill would have required testing for lead hazards before selling or leasing a residence, and mandated that the results be given to prospective buyers or renters. However, during the Subcommittee markup on October 29, two amendments were adopted that would make those requirements less burdensome. One amendment provides an exemption from lead paint testing for the elderly. Instead, a disclosure of known lead hazards would be required. Additionally, owners of large apartment buildings would be able to randomly test for lead paint instead of testing each unit. Another amendment requires testing for leased residences, but not prior to selling a residence. Known lead hazards, however, would have to be disclosed prior to selling a home.

The legislation now moves to the full House Energy and Commerce Committee where several members are expected to oppose the measure. Reportedly, concerns have been raised about provisions that would require cities to pay high cost of inspecting for lead hazards in public housing complexes.

Indoor Air Quality—Legislation that will attempt to reduce human exposure to indoor air contaminants passed the Senate on November 6. The Indoor Air Act of 1991 (S. 455) would authorize $300 million through fiscal 1996 to create an interagency council on indoor air quality, and would establish a research office for indoor air within the EPA. The Indoor Air Quality Council would take the lead in Federal research and regulatory programs related to the reduction of indoor air pollution. The legislation would also require EPA to issue health advisories on listed indoor air contaminants, one of which is lead.

The Bush Administration opposes the legislation because it "would create conflicting responsibilities among Federal agencies." But the overwhelming passage in the Senate (88-7) was indicative of a bi-partisan effort, with members of both parties praising the research provisions which "hopefully will lead to a healthier work environment." The House companion bill, H.R. 1066, remains in the Environment Subcommittee of the House Science Committee where it was returned after several members objected to enforcement provisions.

OSHA Reform—At an October 29 hearing before the Senate Labor and Human Resources Committee, industry representatives objected to most of the major provisions of the Comprehensive Safety and Health Reform Act (S. 1622), including a provision mandating the establishment of joint labor-management safety and health committees for employers with more than 10 employees. Representatives of the AFL-CIO testified that the "committee provision" would significantly assist labor and management in addressing problems with job safety before the occurrence of injury or death.

The Coalition on Occupational Safety and Health, representing 200 corporations and employer organizations, testified in opposition to the legislation, citing among other things, the bill is a working vehicle for labor law reform and several other labor-backed priorities. The general industry opinion appears to be that while the intentions may be good, the bill is too far reaching and the economic realities would place an insurmountable burden on the employer.

Other provisions in the bill include expanded employer obligations, and greater authority for OSHA, including the elimination of required cost-benefit analysis in rulemaking authority. Criminal sanctions against employers for violations that result in serious injury are also included in the bill.

While committee hearings have not yet been scheduled for the House counterpart (H.R. 3160), this issue will undoubtedly see a significant amount of activity in both Houses during the next year.

How to Obtain Congressional Documents

The general public may obtain various Congressional Documents at no charge, but the number of documents one may obtain is limited. The Senate and the House policies are as follows:

SENATE

Senate bills, reports and public laws, and conference reports are available in the Senate Document Room, B-4 Hart Senate Office Building. The public may obtain as many as six different items per request, either in person or by mail. Requests for multiple copies of one item are not permitted. Only one request per person, per day, will be filled. Mail orders may be sent to, The Senate Document Room, B-4 Hart Building, United States Senate, Washington, D.C. 20510. For information on the status and availability of legislative documents, please call the Senate Document Room at (202) 224-7860. This is an information number only, and phone orders will not be accepted.

HOUSE

House bills, reports and public laws, and conference reports are available in the House Document Room, B-18 House Annex No. 2. As many as six different items per request may be obtained in person or by phone, and up to 12 items may be requested by mail. Multiple copies of one item are not permitted. One request per day will be filled. Mail orders may be sent to, The House Document Room, B-18, House Annex No. 2, United States House of Representatives, Washington, D.C. 20515. For information on the status and availability of legislative documents, or to place a document order by phone, please call the House Document Room at (202) 225-3456.

House and Senate hearings and committee prints can be purchased at the Government Printing Office. For information and prices, please call (202) 275-3030. Mail requests should be sent to, Superintendent of Documents, Government Printing Office, Congressional Sales Office, Washington, D.C. 20402-9315.

States Proposed Legislation and Regulations

Arizona

Underground Storage Tanks (Regulation)—Arizona's Department of Environmental Quality (DEQ) has proposed rules that would impose an excise tax on underground storage tanks. The proposal sets a time frame for paying the $100.00 annual tank fee, as well as specifying the responsibilities of suppliers of regulated substances. For more information, contact Martha Seaman at the DEQ, (602) 257-6870.

California

Air Quality—CA A. 158 (Roybal-Allard) extends the air pollution disclosure statement requirements for the operation of hazardous waste facilities until January 1, 1997, and, until that date, prohibits the Department of Toxic Substances Control from issuing a hazardous waste facilities permit on and after July 1, 1992, unless the Department provided notice. Requires the Department to prepare a specified report when it proposes to issue a permit if it makes a certain determination concerning the applicant's past violations.

CA A. 157 (Roybal-Allard) authorizes the air pollution control officer to require specified information from a supplier, wholesaler, or distributor of volatile organic compounds or chemical substances; requires the supplier, wholesaler, or distributor to disclose that information to district; prohibits disclosure of trade secrets, customer lists, and supplier names, except as provided.

Household Hazardous Waste—CA A. 304 (Wright) imposes additional eligibility requirements on small quantity waste generators participating in a household hazardous waste program. Requires compliance with specified Federal regulations. Deletes a limitation on acceptance of halogenated organic compounds and revises the definition of small quantity commercial sources. Specifies a lower facility permit fee for a variance. Variances that have been granted are exempt from the fee.

Hazardous Waste—CA A. 1899 (Frizzelle) revises the conditions under which used or spent etchants, stripping solutions, and plating solutions as recyclable materials are to be regulated as hazardous waste. Requires the Department of Toxic Substances Control to include in the biannual report the additions or deletions to the listing of recyclable hazardous wastes.

CA S. 194 (Torres) includes the collection of fees and taxes related to the handling of hazardous waste and substances within the Hazardous Substances Tax Law; defines the term "feepayer" for purposes of this law and makes various changes concerning statutory references. Declares that it is to take effect immediately as an urgency statute.

Hazardous Waste (Regulation)—Industries that annually generate at least 13 tons of hazardous waste or 26 pounds of extremely hazardous waste will be required to complete a source reduction evaluation review and plan a hazardous waste management performance report under final regulations issued by the Department of Health Services. For further information, contact Ken Smarkel, Department of Health Services, (916) 322-3500.

Florida

Hazardous Waste—FL S.4 (Gardner) prohibits, without exception, the disposal of hazardous waste through an injection well. This bill was prefiled on October 18, and will be considered in 1992.

Hazardous Substances—FL S. 116 requires the Department of Environmental Regulation to compile a list of substances that are deemed toxic or hazardous to humans. Requires persons who manufacture, import, transport, or distribute at wholesale any such substances to register with the Department beginning October 1, 1993, and maintain a permanent record of sales of such substances. This bill was prefiled on October 18, and will be considered in 1992.

Massachusetts

Packaging (Recycling)—MA H. 6133 (Angelo) as amended, imposes greater recycling burdens on manufacturers and users of containers, including paint cans. The content of the legislation changes frequently as the Massachusetts Public Interest Research Group (MASS PIRG), Governor Weld, and State Legislative bodies attempt to "fine tune" the bill. On November 6, the bill was amended on the House floor by the substitution of a new draft. Note—The Massachusetts Paint Council continues to work towards making this a reasonable bill.

Underground Storage Tanks (Regulation)—Under proposed regulations issued by the Department of Public Safety, underground storage tank fees would be levied at the rate of \$50.00 for every 10,000-gallon delivery of a petroleum product to a dispensing facility. For deliveries of less than 10,000 gallons, a formula would be provided to calculate fees, and a fee payment schedule would be established. For further information, contact Gregory Mooney, Department of Public Safety, UST Program, (508) 851-9813.

Michigan

Recycled Materials—MI H. 4656 (Yokich) requires the certification of the percentage of recycled materials and allows contract preferences based on that use.

Solid Waste—MI S. 322 (DiNello) allows municipalities to impose impact fees on solid waste incinerators.

Minnesota

Air Quality (Regulation)—Air Emission Fees. Emission fees were established for regulated air pollutants, including volatile organic compounds. (16 Minnesota State Register, page 1033—October 21, 1991).

Ohio

Occupational Safety and Health—OH H. 545 (Lucas and Hogan) sets the statute of limitations for a workers' compensation occupational disease claim at two years after the disability due to the disease begins, or six months after the employees' illness is diagnosed as occupational; creates a rebuttable presumption relative to exposure to toxic and hazardous substances for purposes of coverage as a compensable injury under the workers' compensation law.

Pennsylvania

Household Hazardous Waste—PA H. 953 (D. Wright et al.) provides for labeling of, and information about, household hazardous materials; establishes the Household Hazardous Materials Fund and provides for its administration; imposes penalties.

Hazardous Waste—PA H. 2063 (Kasunic et al.) amends the Municipal Waste Planning, Recycling and Waste Reduction Act. Further provides for restrictions on certain wastes and out-of-state wastes.

Texas

Air Quality (Regulation)—The Texas Air Control Board has adopted regulations concerning the abrasive blasting of water storage tanks performed by portable operations. The new regulations define terms used in regard to abrasive blasting; outline test methods required before abrasive blasting is performed on any new storage tank; set control requirements for surfaces with coatings containing lead; describe the notification procedures and allowable methods for abrasive blasting if the coating contains 1.0% or more of lead; set control requirements for surfaces with coatings that contain less than 1.0% of lead; and list acceptable methods for abrasive blasting of unleaded surfaces. The rule became effective on November 1, 1991. For further information, call (512) 908-1451. (16 Texas Register, Page 5833—October 18, 1991).

Air Pollution Control Program—Amendments to the state air pollution control program were adopted to make it more consistent with Federal requirements and standards. The amendments include standards relating to capture efficiencies in surface coating processes and a requirement that once a process becomes subject to the regulations because its emissions exceed certain exemption levels, it remains subject to the regulations even if its emissions subsequently go below the exemption levels. (16 Texas Register, page 5837—October 18, 1991).

Washington

Hazardous Waste (Regulation)—Facility Hazardous Waste Reduction Program. Amendments were made to current requirements relating to facilities that are developing plans to reduce the generation of hazardous waste and to maximize recycling. The purpose of the amendments is to increase flexibility and to specify certain requirements that must be included in facility plans. (Washington State Register, Issue 91-20, page 165—October 16, 1991).

Wisconsin

Household Hazardous Waste—WI A. 581 (Black and Panzer) relates to the rate for the temporary recycling surcharge and specifies that the property tax bill must state the amount spent for collection and disposal.

Air Emission and Water Discharge Fees—WI A. 639 (Krug et al.) relates to payment of fees by persons who discharge air contaminants and wastewater.

Solid Waste—WI S. 186 (Chvala and Burke) relates to a solid waste incinerator moratorium and makes an appropriation.

A Soil Resistant Treatment For Low Gloss Coatings

David L. Gauntt, Kenneth G. Clark, Donald J. Hirst, and Charles R. Hegedus
Naval Air Development Center*

A treatment has been developed for low gloss paint surfaces, which retards soil adhesion and improves paint cleanability. The treatment consists of an aqueous solution containing colloidal silica. It is believed that the physical presence of the silica on the paint surface and its permanent charge prevent strong adhesion between particulate soils and the paint. Laboratory tests have illustrated the durability of the treatment after exposure to salt spray, fuel, hydraulic fluid, coolant, and nonabrasive cleaners. Accelerated weathering tests have produced slight degradation of the treatment and some cations can produce minor color changes. However, the actual effect of the weathering and water quality on a treated surface are insignificant compared to the extensive color changes of untreated paint surfaces which have been soiled. Preliminary field tests on fleet aircraft have yielded promising results.

INTRODUCTION

Military aircraft paint systems perform two important functions, protection and appearance. Protection of the underlying metal or composite substrate from environmental degradation is necessary to prolong the life of the aircraft and ensure reliable operations in severe environments. Camouflage, the tactical modification of appearance, is important to the short term survivability of the aircraft during combat. High visibility coatings, such as those used on nontactical aircraft, make aircraft more visually detectable.

Military aircraft paint systems consist of an epoxy primer (MIL-P-23377 or MIL-P-85582) and a polyurethane topcoat (MIL-C 83286). The topcoat is a two-component, aliphatic polyurethane which is the product of a polyester polyol and a biuret of hexamethylene diisocyanate.[1,2] Although this coating exhibits superior chemical and weather resistance, two of the most significant problems encountered with its use are color change and degradation caused by entrapped dirt and other contaminants. This, in turn, has caused extensive unscheduled repainting of military aircraft to improve cosmetic appearance. However, repainting further entraps contaminants, adds weight to the aircraft, requires valuable maintenance manhours and coating materials, and adds photochemically reactive solvent to the atmosphere.

Unauthorized cleaning materials have been used with some success in restoring paint surfaces, but these are usually high pH products which can cause corrosion, damage polyimide airframe wire insulation, and contribute to water pollution. General purpose cleaners used on Navy aircraft (MIL-C-85570, types I and II) are effective corrosion control materials, but lack the ability to remove

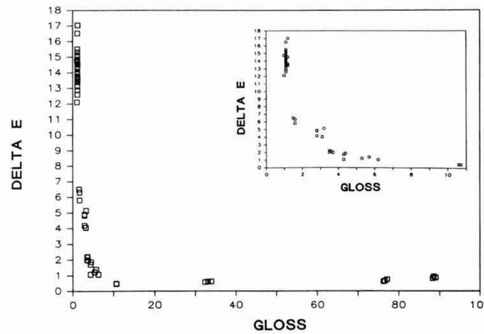

Figure 1—Color change (as measured by ΔE_H after soiling and cleaning) versus gloss for polyurethane topcoats

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carbonaceous materials completely. Special purpose spot cleaners (MIL-C-85570, types III, IV, and V) are available but require additional maintenance manhours and significant effort.

A study on the cleanability of aircraft topcoats indicates that gloss is the most important characteristic. Low gloss topcoats typically used in camouflage schemes pose the most significant problem.[3,4] *Figure* 1 illustrates the effect of gloss on color change after soiling and cleaning. Typically, coatings with a gloss of less than four exhibit extreme color changes indicating poor cleanability. It is obvious that the topography of low gloss coatings consists of valleys and pores which entrap soils, particularly those soils which contain particulate matter such as carbon. Due to persistent cleaning problems with Navy aircraft, a treatment was developed and studied to determine its ability to retard soiling of the coating surface and/or allow the paint appearance to be easily restored upon cleaning.

EXPERIMENTAL—EVALUATION OF COATING CLEANABILITY

Aluminum test panels (6.4 × 12.8 × 0.5 cm) were painted with an epoxy primer (MIL-P-23377) and polyurethane topcoat (MIL-C-83286). The color of the topcoat is that specified in Federal Standard 595: color number 36495. This color is a low gloss lusterless gray with approximately 50% reflectance in the visible spectrum. The approximate X, Y, and Z tristimulus values and the L_H, a_H, and b_H Hunter color coordinates are listed in *Table* 1. The applied coatings were air dried for seven days, then heated in an oven at 65°C for seven days. All test panels, with the exception of those used in the field evaluation, had 60° gloss values between 2.0 and 2.3.

Soil resistance of the coating system was determined by measuring the color change due to soiling and cleaning. Surfaces with good soil resistance can be restored more closely to their original "pre-soiled" color. The test used to determine these changes was a modification of the cleaning performance tests in MIL-C-85570, Cleaning Compound Aircraft Exterior, devised to evaluate the cleaning efficiency of military aircraft surface cleaners[5] on soiled tactical paint systems. This method has provided consistent and representative results, correlating with actual field experience. The soil consisted of a fine dispersion of carbon black in hydraulic fluid which was selected based on previous studies[6,7] indicating this soil to be representative of that found on operational Navy aircraft. A detailed description of the test method is provided in the *Appendix*.

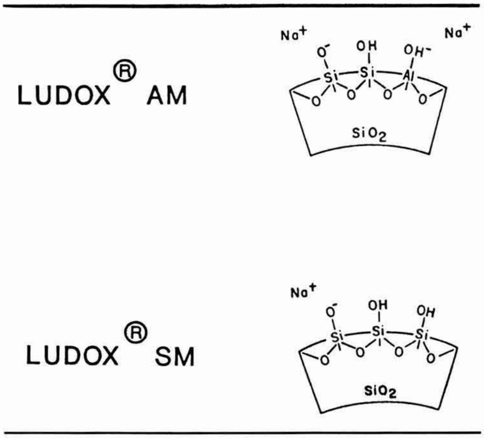

Figure 3—Chemical structure of Ludox silicas (DuPont Product Bulletin, "Ludox, Colloidal Silica, Properties, Uses, Storage, and Handling")

Two equations were used to quantify the cleanability of the coating surface based on the $L_Ha_Hb_H$ color system:

$$\text{Cleanability (\%)} = \frac{L_c - L_s}{L_v - L_s} \times 100 \qquad (1)$$

where L is the Hunter color measurement described in ASTM D 2244[8] and the subscripts v, s, and c stand for the virgin surface (prior to soiling and cleaning), the soiled surface, and the cleaned surface, respectively, and

$$\Delta E_H = [(\Delta L_H)^2 + (\Delta a_H)^2 + (\Delta b_H)^2]^{0.5} \qquad (2)$$

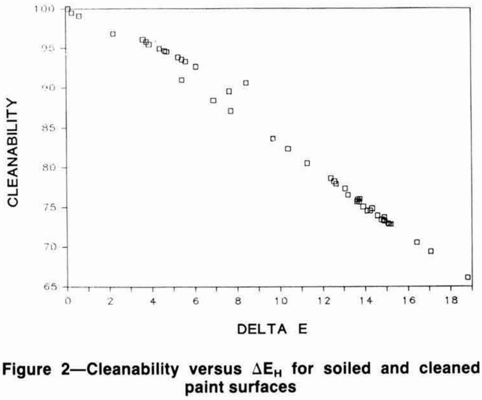

Figure 2—Cleanability versus ΔE_H for soiled and cleaned paint surfaces

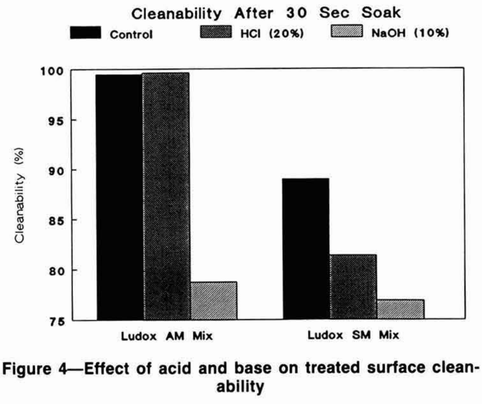

Figure 4—Effect of acid and base on treated surface cleanability

Table 1—Tristimulus Values for Federal Standard 595 Color 36375

$X = 55.9$ $L_H = 76.0$
$Y = 57.8$ $a_H = -1.9$
$Z = 69.2$ $b_H = -0.7$

where $L_Ha_Hb_H$ values are the Hunter color measurements and ΔE_H is the resulting color change. It should be noted that surfaces which have changed significantly by soiling and cleaning have high ΔE_Hs and low cleanability. In addition, *Figure* 2 illustrates that for the evaluations performed in this study, there is an inverse linear relationship between % cleanability and ΔE_H. All ΔEs shown in subsequent figures are ΔE_Hs.

FORMULATION OF A SOIL RESISTANT TREATMENT

Several soil resistant treatments were evaluated: a perfluoroalkyl ester copolymer solution (Teflon SBA manufactured by E.I. du Pont de Nemours & Co., Wilmington, DE), an aerosol fluorocarbon release agent (No Cross manufactured by Lektro-Tech, Inc., St. Petersburg, FL), and two colloidal silica solutions (Ludox® AM and SM manufactured by DuPont). Early in this study, it was found that when a low gloss polyurethane paint was treated with the fluorocarbon, the water-base aircraft cleaner (MIL-C-85570, Type II) would not effectively wet the surface. As a result, cleaning efficiency actually decreased. Colloidal silica, on the other hand, prevented the hydraulic fluid/carbon black soil from adhering to the coating, and vastly improved its cleanability.

Two colloidal silicas (Ludox AM and SM) are dispersions of amorphous silica spheres (diameters 12 and 7 nm, respectively) which have negative surface charges as a result of their ionic interactions with their alkaline media (*Figure* 3). The stabilizing counter ion in both products is sodium. However, aluminum atoms in the surface oxide structure of Ludox AM stabilize the associated negative surface charges. It was thought that these permanent charges might result in a more durable soil resistant treatment.

The two soil resistant treatments listed in *Table* 2 were prepared to compare the effectiveness of the two colloidal silicas, but are actually two soil retardant rug shampoos recommended by DuPont. Test panels were prepared by applying the treatment using an eye dropper to completely wet the surface drying at room temperature for 16 hr, and partially immersing in 10 wt % sodium hydroxide and 20 wt % hydrochloric acid, respectively. The panels were subsequently rinsed with distilled water and dried for 24 hr. *Figure* 4 illustrates cleanability test results, calculated using equation (1), for immersed and dry sections of the test panels.

Table 2—Starting Formulations (Concentrations in wt %)

Formulation	AM	SM
Merpol® HCS	1.5	1.5
Duponol® WAQ	2.0	2.0
Ludox® AM	30.0	—
Ludox SM	—	30.0
Distilled water	66.5	66.5

Merpol, Duponol, and Ludox are registered tradenames of E. I. du Pont de Nemours & Co. (Inc.), Wilmington, DE.

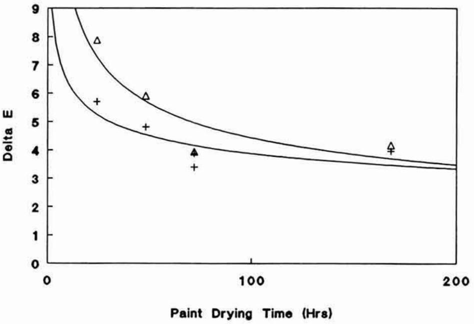

Figure 5—Effect of paint drying time on treated surface color change (as measured by ΔE_H after soiling and cleaning). + = prewashed; Δ = no prewash

It was obvious from this early experiment that the soil resistance of the AM formulation was the better of the two, and that it was resistant to strong acid but not strong base. Use of Ludox SM was discontinued because the SM formulation was not as effective and was affected by both acid and base. Ludox PM was also evaluated but proved to be inferior to the Ludox AM in soil resistance after repeated cleaning.

The AM formulation in *Table* 2 was simplified by substituting a nine-mole nonylphenol ethoxylate for the two surfactants listed, with no change in treated surface cleanability. Since this nonionic surfactant is available as a military specification product, MIL-D-16791, it was thought that, if the pre-mixed colloidal silica treatment could be purchased by field activities, it could be prepared on-site. Further studies involved the modified formulation in *Table* 3, which has been given the nickname, "TACSHIELD."

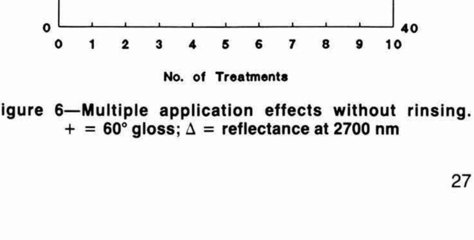

Figure 6—Multiple application effects without rinsing. + = 60° gloss; Δ = reflectance at 2700 nm

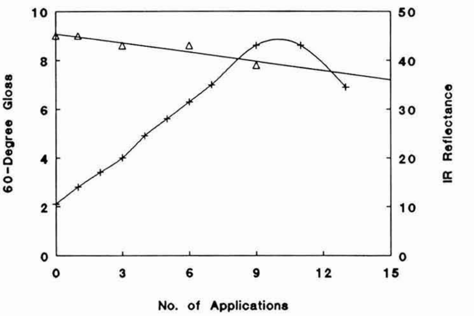

Figure 7—Multiple application effects with rinsing. + = 60° gloss; Δ = reflectance at 2700 nm

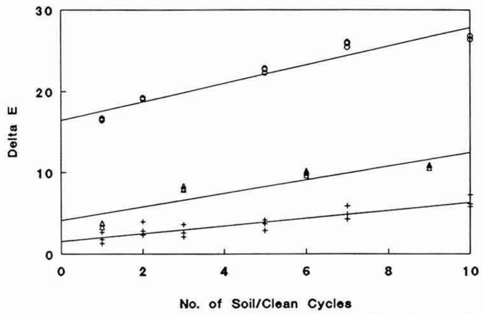

Figure 8—Effect of repeated cleaning on treated surface color change (as measured by ΔE_H after soiling and cleaning). + = treated with Formula AM; Δ = treated with Formula PM; o = untreated

To determine the effect of pH on TACSHIELD, the pH of several samples of TACSHIELD was varied by adding hydrochloric acid or sodium hydroxide, respectively. Over the range of 5.5 to 10.5, pH had no effect on the treatment performance.

EVALUATION OF TACSHIELD APPLICATION PROCEDURE AND EFFECTS

Initially, two TACSHIELD application methods were evaluated. In Method 1, the treatment solution was applied by pipette to the top of a 2.5 × 5 in. test panel which was inclined at a 60° angle to the horizontal. Enough solution was applied to run down and off the panel, giving uniform coverage with no bubbles. Test panels were then dried at room temperature for 16 hr. When large bubbles were inadvertently produced on the surface, subsequent soiling and cleaning resulted in a spotty appearance.

In Method 2, the TACSHIELD solution was applied as in Method 1 but then rinsed immediately with distilled water and air dried. Cleanability results were clearly inferior. The first method of application produced a 97.4% cleanability, whereas the second method produced only 88.6%. Along with the decrease in cleanability, the panels from Method 2 had a very streaky appearance after soiling and cleaning.

For the remainder of the laboratory soil resistant treatment evaluation, Method 1 was used to prepare test panels. In the later service test on the trailing edges of a Navy P-3 aircraft, TACSHIELD was applied, using a conventional paint spray gun at 20 psig line pressure. This low pressure spray proved very effective in creating a thin uniform film, and was suitable for large area applications of TACSHIELD.

To determine the optimum drying time for the polyurethane topcoat prior to application of the soil resistant treatment, test panels were painted and individual panels were periodically treated with TACSHIELD at various times after the paint application. In addition, in order to determine if pre-washing the paint prior to treatment was effective, one set of panels was pre-cleaned between painting and application of the treatment. After treatment, the panels were soiled and cleaned to determine soil resistance. The results, shown in *Figure* 5, indicate that freshly painted surfaces can be treated after three days of drying time at room temperature (approximately 23°C) and that cleaning prior to application of the treatment may not be necessary.

When TACSHIELD was applied to high gloss white paint surfaces, soiling and cleaning resulted in a streaky appearance. Further work with gloss surfaces was discontinued due to the ease with which they are normally cleaned.

One of the initial concerns about tactical paint schemes was the effect of the treatment on visual characteristics. The low gloss requirement for tactical aircraft (60° gloss ≤ 3) is important in achieving the desired visual camouflage appearance. Abrasive materials, such as cleaners or abrasive mats, are forbidden on these paint systems since they tend to burnish the coating and significantly increase gloss. Higher paint glosses provide more specular reflectance, increasing detectability, thereby increasing vulnerability.

To determine the effect on gloss, TACSHIELD was applied to a test panel and air dried for 30 min. After obtaining the 60° gloss and near infrared total reflectance data (wavelength range from 400 to 3000 nm), the treatment was reapplied and dried as before. This process was

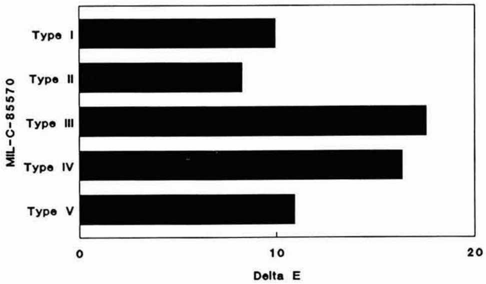

Figure 9—Effect of repeated cleaning with other cleaner types on treated surface color change (as measured by ΔE_H after soiling and cleaning). ■ = cleanability at 20 cycles

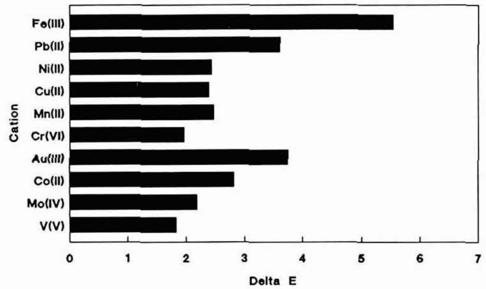

Figure 10—Effect of various cations on the appearance of TACSHIELD on treated surfaces. ■ = cleanability testing

repeated nine times to simulate a worst case situation. Results are shown in *Figure* 6. In general, the infrared reflectance over the 400 to 3000 nm range was virtually unchanged with only a minor decrease in reflectance at 2700. Gloss, however, did show significant and constant increases with each application. Since the surfactant could have contributed to the increase in gloss, the gloss study was repeated using an intermediate rinse following the drying step. Results are shown in *Figure* 7. The gloss and IR reflectance results were essentially the same as before. The 60° gloss reached a maximum of nine after 10 applications.

In the later field test on a P-3 aircraft, gloss measurements for untreated and TACSHIELD treated (one application) topcoat sections were 1.2 and 1.3, respectively. Although this is a slight increase, it is well within experimental error and further field testing must be performed, including multiple TACSHIELD applications.

DURABILITY OF THE TACSHIELD TREATMENT

The potential effectiveness in a service environment was evaluated by exposing the treatment to a number of different conditions, as follows: repeated cleaning with MIL-C-85570 Type II; cleaning with other MIL-C-85570 products; colored cations in water supplies; salt spray exposure; SO_2/salt spray exposure; accelerated weathering; heat transfer fluid and jet fuel exposure; mechanical effects; repainting; and removal of the treatment.

To estimate the durability of the application, treated and untreated test panels were repeatedly soiled and cleaned. Colorimeter readings were obtained before and after this procedure. *Figure* 8 compares the color change effects of repeated soiling/cleaning on untreated, AM treated (*Table* 3), and PM treated topcoats. The untreated specimen exhibited excessive color change (ΔEs exceeding 25) while the PM treated specimen had moderate color change. Treatment with the AM formula resulted in minimal color change, providing significant improvements over the untreated and PM treated specimens.

Since military aircraft are frequently cleaned for corrosion control as well as appearance, it was deemed necessary to identify cleaners which cause degradation of the treatment. Test panels were TACSHIELD treated and repeatedly cleaned with a specific cleaner type under MIL-C-85570:

Type I—General purpose exterior aircraft cleaner (maximum solvent content = 32%; contains aromatic hydrocarbons)

Type II—General purpose exterior aircraft cleaner (maximum solvent content = 15%; aromatic hydrocarbons prohibited)

Type III—Abrasive spot cleaner for gloss painted surfaces

Type IV—Rubberized spot cleaner for tactical paint surfaces

Type V—Gel-type degreaser for wheel wells

Cleaning was performed using the Gardner Heavy Duty Wear Tester as specified in the *Appendix* with 100 back and forth strokes in one direction followed by 100 back and forth strokes in the 90° direction (equivalent to 20 normal cleaning cycles as specified in MIL-C-85570). After rinsing and drying, panels were soiled and cleaned as in previous tests to determine soil resistance. The results (*Figure* 9) indicate that the more aggressive spot cleaners (Types III and IV) are the most damaging to the treatment, followed by Types I and V. The mildest effects

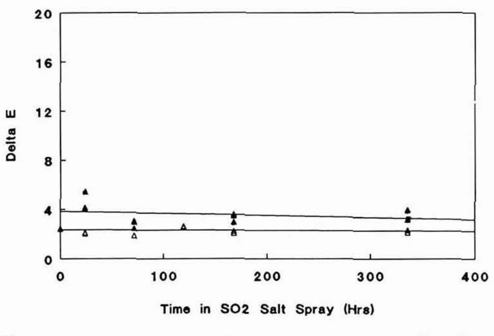

Figure 11—Effect of salt spray exposure on treated surface color change (as measured by ΔE_H after soiling and cleaning). Δ = neutral salt spray; ▲ = SO_2 salt spray

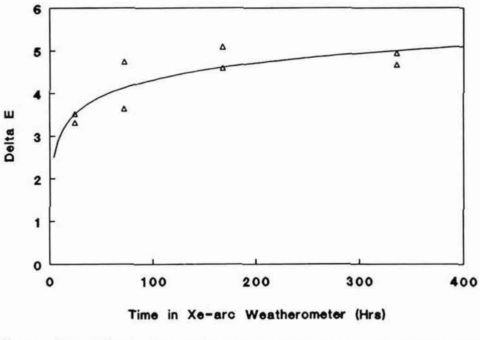

Figure 12—Effect of accelerated weathering on treated surface color change (as measured by ΔE_H after soiling and cleaning). Δ = treated

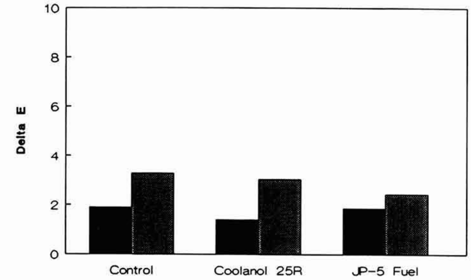

Figure 13—Effect of various fluids on treated surface color change (as measured by ΔE_H after soiling and cleaning). ■ = soak/soil/clean; ▨ = soak/clean/soil/clean

were obtained by the MIL-C-85570, Type II cleaner. It should be noted that the accelerated cleaning procedure described previously may be equivalent to more than 100 aircraft washings. Nonetheless, it appears that numerous washings of aircraft with these cleaners will adversely affect the TACSHIELD treatment. Therefore, periodic re-application of this treatment may be necessary. Although actual field experience will be needed to determine the required frequency of re-application to maintain effectiveness, the results to be presented in this paper indicate that the treatment is reasonably durable when exposed to operational conditions.

Since the dried TACSHIELD treatment had some similarity to cation exchange media, it was thought that colored cations in wash rack water supplies (such as iron or copper) might be held preferentially, discoloring the treatment. To check this phenomenon, treated test panels were measured by colorimeter and subsequently immersed for five minutes in 5 wt % solutions of various compounds. After rinsing and drying, panels were soiled, cleaned, and measured again to determine ΔE. Results, shown in *Figure* 10, indicate this type of discoloration is

Table 3—Soil Resistant Treatment Formulation TACSHIELD (Concentrations in wt %)

Ludox AM	15.0
Distilled water	84.0
MIL-D-16791	1.0

possible with iron (III) causing the most significant change. This ΔE, however, is still well below those values observed for untreated surfaces which have been soiled and cleaned.

The durability of TACSHIELD in a salt fog environment was evaluated by treating test panels, then exposing them at a 15° angle from the vertical in 5% salt fog chambers in accordance with ASTM B 117 and G 85, respectively. After various durations of exposure up to 350 hr, panels were removed, rinsed, dried, soiled, and cleaned to determine soil resistance. Results presented in *Figure* 11 indicate no apparent loss of treatment effectiveness. Untreated test panels exposed in SO_2/salt spray exhibited an unexplained increase in soil resistance.

In contrast to salt spray exposure, treated test panels exposed in a xenon arc accelerated weathering chamber (ASTM G 26, Type BF) appeared to lose some of their soil resistance. Results shown in *Figure* 12 show a slight loss in soil resistance with increasing exposure. However, these results are still superior to those of unweathered, untreated test panels.

To determine the effect of two common aircraft fluids, a silicate ester heat transfer fluid (Coolanol® 25R) and a kerosene based jet fuel (JP-5), test panels were treated, then soaked for 16 hr in each of the fluids. After the panels were removed, cleaned and dried, they were soiled and cleaned to measure soil resistance. Comparison with unexposed panels indicates no significant change in soil resistance (*Figure* 13).

To determine the potential harm caused by mechanical effects, a treated test panel was masked with MIL-T-21595 masking tape, then the tape was peeled off. A

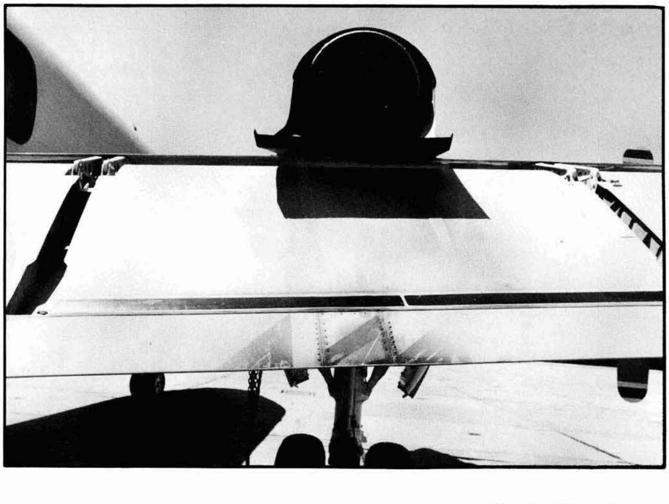

Figure 14—TACSHIELD treated and untreated wing section aft of engine exhaust

second panel was smudged with finger pressure, and a third panel was scuffed with black rubber. Panels were then soiled and cleaned and reflectance was measured with a colorimeter to determine soil resistance. Somewhat lower soil resistances were noted for areas which were masked and smudged. Rubber scuff marks could not be removed from either treated or untreated areas.

To insure that TACSHIELD could be refinished with topcoat if necessary, a treated surface was cleaned using MIL-C-85570 Type II cleaner and a MIL-C-83286 polyurethane topcoat was spray applied. A wet tape test (ASTM D 3359), performed after the normal seven day ambient drying conditions, indicated excellent adhesion of the re-applied topcoat.

Strong caustic solutions and abrasive cleaning compounds were the only effective means found to remove the TACSHIELD treatment, but caustics can cause aluminum corrosion and abrasives increase the gloss of the topcoat. However, as noted previously, TACSHIELD can be oversprayed with a new polyurethane topcoat, if the surface appearance becomes objectionable.

FIELD TEST RESULTS

TACSHIELD has been applied to freshly painted sections of a P-3 aircraft wing trailing edge, just aft of the inboard engine exhausts. These areas typically discolor within weeks of painting due to excessive carbonaceous exhaust deposits. The treated test areas showed only a minor gloss increase (from about 1.1 to about 1.3). As illustrated in *Figure* 14, exhaust residues on TACSHIELD treated areas were removed easily with the MIL-C-85570 Type II cleaner. In untreated areas, exhaust soils were embedded in the paint and could not be removed.

A second field test was initiated at Naval Air Station Mayport, Mayport, FL, where selected "problem areas" of an SH-60 helicopter were treated. Initial field reports support the data discussed previously.

CONCLUSIONS

An effective soil resistant treatment (TACSHIELD) was developed for low gloss aircraft paint surfaces. Even after repeated cleaning with exterior aircraft cleaner, the treatment provides superior soil resistance to that of the untreated topcoat. Laboratory tests have shown that exposure to SO_2-salt spray, conventional salt spray, fuel, hydraulic fluid, coolant, nonabrasive cleaners, and strong acid have little or no effect on the durability of TACSHIELD. Accelerated weathering tests have produced some degradation of the treatment and some cations, such as iron, can produce some minor changes in color. The actual effect of weathering and water quality on a treated surface are relatively insignificant compared to the poor soil resistance characteristics of untreated surface.

The TACSHIELD treatment has a minimal increase in the gloss of lusterless coatings, even after several applications. However, paints with higher glosses will require additional study. Preliminary field tests on the effectiveness of the coating have confirmed laboratory results. Additional field tests will be required to determine the life expectancy of the treatment and the need for re-application.

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APPENDIX

Cleanability of Painted Surfaces

APPARATUS: Test panels 3 × 6 × 0.02 in. (7.6 × 15.2 × 0.05 cm), cut from 2024-T3 aluminum alloy, chromate conversion coated with materials conforming to MIL-C-81706 to produce a coating meeting the requirements of MIL-C-5541; one-quart (1 L), wide mouth, glass jar; balance accurate to 0.1 g; high shear mixer; hog bristle brush (Gardner WG-2000-B); acid brush; rubber roller, 5.0 ± 0.1 lbs (2270 ± 50 g); forced draft oven, capable of 221 ± 4°F (105 ± 2°C); wear tester (Byk Gardner Heavy Duty Wear Tester); template for positioning panels on wear tester at ± 45° to the cleaning stroke; cellulose sponge backed with nylon web (Scotch Brite 63); and colorimeter, suitable for measurement in the L*a*b color system (MacBeth Model MC-1010 S).

PREPARATION OF SOIL: Place 50.0 ± 0.5 g carbon black (such as Raven 1040, manufactured by Columbian Chemical Company) and 500 ± 1 g MIL-H-83282 hydraulic fluid. Homogenize this mixture using a high shear mixer for 15 ± 1 min. Prior to application of the soil to the test specimen, thoroughly stir or shake the mixture.

PREPARATION OF THE CONTROL FORMULA CLEANER: The following is a control formula for MIL-C-85570, Type II aircraft cleaner as listed in paragraph 4.6.13.1 of the specification.

Mix Igepal CO-630, Monamid 150CW, dipropylene glycol methyl ether, deionized water, and benzotriazole, then neutralize the mixture to a pH of 8.0 with acetic acid. Add Hostacor 2098 and morpholine and mix until homogeneous.

Ingredients	Wt %
Igepal CO-630[a]	10.0
Monamid 150CW[b]	5.0
Dipropylene glycol methyl ether	10.0
Deionized water	71.5
Benzotriazole	0.5
Hostacor 2098[c]	2.0
Morpholine	1.0
	100.0

(a) GAF Corporation or equivalent.
(b) Mona Industries, Inc. or equivalent.
(c) American Hoechst Corporation or equivalent.

Preparation of Test Panels: To the aluminum test specimens, apply MIL-P-23377 epoxy primer to a thickness of 0.6 to 0.9 mils (15 to 23 μm). Allow to dry for one hour at ambient laboratory conditions. Apply the desired topcoat to the intended thickness. For MIL-C-83286 polyurethane, mix the two components and allow a 30 min dwell time. Apply the paint to a thickness of 1.8 to 2.2 mils (46 to 56 μm) and allow the coating to cure for one week at room temperature, then bake the coated panels at 150 ± 4°F (66 ± 2°C) for one week.

If determining percent cleanability, measure the L_H value of the virgin surface (L_v). If determining the total color difference between the virgin and the soiled and cleaned surface, measure the L_H, a_H, and b_H values for the virgin surface (L_v, a_v, and b_v).

After allowing the desired cure time and conditions, use an acid brush to coat the painted surface of a test panel with the soil previously described. Remove excess soil by covering the test panel with absorbent tissue and exerting pressure by rolling the tissue with the rubber roller. Repeat this blotting procedure three times using fresh tissue each time. Brush the soiled surface 10 times in one direction only, parallel to the long dimension of the test panel, using the hog bristle brush. Bake the test panel at 221 ± 4°F (105 ± 2°C) for 60 ± 1 min.

If determining percent cleanability, measure the L_H value of the soiled surface (L_s).

Cleaning Procedure: Dilute one part of the control formula with nine parts distilled water (by volume).

Clean the test panel using the wear tester as follows. Cut the sponge so that any texture "ribs" run perpendicular to the cleaning stroke and with the dimension parallel to the stroke equal to 3.5 in. (90 mm) and the dimension perpendicular to the stroke equal to 2.75 in. (70 mm). When the dry sponge is attached to the cleaning head of the wear tester, the combined weight shall be between 1350 and 1400 g. (Note: Use hook and loop type strips to attach the nylon web of the sponge to the cleaning head.) Place the soiled test panel in the template at 45° to the cleaning stroke. Saturate the sponge and cover the test panel with the cleaning solution. After 30 ± 3 sec, clean the test panel using five cycles (one cycle = a stroke in each direction) of the wear tester, then immediately turn the test panel 90° in the template and clean for an additional five cycles. Rinse the panel under a flowing stream of tap water at room temperature and allow to dry fully.

If determining percent cleanability, measure the L value of the cleaned surface (L_c) and calculate cleanability as shown in equation (3):

$$\text{Cleanability (\%)} = \frac{L_c - L_s}{L_v - L_s} \times 100 \qquad (3)$$

If determining the total color difference between the virgin and the soiled and cleaned surface, measure the L_H, a_H, and b_H values for the cleaned surface (L_c, a_c, and b_c) and calculate ΔE as shown in equation (4):

$$\Delta E_H = [(\Delta L_H)^2 + (\Delta a_H)^2 + (\Delta b_H)^2]^{1/2} \qquad (4)$$

Electrostatic Painting of Plastics I: Electrical Properties of Plastics and Primers

David P. Garner and Alaa A. Elmoursi
General Motors Research Laboratories*

To better understand the problems associated with the electrostatic painting of plastics, we examined the ability of reaction injection molded polyurethane/polyureas, thermoplastic olefins, aromatic nylon blends, thermoplastic urethanes, polycarbonate blends, and nylon/polyphenyleneoxide blends to dissipate charge. Six conductive primers (based on different resin chemistries) were also examined. Bulk and surface resistivities of the plastics were determined under dry, ambient, humid, and wet conditions. In general, the more polar the plastic, the greater the decrease in resistivity on going from dry to wet conditions. Bulk and surface resistivities were determined for the conductive primers under dry, ambient, and wet conditions. The bulk and surface resistivities of the conductive primers were approximately the same under all conditions.

INTRODUCTION

Electrostatic spray painting began in the 1930s, and by 1960 a variety of air and centrifugally assisted atomizing electrostatic guns were available.[1,2] Since then, the automotive industry has acquired substantial experience in the electrostatic painting of exterior metal body panels.[3,4] With the increasing introduction of plastic materials for vehicular components, more research is required so that these new materials can be painted with the same high quality and appearance as metal parts, particularly when using electrostatic spray equipment. The work reported here promotes the basic understanding of the electrostatic painting of plastics.

In a typical electrostatic painting process, such as shown in *Figure* 1, the sprayer is maintained at high voltage (50-90 kV) while the target is grounded. Normally when a metallic substrate is being painted, it is rather simple to maintain the target at ground potential by using an appropriate grounding strap. In this case, the spray current, I_{sp}, is equal to the current measured by the grounding ammeter, I_m. In the case of a plastic substrate, the currents I_{sp} and I_m would not be equal, I_m being smaller. This is because the charge accumulated on the surface due to the incoming current, I_{sp}, does not dissipate as readily as with metals. The rate of charge dissipation, as will be explained later, is dependent on the surface and bulk resistivity of the plastic materials.

The charge accumulated at the surface of a plastic target is a disadvantage in the electrostatic painting process. As a potential is built along the target surface, it causes a reduction in the potential difference between the sprayer and the target, leading to deficient charging and weaker electric forces on the charged paint droplets. Moreover, the charge retained at the surface causes an opposing electric field to the incoming charged droplets that further reduces the deposition of the paint on the target surface. Because the potential distribution along the target surface is nonuniform, there are current components along the surface that can affect the paint particles. Furthermore, the nonuniformity causes the opposing electric fields also to be nonuniform. As a result, not only do we get less paint deposition but also a nonuniform film build. In some plastics, the retained charges may continue to exist for long periods after the paint has been sprayed, making the painted surface more vulnerable to dust attraction.

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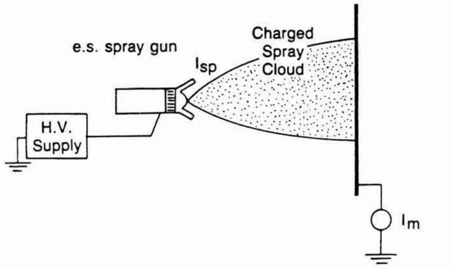


Figure 1—Schematic diagram of an electrostatic painting system

Fundamental information that serves as a guide for the electrostatic spraying process as applied to plastics is needed. However, little quantitative data on this subject is available. This report will focus on the role that charge dissipation has on the electrostatic painting of plastics. One of our research goals is to perform measurements on small samples of plastic materials and, from the information acquired, be able to determine the materials' potential for electrostatic coating. Another goal is to determine and document procedures and equipment to allow a better understanding of the electrostatic painting of plastics.

EXPERIMENTAL

Materials and Sample Preparation Procedures

The plastics and conductive primers used in this study and their suppliers are listed in *Table* 1. Plastic samples were cut to the desired size using a shear (4 in. × 4 in. for the resistivity measurements and 4 in. × 2 in. for the permittivity measurements), rinsed with deionized water, and then air dried before use. The primers were sprayed on Bonderite 40 phosphated cold rolled steel panels (4 in. × 12 in.) and cured by baking at 250°C for 30 min. The application conditions were such as to yield a film build of 1.0 ± .2 mils. Samples of the primed steel panels were cut to sizes similar to the plastic samples.

Bulk and surface resistivity measurements for the plastics were taken at dry (samples placed in a desiccator over calcium sulfate at 21°C for three days), ambient (samples kept at room conditions at approximately 21°C and 50% relative humidity for at least three days), humid (samples exposed to 27°C and 80% relative humidity for three days), and wet (samples soaked in deionized water at 21°C for three days) conditions. Bulk and surface resistivity measurements for the primer were taken at dry, ambient, and wet conditions. The permittivities for the plastics were determined on dry, ambient, and wet samples. The permittivities of the primers were not measured because the experimental apparatus was not designed for measuring permittivities of thin films. The permittivities of all primers in this study were assumed to be 2. This value was selected because the permittivities of most organic solids lie in the range of 2 to 10, mostly being on the lower end of the range.[5]

Experimental Measurement of Electrical Parameters

The three parameters measured were the bulk resistivity, surface resistivity, and relative permittivity. The first two parameters were measured using a Keithley Instruments resistivity cell model #6105 with a 0-3 kV dc supply and a digital electrometer for measuring currents in the range below micro-amps. *Figures* 2a and 2b represent the electrical connections to the resistivity cell to make measurements of bulk and surface resistivities, respectively. The resistivity cell is composed of two disk electrodes, the lower being surrounded by a guard electrode as shown in both figures. A sample of the plastic substrate is sandwiched between the upper and lower electrodes. When making measurements of bulk resistivity (see *Figure* 2a), the high voltage is applied to the upper electrode while both the lower and the guard electrodes are grounded. The lower electrode is grounded through the electrometer which measures the current flow through the bulk of the material between the upper and lower electrodes. Knowing the dimensions of the cell (D_1,d), the applied potential (V), and the current (I), it is then possible to calculate the bulk resistivity, ρ, from equation (1).

$$\rho = \frac{V}{I}\,\frac{(\pi/4)D_1^2}{d} \tag{1}$$

For measuring surface resistivity (see *Figure* 2b), the high voltage is applied to the lower electrode. The upper electrode and the guard ring are both grounded. The latter is grounded through the electrometer to measure the surface current between the lower electrode and the guard ring. The surface resistivity is then evaluated using equation (2).

$$\sigma = \frac{V}{I}\,\frac{(D_2 - D_1)}{\pi(D_2 + D_1)} \tag{2}$$

To measure the relative permittivity of the substrate, a Hewlett Packard Q meter model #4342A was used. With

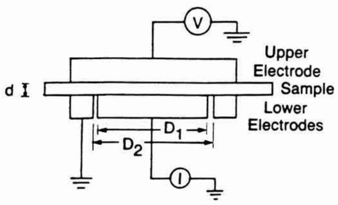
Table 1—Materials and Suppliers

PLASTICS

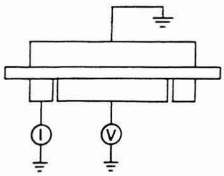
Material Name	Material Type	Supplier
NPB	Nylon 6/PPO blend	General Electric
PCB	Polycarbonate blend	Dow Chemical
RIM	Polyurethane/Polyurea	Dow Chemical
ANB	Aromatic nylon blend	Du Pont Chemical
TPO	Thermoplastic olefin	Republic Plastics
TPU	Thermoplastic urethane	Shulman

PRIMERS

Primer Designation	Type	Supplier
Primer (1)	Polyurethane	AKZO
Primer (2)	Amino-Polyester	Sherwin-Williams
Primer (3)	Epoxy	AKZO
Primer (4)	Polyester-Melamine	Du Pont
Primer (5)	Melamine-Formaldehyde	BASF
Primer (6)	Polyurethane	BASF



a. Connections for measuring bulk resistivity.



b. Connections for measuring surface resistivity.

Figure 2—Electrical connections for meters and electrodes to perform resistivity measurements on plastic samples

this device, the plastic sample is sandwiched between two electrodes and the capacitance of the sample is determined. Later, the sample is removed and the same gap spacing is adjusted between the two electrodes and the capacitance of the air gap is measured. The relative permittivity of the material is determined as the quotient of the sample capacitance and the air gap capacitance. For thin films, such as primers, the air gap could not be adjusted to the thickness of the primer. Thus, the permittivities of the primers were not determined experimentally.

RESULTS AND DISCUSSION

Mechanism of Charge Dissipation

Charges deposited on any surface, even metallic, will reside on the surface if it has no leakage path to ground. If a leakage path is available, the charge will leak at a rate dependent on the electrical conductivity of the leakage path. With reference to *Figure* 3, consider a plastic substrate in contact with a grounded metal plate. If charge is deposited on the surface of the plastic substrate, the charge will leak to the metallic plate in one of two manners or both depending on the most conductive path.

CHARGE RELAXATION: This is presented in *Figure* 3a, where the charge residing on the surface is neutralized through the bulk of the material. The magnitude of the charge on the surface will decay according to equation (3), where τ is the charge relaxation time constant and is given by equation (4). The terms ρ and ϵ_r are the bulk resistivity and relative permittivity, respectively.

$$Q(t) = Q_o e^{-t/\tau} \tag{3}$$

$$\tau = \rho \epsilon_o \epsilon_r \tag{4}$$

SURFACE DIFFUSION: This is presented in *Figure* 3b, where the charge dissipates along the surface of the material and not through the bulk. The diffusion equation in a one-dimensional problem is represented by equation (5). The diffusion time constant, τ_D, is a function of the surface resistivity σ and the relative permittivity ϵ_r.

$$\frac{\delta^2 V}{\delta x^2} = \tau_D \frac{\delta V}{\delta t} \tag{5}$$

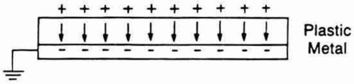
$$\tau_D \, \alpha \, \sigma \epsilon_o \epsilon_r \tag{6}$$

From equations (3) to (6), it is clear that it is possible to determine the electrostatic paintability of plastic materials by measuring the bulk and surface resistivity of the material as well as its relative permittivity. Thus, rather than conducting a full scale experiment on the plastic substrate, only a small sample (0.1 × 0.1 m) is needed for determining the electrical properties and, accordingly, predicting the electrostatic paintability of the material.

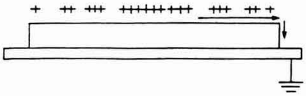
Charge Dissipation for Plastics and Conductive Primers

The bulk resistivity, surface resistivity, and permittivity for reaction injection molded polyurethane/polyureas (RIM), thermoplastic urethanes (TPU), nylon/polyphenyleneoxide blends (NPB), aromatic nylon blends (ANB), thermoplastic olefins (TPO), and polycarbonate blends (PCB) were determined under dry, ambient, humid, and wet conditions. The bulk and surface resistivities were calculated from equations (1) and (2), respectively, and equation (4) was used to calculate the time constant for charge dissipation through the bulk.

The resistivities of the plastics ranged over several orders of magnitude. Repeated resistivity measurements of the plastics at the higher resistivities indicated the



a. Charge Relaxation



b. Charge Diffusion

Figure 3—Mechanisms for charge dissipation from plastic substrates

accuracy of the measurement to be about one order of magnitude. All resistivities and time constants values are given in orders of magnitude. Although resistivities lower than 10^{14} could be measured more accurately, the order of magnitude is all that is needed for comparison purposes or to determine the sprayability of a plastic as will be shown. The permittivities for all plastics at any of the previously noted conditions was 2.0 ± 0.6.

Table 2 shows the bulk and surface resistivities, permittivities, and time constants for charge dissipation through the bulk taken under dry conditions. The bulk resistivities ranged from 10^{11} Ω-cm for RIM to 10^{17} Ω-cm for PCB, and the surface resistivities ranged from 10^{14} Ω for RIM to 10^{18} Ω for TPO and PCB. The order of increasing resistivity for the plastics was: RIM, NPB, ANB, TPU, TPO, and PCB. The time constants ranged from 10^{0} seconds for RIM to 10^{6} seconds for PCB. In *Table* 3, the values determined at ambient conditions showed a change in the order of resistivity. TPU was now less resistive than ANB and, in general, the resistivities and time constants for the plastics decreased slightly. At humid conditions, shown in *Table* 4, the order remained the same, but there were decreases in resistivities and time constants for RIM and NPB. The bulk resistivity, surface resistivity, and time constant for RIM are: 10^{07} Ω-cm, 10^{12} Ω, and 10^{-4} seconds, respectively, and for NPB: 10^{09} Ω-cm, 10^{11} Ω, and 10^{-2} seconds, respectively. However, the resistivities and time constants for ANB, TPO, and PCB remain virtually the same. The values obtained under wet conditions (*Table* 5) are very similar to those obtained under humid conditions.

The decrease in resistivity (increase in conductivity) for RIM and NPB with increasing water availability can be explained from an understanding of the structure of the molecules which form the plastic. RIM is based on polyurethane and polyurea and the urethane and urea linkages are very polar. In addition, the flexible portion of the plastic is usually based on polyethers, another polar linkage. NPB is a blend of polyphenyleneoxide and nylons. The nylons used in NPB are secondary polyamides and these amides are also polar groups. Water, a polar molecule, would therefore be attracted to those sites, and indeed polyurethanes, polyureas, and secondary polyamides are known to absorb significant amounts of moisture. The increase in conductivity for RIM and NPB is then due to the absorbed water in the bulk or on the surface of the plastic. The linkage groups in the ANB, TPO, and PCB plastics are much less polar and therefore do not attract water—hence, poor bulk or surface conductivity.

The bulk resistivities, surface resistivities, and time constants for a number of conductive primers were determined under dry, ambient, and humid conditions and their values are shown in *Tables* 6, 7, and 8, respectively. The most important factor observed for this series of experiments is that, when going from a dry condition to a wet condition, there were only slight decreases in the bulk and surface resistivities or time constants. Values ranged from 10^{05} to 10^{07} Ω-cm for bulk resistivity, 10^{07} to 10^{12} Ω for surface resistivity, and 10^{-4} to 10^{-6} sec for the time constants, and in no case did the change exceed two orders of magnitude when going from the dry to the wet condition.

To put the time constant data into perspective: 10^{-6} seconds is microseconds, 10^{0} is one second, 10^{2} is minutes, 10^{4} is hours, and 10^{6} is days. Thus, at ambient conditions, the conductive primers are capable of fully dissipating charge in the milli- to micro-second range. RIM requires about a second to dissipate charge. NPB requires a couple of minutes to dissipate charge. TPU and ANB require a few hours, and TPO and PCB need about a day to dissipate a deposited charge.

The elapsed time from the generation of charged paint particles at the spray device to their deposition on the surface of a work piece is on the order of 10^{-1} sec for electrostatic bells and 10^{-2} sec for electrostatic air as-

Table 2—Resistivities of Plastics Under Dry Conditions

Material	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Permittivity	Time Constant (sec)
RIM........	10^{11}	10^{14}	2.3	10^{0}
NPB........	10^{13}	10^{16}	1.9	10^{2}
ANB	10^{15}	10^{17}	1.9	10^{4}
TPU........	10^{16}	10^{15}	2.7	10^{5}
TPO........	10^{16}	10^{18}	1.5	10^{5}
PCB........	10^{17}	10^{18}	1.7	10^{6}

Table 3—Resistivities of Plastics Under Ambient Conditions

Material	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Permittivity	Time Constant (sec)
RIM........	10^{10}	10^{14}	2.4	10^{0}
NPB........	10^{13}	10^{15}	1.9	10^{2}
TPU........	10^{13}	10^{14}	2.7	10^{4}
ANB	10^{14}	10^{18}	1.9	10^{4}
TPO........	10^{16}	10^{17}	1.5	10^{5}
PCB........	10^{17}	10^{16}	1.7	10^{5}

Table 4—Resistivities of Plastics Under Humid Conditions

Material	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Permittivity	Time Constant (sec)
RIM........	10^{07}	10^{12}	2.6	10^{-4}
NPB........	10^{09}	10^{11}	2.1	10^{-2}
ANB	10^{14}	10^{16}	1.9	10^{3}
TPO........	10^{16}	10^{18}	1.5	10^{5}
PCB........	10^{16}	10^{17}	1.7	10^{5}

Table 5—Resistivities of Plastics Under Wet Conditions

Material	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Permittivity	Time Constant (sec)
RIM........	10^{07}	10^{12}	2.9	10^{-3}
NPB........	10^{09}	10^{11}	2.1	10^{-2}
ANB	10^{14}	10^{15}	1.9	10^{3}
TPO........	10^{16}	10^{17}	1.5	10^{5}
PCB........	10^{15}	10^{16}	1.8	10^{4}

Table 6—Resistivities of Conductive Primers Under Dry Conditions

Conductive Primer	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Time Constant (sec)
Primer (1)	10^{05}	10^{10}	10^{-6}
Primer (2)	10^{06}	10^{09}	10^{-5}
Primer (3)	10^{06}	10^{08}	10^{-5}
Primer (4)	10^{07}	10^{12}	10^{-2}
Primer (5)	10^{06}	10^{09}	10^{-5}
Primer (6)	10^{05}	10^{12}	10^{-6}

Table 7—Resistivities of Conductive Primers Under Ambient Conditions

Conductive Primer	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Time Constant (sec)
Primer (1)	10^{05}	10^{09}	10^{-6}
Primer (2)	10^{05}	10^{08}	10^{-5}
Primer (3)	10^{05}	10^{08}	10^{-6}
Primer (4)	10^{07}	10^{12}	10^{-4}
Primer (5)	10^{05}	10^{09}	10^{-5}
Primer (6)	10^{05}	10^{12}	10^{-6}

sisted guns.[6] Thus, any of the conductive primers with time constants of 10^{-4} or less should be able to dissipate the incoming charge by either method, but none of the plastics can dissipate the charge fast enough to prevent a charge build-up with eventual repulsion of the incoming paint particles. This does not mean that paint will not be deposited on plastics, particularly in the case of air assistance, but it does mean that the paint will be applied unevenly.

Charge Dissipation in Wet Paint

Another interesting factor is the paint itself. For a typical basecoat, the bulk resistivity was found to be 10^6 Ω-cm. If we assume a relative permittivity of 2 (organic liquids range from 1.8 to 4.0[5]), then the corresponding time constant is about 10^{-5}. From the point of view of charge dissipation, the wet paint has the same characteristics as a conductive primer. In an electrostatic painting process where a plastic substrate is being painted, if the spray fan is first passed over a ground point on the substrate, then the wet paint should be able to dissipate the charge. Yet, from experience we know this is not the case. We have further investigated this and our findings are reported in a later paper.[7]

Table 8—Resistivities of Conductive Primers Under Wet Conditions

Conductive Primer	Bulk Resistivity (Ω-cm)	Surface Resistivity (Ω)	Time Constant (sec)
Primer (1)	10^{05}	10^{09}	10^{-6}
Primer (2)	10^{05}	10^{07}	10^{-6}
Primer (3)	10^{05}	10^{07}	10^{-6}
Primer (4)	10^{06}	10^{12}	10^{-4}
Primer (5)	10^{05}	10^{09}	10^{-6}
Primer (6)	10^{05}	10^{11}	10^{-6}

CONCLUSIONS

There are three major contributions that represent the work reported here. First, a method has been developed that allows the measurement of bulk and surface resistivities on very small samples of materials prior to attempts to electrostatically spray them. From the bulk resistivity measurement the charge dissipation time constants can be determined and, therefore, ultimately the sprayability of the material can be determined. Second, a charge dissipation time constant of 10^{-4} sec (at ambient conditions) has been determined to be adequate for electrostatic spraying based on literature values and the above work. However, as also shown, at higher humidities materials which absorb water will lower their resistivities while materials that do not absorb water will maintain about the same resistivity. Thus, spraybooth conditions can also affect the ultimate sprayability of a material. Third, since freshly applied paint is sufficiently conductive to dissipate the incoming charge, factors other than charge dissipation are important for the electrostatic painting of plastics.

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Formulating Stable Latex Paints With Zinc Oxide

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The stability of architectural latex paints containing zinc oxide was examined in terms of the influence each formulation component had on the stability of the formulation. This study examines the effect of dispersant selection, titanium dioxide grade, extenders, and binder, as well as formulation parameters such as pH, initial viscosity, pigment volume content, and percent volume solids. While typical single component effects were observed, interaction effects between components were found to be equally important in determining the stability of the formulation.

INTRODUCTION

Zinc oxide offers the coatings formulator a method to enhance many of the performance aspects of a latex paint. In its own right, zinc oxide is an excellent mildewstat[1] and functions synergistically with isothiazolone microbiocides.[2] Zinc oxide also improves the film's weathering characteristic through both the absorption of ultraviolet radiation[3,4] and by decreasing the water sensitivity of the film through ionic complexation of carboxylate moieties in the paint.[5] Finally, the refractive index of zinc oxide is high[6] allowing the particle to contribute somewhat to hiding as well, assuming that the particle size is in a range that can effectively scatter light.[7] With this impressive list of formulating benefits, one would expect zinc oxide to be used as a matter of course. However, during shelf aging or in accelerated aging tests, some latex paint formulations will show a catastrophic viscosity increase that can be attributed to the zinc oxide. As a result, many formulators have chosen to forego the advantages of zinc oxide to reduce the risk of product loss.

Over the years, several mechanisms have been proposed for the viscosity instability. While zinc oxide is relatively insoluble in water,* its amphoteric nature and its complex chemistry allow it to be solubilized in significant quantities in the presence of acids and bases.[8] In the presence of ammonia, the most common neutralizing agent in latex paints, zinc can form a series of zinc ammine complexes which further promotes its solubilization.[9] As this pool of zinc cations develops, the latex is destabilized by both the double layer compression effect caused by this multivalent ion[10] and the neutralization of surface charge caused by the specific interaction of carboxylate stabilizing moieties with the zinc complex ions.[11] It is interesting to note that this mechanism is used by the rubber industry for the gelation of latex rubber foams.

Another mechanism has been proposed[12] that predicts the hetero-flocculation of titanium dioxide (TiO_2) (as well as other anionically charged particles, such as latex binder) based upon the isoelectric behavior of the pigments. This work points out that zinc oxide carries a positive electrostatic charge at pH's below 9.5 whereas other particles, such as TiO_2 would be negatively charged above its isoelectric point of 7.6 in water. Therefore, the isoelectric behavior of the zinc oxide sets the stage for an attractive coulombic interaction between the zinc oxide and the other particles. While this effect occurs in relatively pure water, one would expect significant modification of the isoelectric behavior through the adsorption of a polyelectrolyte dispersant thus reducing or eliminating this interaction.

Other work[13] has suggested that the formation of a complex between zinc oxide and a lower fraction of the latex may form, resulting in "conglomerates or gel-like formations with latices, which are not readily redispersible."

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*Approximately 0.005 g/l in pure water at 25°C.

Table 1—Zinc Oxide Gloss Formulation

Materials	Lb	Gal
Propylene glycol	60.0	6.98
Dispersant (35% solids)	7.9	0.87
Water	5.1	0.62
Defoamer	1.0	0.13
TiO_2	250.0	7.30
Zinc oxide	25.0	0.54

Grind the above materials in a high speed mill (Cowles, 3800 to 4500 fpm for 20 to 25 min) and letdown at a slower speed as follows:

Materials	Lb	Gal
Water	30.0	3.60
Acrylic latex binder (46%)	546.7	62.38
Texanol	25.7	3.16
Propylene glycol	38.0	4.42
Microbiocide	2.0	0.23
Defoamer	1.0	0.13
Water/Low Mw HEC (2.5%)	74.2	9.64
Total	1071.2	100.00

Formulation Constants

PVC, %	22.5
VS, %	34.8
WS, %	49.0
pH	9.0
Initial viscosity, KU	72 to 76

While most of these mechanisms seen plausible, none of them have offered a general formulation solution to the problem. Since no one mechanism can offer a general panacea to the problem, it becomes important to understand the effect of every formulation parameter on the paint's stability. While conventional wisdom has it that dispersant selection controls the overall stability of the zinc oxide formulation, it is demonstrated that many other factors, including binder selection, volume solids, initial viscosity, adjuvant dispersants, and surfactants, are equally important.

Table 2—Zinc Oxide Flat Formulation A

Materials	Weight Ratio	Parts per Hundred (volume solids)
Water	125.0	15.00
Dispersant (40%)	7.1	0.67
Wetting agent	2.5	0.28
Defoamer	1.0	0.13
Propylene glycol	34.0	3.95
Low Mw HEC 250 MR (100%)	3.0	0.26
Ethylene glycol premix	25.0	2.69
TiO_2	225.0	6.54
Zinc oxide	25.0	0.54
Alumina silicate extender	147.3	6.76
Calcium carbonate	50.0	2.33
Attapugite clay	5.0	0.25

Grind the above materials in a high speed mill (Cowles, 3800 to 4500 fpm for 20 to 25 min) and letdown at a slower speed as follows:

Materials	Weight Ratio	Parts per Hundred (volume solids)
Acrylic latex binder	305.9	34.17
Defoamer	3.0	0.39
Texanol	9.3	1.17
Microbiocide	2.0	0.24
Ammonium hydroxide (28%)	2.0	0.27
Water/Low Mw HEC MHR (2.5%)	202.4	24.36
Total	1176.9	100.00

Formulation Constants

PVC, %	45.4
VS, %	36.2
WS, %	54.2
pH	9.2 to 9.6
Initial viscosity, KU	90 to 95

METHODS

To evaluate the effect of compositional variation on the stability of the paint, three base formulations, given in *Tables* 1, 2, and 3, were used. These formulations were selected based upon their marginal stabilities and the degree to which formulating parameters could affect that stability. All materials were commercial products and were used as supplied. All paints were prepared from the same lot of each raw material.

The stability of these paints was evaluated by accelerated aging methods. A great deal of conflict exists regarding accelerated stability testing and the conditions used. Most use the viscosity change after storage at elevated temperatures as an indicator of long-term stability. Typical conditions for this type of testing regime are 60°C for 10 days. Since the primary concern is the length of time that the paint's viscosity will remain stable during shipping and storage, it would seem reasonable to run the accelerated testing until the paint demonstrates this failure and compare the times required to induce this failure. Since this protocol would be impractical for laboratory testing, we have opted to extend this regime to 28 days. During this period, the paints were evaluated daily. The stability of paints exhibiting a catastrophic rise in viscosity in less than 28 days was recorded in terms of the number of days to failure. Those which remained fluid throughout the 28-day testing regime but showed an in-

Table 3—Flat Formulation B

Materials	Lb	Gal
Water	200.0	24.00
Defoamer	1.0	0.13
Ethylene glycol	27.9	3.00
HEC	2.0	0.17
KTPP	1.5	0.07
Wetting agent	2.5	0.28
TiO_2	250.0	7.60
ZnO	50.0	1.07
Alumino silicate extender	150.0	6.48

Grind the above materials in a high speed mill (Cowles, 3800 to 4200 fpm) then add the following at a slower speed as follows:

Materials	Lb	Gal
Acrylic latex binder (60.5%)	363.6	40.55
Defoamer	1.0	0.13
Texanol	11.0	1.39
Microbiocide	1.5	0.17
Water/HEC Medium Mw (2.5%)	115.9	13.91
Total	1188.4	100.00

Formulation Constants

PVC, %	39.1
VS, %	38.7
WS, %	56.5
Initial KU	80
pH	9.3 to 9.5

Table 4—Initial Evaluation of Formulation Stability with and without Zinc Oxide

	Flat Formulation A				Gloss Formulations			
	w/o ZnO		with ZnO		w/o ZnO		with ZnO	
Dispersant Type	Heat Aged	Roller	Heat Aged	Roller	Heat Aged	Roller	Heat Aged	Roller
High Mw poly acid, Na+ salt	P	P	P	F(27)	P	P	P	P
Hydrophobic copolymer, Na+ salt	P	P	P	P	P	P	F(3)	F(3)

P = Pass.
F(x) = Fail (days to failure).
Note: Samples subject to accelerated aging conditions for 28 days (see text).

crease in Stormer viscosity of more than 10 Krebs Units (KU) were recorded as 28 days to failure. Those that exhibited viscosity change of less than 10 KU were considered to pass. Using this protocol, the relative stability of the paints can be assessed based upon the days to failure.

A similar protocol was used for another accelerated testing method, mechanical agitation. In this test, 250 g of the formulated paint was placed into ½ pint paint cans. These cans were then subjected to agitation for 28 days on a roller mill revolving at ca. 130 rpm and evaluated as previously mentioned.

Paints were considered to be stable only if they passed both testing protocols.

Even with this more rigorous protocol, the evaluation of accelerated testing data must be interpreted cautiously. In a study correlating the accelerated stability testing of nearly 300 paints to shelf stability of these paints for one year at ambient conditions, we found only 78% correlation. Of that 22% which did not correlate, 13% were found to pass accelerated testing but failed one-year shelf stability. Therefore, one must be exceedingly cautious.

RESULTS AND DISCUSSION

Verify Formulation Instability

Before proceeding with an evaluation of the factors controlling zinc oxide stability, it is imperative to verify that the stability problem with the formulation is indeed caused by the presence of zinc oxide. To verify this, both flat formulation A and the gloss formulation were prepared with and without zinc oxide. For both formulations, TiO_2 was substituted for the zinc oxide removed on an equal volume basis. The data in *Table* 4 demonstrate that the viscosity instability that was observed was linked to the presence of zinc oxide in the formulation and not a result of other instability. This table also demonstrates another important observation echoed throughout this study. The correct selection of a 'zinc oxide stable' component, in this case a dispersant, is specific to the given formulation. Neither dispersant used provided stability in both formulation types.

pH Effect

Based upon the possible failure mechanisms previously presented, the pH of the continuous phase should have a remarkable effect on the formulation stability both through its influence on the charge on the dispersed particles and through the influence over the zinc ion species present. At a pH in excess of 9.7, the zinc oxide, as well as the other dispersed phases, would carry a negative charge, thus eliminating any attractive coulombic interactions. Likewise, at high pH, zinc ion is present as the zincate anion (ZnO_2^{-2}) which is less destabilizing than the zinc cation complexes present at lower pH. To demonstrate these effects, the pH of the gloss formulation was raised to pH = 12 using 50% NaOH solution at the end of the letdown. From the data in *Table* 5, it was observed that this formulation remained stable at high pH. However, as zinc oxide solubilizes, the pH of the paint drops as the base is consumed. While academically interesting,

Table 5—pH Effect on Heat Age Stability of Gloss Formulation (Paints Adjusted with NaOH)

Initial pH	1 day pH	1 day Stability	10 days pH	10 days Stability	28 days pH	28 days Stability
pH = 9	9	F	F	F	F	F
pH = 12	12	P	9.8	P	9.3	F(25)

P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

Table 6—Dispersant Effect on Zinc Oxide Stability

Dispersant Type	Flat Formulation Roller	Flat Formulation Heat Age	Gloss Formulation Roller	Gloss Formulation Heat Age
Hydrophilic copolymer NH_4+ salt	P	F(10)	F(4)	P
Hydrophobic copolymer Na+ salt	P	P	F(5)	F(1)
Hydrophobic copolymer NH_4+ salt	P	F(28)	F(3)	F(3)
High Mw acid homopolymer Na+ salt	P	F(27)	P	P
Low Mw acid homopolymer Na+ salt	P	F(17)	P	P

P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

Table 7—Effect of Potassium Tripolyphosphate (KTPP) on the Stability of Flat Formulation A

	w/o KTPP		With KTPP	
Dispersant	**Heat Age**	**Roller**	**Heat Age**	**Roller**
Hydrophilic copolymer NH$_4$+ salt	F(10)	F(10)	F(10)	F
Hydrophobic copolymer NH$_4$+ salt	F(28)	P	P	P
High Mw acid homopolymer Na+ salt	F(27)	P	P	P
Low Mw acid homopolymer Na+ salt	F(17)	P	F(28)	P

KTPP added to millbase at 1.5 lbs/100 gal.
P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

this method of stabilizing a paint offers no practical solace to the paint formulator. First, the permanent base NaOH was used for the pH adjustment, since a rather large amount of ammonium hydroxide would have been required to reach a pH of 12. Furthermore, if ammonia had been used, the increased level would have further promoted the solubilization of the zinc oxide through the formation of zinc ammine complexes. Even more importantly though, it would be impossible to maintain stability over time, since the zinc oxide solubilization process will cause the pH to drift downward.

Dispersant Effect on Stability

Clearly, the industry recognizes pigment dispersants to be the primary controlling factor for zinc oxide stability. This belief is so strong that raw materials suppliers classify dispersants based upon their 'zinc oxide stability.' While it is true that they do play an important role in stability, no one dispersant can be considered to be zinc oxide stable in all formulations. None of the dispersants shown in *Table* 6 conveyed stability to both formulations. While the Na+ salt acid homopolymers convey greater stability overall than the ammonium salt copolymers, no generalization would be rigorously correct.

Adjuvant Dispersants and Surfactants

The use of adjuvant dispersants, such as potassium tripolyphosphate (KTPP) or aminomethylpropanol (AMP), and surfactants have long been touted for their ability to improve zinc oxide stability. Indeed, the adjuvants can act as dispersants in their own right, and all of these additives can improve the dispersion stability. In addition, KTPP can complex with zinc cations reducing their adverse impact on stability.

To demonstrate this effect, KTPP was added to the millbase of flat formulation A at 1.5 lb/100 gal of paint. As shown in *Table* 7, a stability improvement with those dispersants that were producing a marginally stable formulation without KTPP can be observed. Those formulations which exhibited poor stability without KTPP were not improved sufficiently to pass this testing protocol.

In *Table* 8, the use of surfactants and adjuvants is demonstrated with similar results. In only one of the three cases, the formulation dispersed with hydrophilic copolymer, was the addition of a surfactant sufficient to convey good stability to the paint. In both of the other cases, significant stability improvements were observed with the addition of both surfactant and adjuvant, but their effect was still insufficient for these formulations.

Effect of TiO$_2$ Type

Remarkably, the choice of TiO$_2$ grade can have a profound effect on the formulation stability. In *Table* 9, the stabilities of three classes of TiO$_2$ were compared; these included grades with alumina, alumina/silica, and alumina/organic surface treatments. While each pigment demonstrated good stability with at least one dispersant type, none were stable with all of the dispersants. It was also remarkable that the rather typical combination of the copolymer dispersants with the alumina coated gloss grade pigment was the least stable. However, the sodium salt copolymer dispersant was stable with both of the other pigments.

Effect of Extender Selection

With an appreciation for the effect of the TiO$_2$ grade on zinc oxide stability, we would predict that the surface characteristics of other dispersed phases may also exert an important influence on stability. To examine this question, small portions of each of several different extenders were added to separate portions of the gloss formulation. Two china clays, a silica and a calcium carbonate extender were added at a loading of 0.7 gal/100 gal. This selection of extenders covered a wide range of particle sizes, oil absorption, and pH behavior. At this low level, almost no effect on stability was observed (*Table* 10).

Table 8—Effect of Adjuvant Dispersants and Surfactant as Stabilizing Additives to Gloss Formulation

Dispersant	Additives	Roller Stability	Heat Age Stability
Hydrophobic copolymer NH$_4$+ salt	None	F(3)	F(1)
	Surfactant	F(28)	F(3)
	Surfactant, AMP	P	F(6)
	Surfactant, AMP, KTPP	P	F(6)
Hydrophobic copolymer Na+ salt	None	F(18)	F(1)
	Surfactant	P	F(5)
	Surfactant, AMP	P	F(10)
	Surfactant, AMP, KTPP	P	F(10)
Hydrophilic copolymer NH$_4$+ salt	None	F(4)	P
	Surfactant	P	P
	Surfactant, AMP	P	P
	Surfactant, AMP, KTPP	P	P

Additives were blended with millbase liquids prior to pigment addition at the following levels:

	Level
Surfactant—Octyl phenol ethoxylate $(EO)_{9.5}$	2.5 lb/100 gal
AMP —Amino-2-methyl propanol	3.2 lb/100 gal
KTPP —Tripotassium phosphate	1.5 lb/100 gal

P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

Table 9—Effect of TiO_2 Type on the Stability of the Gloss Formulation

Dispersant	TiO_2 Gloss Grade Alumina Surface Treatment Heat Age	Roller	Gloss Grade Organic/ Alumina Surface Treatment Heat Age	Roller	Gen Purpose Alumina/ Silica Surface Treatment Heat Age	Roller
Hydrophilic copolymer NH_4+ salt	P	F(4)	P	F(7)	P	F(4)
Hydrophobic copolymer Na+ salt	F(3)	F(18)	P	P	P	P
High Mw acid homopolymer Na+ salt	P	P	F(25)	P	F(25)	P
Low Mw acid homopolymer Na+ salt	P	P	F(14)	F(17)	F(14)	P

P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

Table 10—Effects of Extender/Dispersant Variations on Stability of the Gloss Formulation

Extenders	China Clay A	 B	Silica C	$CaCO_3$ D
pH of 10% Slurry	4.5	7.0	6-7	9.5
Particle size (μ)	0.2	0.4	2.4	2.0
Oil adsorption value	47	39	30	18
Dispersant		**Heat Stability**		
Hydrophilic copolymer NH_4+ salt	P	F(5)	P	P
Hydrophobic copolymer Na+ salt	F(3)	F(3)	F(3)	F(3)
Acid homopolymer Na+ salt	P	P	P	P
		Roller Stability		
Hydrophilic copolymer NH_4+ salt	F(3)	F(3)	F(3)	F(3)
Hydrophobic copolymer Na+ salt	F(3)	F(7)	F(10)	F(3)
Acid homopolymer Na+ salt	P	P	P	P

P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

Only one combination, the hydrophilic copolymer dispersant with china clay B, substantially affected stability performance. To be conclusive, the examination of this effect should include higher extender pigment volume contents.

Effect of Latex Binder Selection

The selection of the latex binder, normally chosen for other performance characteristics, has an important influence on the stability of the formulation. For this study, four latex binders with dramatically different stabilization systems were substituted into flat formulation-B. The results in *Table* 11 suggest that while binder selection influences the stability, no generalization about binder stabilization type could be drawn. None of the binders exhibited good stability with all of the formulation variants. Each binder, though, was found to have at least one stable dispersant variant.

Effect of Zinc Oxide Selection

Two large particle size, latex coating grade, French Process zinc oxides from two different suppliers were evaluated in the gloss formulation at a level equal to 25 lb/100 gal. Despite the obvious importance of zinc oxide's role in the failure of these paints, the data in *Table* 12 show remarkably few differences in stability between the zinc oxides. This does not suggest that all zinc oxide grades are equal in terms of latex stability. However, where the zinc oxides were very similar in terms of process, morphology, and particle size, substitution had a limited effect in this formulation.

Effect of Pigment Volume Content, Volume Solids, and Initial Viscosity

To examine the effect of these formulation parameters on zinc oxide stability, the flat formulation B was modified as follows. Pigment volume content was varied by holding the relative volume ratio of the pigments, except zinc oxide, constant while the total content was varied. The zinc oxide level was maintained at 50 lb/100 gal. Dispersant level was held constant relative to the total pigment level (0.7% weight solids of dispersant on pigment). Volume solids was adjusted by dilution with water and 2.5% HEC solution to maintain constant initial viscosity. Viscosity was varied by changing the water/thickener balance.

Table 13 shows that these formulation parameters did not have any significant effect on the more stable polyacid dispersant variation of this formulation. However, some trends did emerge for the marginally stable formulation variant dispersed with the copolymer dispersant. As volume solids of the formulation were increased, the stability of the formulation decreased. If the failure mechanism involves the flocculation and/or coagulation

Table 11—Effect of Binder Selection on the Stability of Flat Formulation B

Acrylic Binder Type	Stability with Hydrophobic Copolymer Disp, NH_4+ salt Heat Age	Roller	Stability High Mw Polyacid Disp, Na+ salt Heat Age	Roller	Stability with Hydrophilic Copolymer Disp, NH_4+ salt Heat Age	Roller
A	P	F	P	P	P	F
B	P	P	P	P	F	F
C	P	P	P	P	P	F
D	P	P	F	P	P	P

Both binder and dispersant substituted at an equal weight solids basis.
A—Small particle, non-ionically stabilized architectural vehicle.
B—Large particle, HEC stabilized architectural vehicle.
C—Small particle, anionically stabilized architectural vehicle.
D—Small particle, highly stabilized anionic maintenance vehicle.
P = Pass.
F = Fail.
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

Table 12—Effect of Zinc Oxide Type on the Stability of the Gloss Formulation vs Dispersant and TiO_2 Selection

	Gloss Grade Alumina Surface Treatment		Gloss Grade Alumina/Organic Surface Treatment		Gen Purpose Grade Alumina/Silica Surface Treatment	
	ZnO-A	ZnO-B	ZnO-A	ZnO-B	ZnO-A	ZnO-B
Heat Stability						
Hydrophilic copolymer, NH_4+ salt	P	P	P	P	P	P
Hydrophobic copolymer, Na+ salt	F(3)	F(3)	P	F(10)	P	P
High Mw acid homopolymer Na+ salt	P	P	F(27)	F(10)	F(25)	F(26)
Low Mw homopolymer, Na+ salt	P	P	F(14)	F(6)	F(14)	F(25)
Roller Stability						
Hydrophilic copolymer, NH_4+ salt	F(4)	F(3)	F(7)	F(3)	F(4)	F(7)
Hydrophobic copolymer, Na+ salt	F(18)	F(3)	P	P	P	P
High Mw acid homopolymer Na+ salt	P	P	P	F(19)	P	P
Low Mw homopolymer, Na+ salt	P	P	F(17)	F(19)	P	P

Zinc oxide substituted at 25 lb/100 gal.
P = Pass.
F(x) = Fail (days to failure).
Note: Samples subjected to accelerated aging conditions for 28 days (see text).

of the dispersed phases, the likelihood of failure would increase with increasing volume solids due to the reduction of interparticle distance and the increase of collisional frequency at higher solids concentration. The data also suggest that for this formulation, increased pigment volume content and decreased initial viscosity improve stability; however, the reason for these effects are less clear.

Interaction Effects on Formulation Stability

Thus far, we have been able to make very few clear generalizations about the formulation effects important to the stability of a zinc oxide paint. The source of this complexity could be two-fold. First, the chemistry of the zinc oxide failure mechanism is exceedingly complicated. Second, very few of the formulation stability responses previously shown could be interpreted in terms of a single factor effect. That is to say, many variables act in concert to affect the stability of the paint. Several will be examined.

Table 13—Effect of Pigment Volume Content, Volume Solids, and Initial Viscosity on the Stability of the Flat Formulation B

			Roller Stability	
PVC	% Solids by Volume	Equil. Visc (KU)	High Mw Polyacid Dispersant, Na+ salt	Hydrophobic Copolymer Dispersant, Na+ salt
19	38.5	80	P	F
29	38.5	80	P	F
39	38.5	80	P	F
49	38.5	80	P	P
39	18.5	80	P	P
39	28.5	80	P	F
39	38.5	80	P	F
39	38.5	60	P	P
39	38.5	70	P	P
39	38.5	80	P	F
39	38.5	90	P	F

Viscosity was adjusted by varying the 2.5% HEC/water balance.
Volume solids adjusted by dilution with water and correction of viscosity with thickener.
Pigment volume content varied by all pigments and extenders in equal proportion.
P = Pass.
F = Fail.
Pass/Fail evaluated at 28 days.

For example, in *Table* 6, the effect of dispersant selection was also a factor of the formulation type. None of the dispersants selected were stable in both formulations. On the other side, several were unstable in both. When a dispersant is said to be zinc oxide stable, this does not suggest that it will render any zinc oxide containing formulation stable. It does suggest, though, that the dispersant has a tendency to produce stable formulations when other factors are controlled.

While the previously mentioned example is obvious and simplistic, it does illustrate a point. Other more interesting and more complicated interaction effects were also observed. For example, in *Table* 9, the interaction effects between the dispersant and the TiO_2 became quite apparent. The stability of any given dispersant was highly dependent on the TiO_2 grade selected. Similarly, a binder/dispersant interaction effect became apparent in *Table* 11. It does not take much of an excursion beyond the data presented to assume that the interactions go well beyond these binary pairs.

CONCLUSIONS

The intent of this paper was not to point out the number of factors which can lead to stability failure but to point out the number of formulation tools available to obtain stability. Dispersant selection is not the only controllable parameter. Selection of TiO_2 grade, binder, volume solids, initial viscosity, pigment volume content, pH, choice of neutralizing base, the use of adjuvant dispersants and surfactants, and the selection of zinc oxide grade can all be used to optimize stability.

The results of this study suggest certain imperatives for the paint manufacturer. First and foremost, any zinc oxide formulation should be carefully designed and rigorously tested. The effect of each variable should be tested to determine its effect on stability. Once the formulation has been defined, the raw materials should be controlled very carefully. Substitution should be approached cautiously, and only if absolutely required. The TiO_2 grade should have the appropriate surface treatment for satisfactory durability and stability. Finally, the nature of the zinc oxide should be consistent from batch to batch.

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Waterborne Nitrocellulose Wood Lacquers with Lower VOC

Charles M. Winchester
Aqualon Company*

Introduction

Increasing regulation of the emissions of volatile organic compounds (VOC) has renewed interest in nitrocellulose lacquers for wood with lower solvent content. Waterborne lacquers formulated with nitrocellulose have been used on paper, cloth, and leather since before World War II. In the early 1980s, similar technology was adapted to waterborne wood coatings. Recent laboratory work has produced nitrocellulose lacquers with ultra high solids that have then been emulsified to produce waterborne wood lacquers with a VOC content of 300-420 g/L. The resulting coatings have the appearance, ease of handling, and film properties of traditional solvent-borne lacquers. A patent application has been filed covering this technical advance.

Reason for Emulsification

To explain the reason for emulsification of nitrocellulose lacquers, we must first consider an inherent property of nitrocellulose. It has the property of producing viscous solutions at comparatively low concentrations. The viscosity of a solution of nitrocellulose at any given concentration depends upon the viscosity grade of the nitrocellulose employed. The lower the viscosity grade, the more fluid will be the solution produced. However, there is a limit below which the viscosity grade cannot be reduced without a marked loss in the strength and flexibility of the film produced. There is, then, a definite limitation on the concentration of nitrocellulose which can be put into a solution to be used for a given method of application. Thus, not more than 10 to 12% of ½ sec nitrocellulose in a good solvent mixture can be applied satisfactorily with a spray gun.

The viscosity of an emulsion depends upon the viscosity of the continuous or external phase, on the ratio of the amount of dispersed phase or internal phase to the amount of continuous or external phase, and upon the droplet size of the internal phase. The viscosity of the internal phase has no bearing whatever on the viscosity of the final emulsion.[1]

A lacquer emulsion is prepared in two basic steps. First, the vehicle solids, including the plasticizer, are dissolved in the organic solvent blend which contains a surfactant system. This is the "lacquer" phase. Water is then mixed into the lacquer to "invert" it from a water-in-oil to an oil-in-water emulsion. The lacquer becomes the discontinuous or dispersed phase in water.

History of Waterborne Lacquers

Nitrocellulose lacquer emulsion technology predates World War II. Emulsified lacquers were developed for coating porous substrates such as paper, cloth, and leather. A lacquer applied as a water emulsion penetrates much less into a porous substrate than a solventborne lacquer because the base lacquer that is emulsified can be more viscous. Thus a thin, continuous, nonporous film is produced over the surface of the substrate. None of the nitrocellulose is wasted by penetration, and less solvent is used per pound of solids.[1]

Three clear lacquer emulsions from a 1953 bulletin are described in *Table* 1.[2] The solids content of the lacquer phase in each of these examples is around 40 wt%. In conventional clear lacquers, solids run around 20-25 wt%.

With the advent of air quality regulations, it became necessary to maximize the lacquer phase solids in order to minimize the volatile organic compound (VOC) content in coating systems. In *Figure* 1, the VOC is plotted against the solids of a simplified wood lacquer. In this case, a lacquer at 20 wt% solids has a VOC of 750 grams per liter (g/L). To reduce the VOC by at least half to 350 g/

Table 1—1953 Clear Nitrocellulose Lacquer Emulsions

Product	Lacquer/Water Ratio	Solids % Lacquer Phase
Book cover size. .	2.5/1	43
Paper coating. . . .	3/1	40
Leather coating . .	2.5/1	40

Presented at the 18th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium, in New Orleans, LA, on February 6-8, 1991.

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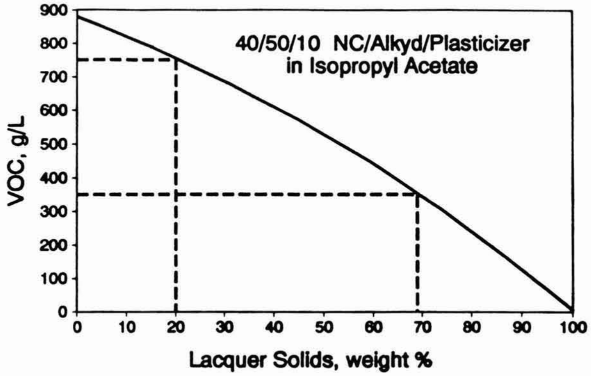

Figure 1—VOC vs lacquer solids

L, the lacquer solids must be increased to 68 wt%. Note that if you had a wood lacquer at 40 wt% like the lacquer phase solids of the paper, cloth, and leather emulsions in *Table* 1, the VOC would be approximately 600 g/L. The challenge is making an emulsion with lacquer solids of 65-70 wt%.

If this challenge can be met, not only would the VOC of the wet coating be reduced by 50%, but also the actual solvent emissions would decrease by much more than 50%. In the examples in *Figure* 1, the typical lacquer at 20 wt% solids has 80% solvent, or four pounds of solvent for every pound of solids. The ultra high solids lacquer at 68% solids would have only 32% solvent, or about one-half pound of solvent for every pound of the same lacquer solids. Hence, on the basis of pounds of solvent emitted per pound of lacquer solids deposited, there would be an eightfold, or 88%, reduction in emissions.

Lacquer Components

The solids composition of a typical wood lacquer consists of nitrocellulose, modifying resin, and plasticizer. Nitrocellulose* wet with alcohol, either ½-sec or ¼-sec viscosity grade, is normally used. The modifying resin is an alkyd, a rosin ester, or a combination of both. Better quality furniture lacquers use a short-oil, coconut alkyd supplied as a xylene solution. Common plasticizers are phthalate esters or vegetable oils such as castor oil or blown soybean oil. Lacquer solvents are classified according to their solvency for nitrocellulose. Esters, ketones, glycol ethers, and glycol ether esters readily dissolve nitrocellulose and are called *active* solvents. Hydrocarbons, such as toluene or heptane, are nonsolvents for nitrocellulose and are used as *diluents* to reduce cost. Alcohols offset the nonsolvency of hydrocarbons and are called *cosolvents*.

When formulating a waterborne lacquer with minimum solvent, solvents are selected for maximum solvency for the nitrocellulose. All diluents and cosolvents are eliminated. A plasticizer is chosen that is an active solvent for nitrocellulose, such as dibutyl phthalate or tributoxyethyl phosphate (TBEP). Nitrocellulose wet with water is used rather than the conventional alcohol-wet nitrocellulose. The alkyd resin preferably should be supplied in active solvent instead of a hydrocarbon diluent. For good emulsion stability, ester solvents with low water solubility are needed. Since minimum solvent is employed, a major portion of the solvent must serve as a coalescent and thus must evaporate more slowly than water. Typical solvents are shown in *Table* 2. Isopropyl acetate has been traditionally used as a fast evaporating solvent in nitrocellulose emulsion development because it is relatively easy to remove by vacuum distillation should very low VOC be desired.

In the early 1980s, work was done to maximize the solids in the lacquer phase using the then established laboratory procedure for emulsification. Solid components were selected for minimum viscosity contribution to the lacquer phase. The formulation in *Table* 3 is based on 18-25 cps viscosity-grade, nitrocellulose and a solid, maleic-modified, rosin ester.

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*10.9-12.2 percent by weight nitrogen.

Table 2—Solvents for Nitrocellulose Lacquer Emulsions

Solvent	Solubility Parameter[a]	Evaporation Rate[b]	Weight Percent Solubility In Water	Water In
Isopropyl acetate	8.6	500	2.9	1.8
n-Butyl acetate	8.7	100	0.7	1.2
Amyl acetate, primary	8.4	42	0.2	0.9
Water	—	36[c]	—	—
EB acetate[d]	8.9	5	1.1	1.6
2-Ethylhexyl acetate	8.3	3	0.03	0.6

(a) $cal^{1/2}\ cm^{-3/2}$.
(b) Relative to n-butyl acetate.
(c) 25°C, 0% RH.
(d) Ethylene glycol butyl ether acetate.

Table 3—Utility Waterborne Nitrocellulose Lacquer

	Wt %
Nitrocellulose, 18-25 cps (100%)	17.6
Pentrex® 28 rosin ester	9.2
Dibutyl phthalate	4.6
Surfactant	4.6
Isopropyl acetate	9.2
Ethylene glycol butyl ether acetate	9.2
Water	45.6
	100.0
Lacquer Phase Solids	66%
VOC, g/L	420

The resulting lacquer-phase solids were 66 wt%, and the calculated VOC content of the emulsion was 420 g/L. The film properties of this lacquer emulsion, however, did not meet the cold check requirements for fine wood furniture.

In the late 1980s with new VOC regulations pending, particularly for the wood furniture industry, waterborne lacquer technology was revisited. The earlier formulation in *Table* 3 needed to be upgraded for performance with the same or even lower VOC. Furthermore, the emulsification process had some serious shortcomings.*

Equipment and Process

Heretofore the emulsions had been made in an open vessel using a conventional high-speed disperser.[3] On both a laboratory and plant scale, there tended to be incomplete dissolution of the nitrocellulose with accumulation of nitrocellulose particles on the vessel walls. Solvent loss was uncontrolled and temperature control was poor. Finally, in trying even high-viscosity, higher-solids lacquer phases agitation power was inadequate.

To overcome these shortcomings and better define the process variables, more refined equipment was needed with the following features:

(1) Closed and jacketed vessel.

(2) Charge port for nitrocellulose addition while mixing.

(3) Water supply that is temperature controlled, and has the ability to rapidly cool the batch.

(4) Agitation that (a) handles two KPa·s material, (b) provides good dispersion, (c) perferably scrapes the vessel walls for good heat transfer, and (d) is effective with the vessel one-third full in order to handle the small volume of the initial lacquer phase during the initial mixing.

The Hockmeyer HHL-11-LAB, dual-shaft mixer (*Figures* 2 and 3) met these requirements, and was readily available. The disperser has a 2-in. disc impeller driven by a 1½-HP motor with variable speed up to 8200 rpm. The anchor agitator has fluoropolymer scrapers for the walls and flat bottom of the vessel, and is driven by a ¾-HP motor with variable speed up to 360 rpm. The two agitator speeds are controlled by frequency inverters located remotely. The vessel lid and agitator assemblies can be raised by a hydraulic lift. The lid is equipped with a thermowell, a vent, an inlet for liquid addition, and a charge port with a sight-glass insert.

Because of the Hockmeyer's high power and thorough, efficient mixing action, over 90 batches having a wide range of composition and viscosity were prepared reproducibly, and without difficulty.

Furthermore, there were no problems when scaling up from the 1½-gal lab mixer to a 100-gal unit of the same basic design. The 100-gal Hockmeyer was equipped with a hot-oil heating system, however, which could not be adapted to the temperature range previously used in the lab unit with the hot-water heating system. Therefore, the procedure was changed, allowing the batch temperature to rise adiabatically.

Scale-up was also successful in a 50-gal Pfaudler reactor with the completely different agitation system shown in *Figure* 4. The agitator has a low-shear, four-blade turbine with a maximum speed of 250 rpm driven by a 2-HP motor. The vessel is equipped with an "h" shaped stationary baffle, one arm of which contains a thermowell. A successful emulsion was also made in a 140-gal reactor equipped with a low-speed, anchor agitator. While these trials established that an expensive dual-shaft mixer is not essential, the low-speed, single-shaft mixers take more than twice as long to dissolve the nitrocellulose.

Preparation Procedure

The first step in preparing a nitrocellulose lacquer emulsion is to charge all the lacquer components except the nitrocellulose to the vessel, that is, the solvents, modifying resin, plasticizer, and surfactant. These are mixed well at low speed. Next, the nitrocellulose, wet with water is added, with agitation gradually increased as needed to maintain a good vortex. The batch is held with the agitation at maximum to dissolve the nitrocellulose. The length of time required for complete dissolution will depend on the vessel and agitator design. The batch temperature will rise to 60-70°C under adiabatic conditions. At this point, the batch is a water-in-oil emulsion at a very high viscosity as described in the following. The water, to invert the material to an oil-in-water emulsion, is added to the vortex slowly to avoid flooding. The water, which is at ambient temperature, will cool the batch and reduce its viscosity particularly as the inversion occurs. The inverted product now has a much lower viscosity. As a final step, the batch is filtered to remove any large particles.

Samples of the lacquer phase were taken routinely before the inversion water was added. These were measured with a Brookfield viscometer at very low spin-

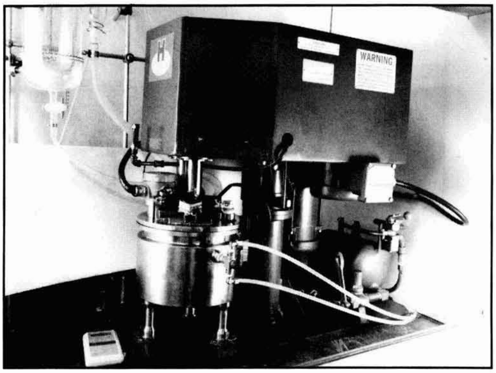

Figure 2—Hockmeyer HHL-11-LAB

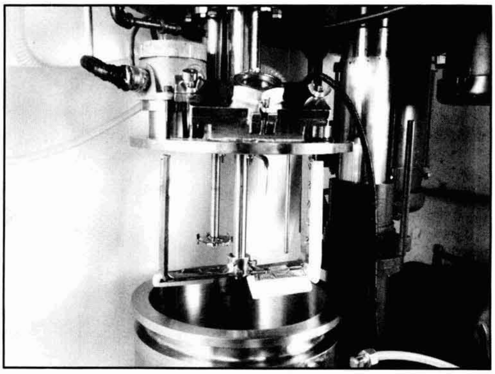

Figure 3—Agitator assembly

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*Both compositions and procedures described herein are the subject of Aqualon patent application filed January 3, 1991. It is Aqualon Company's intention to license this technology, and full details including the patent application will be made available.

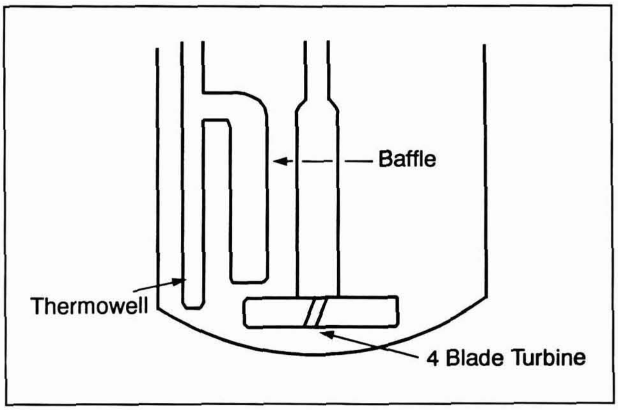

Figure 4—50 gallon reactor

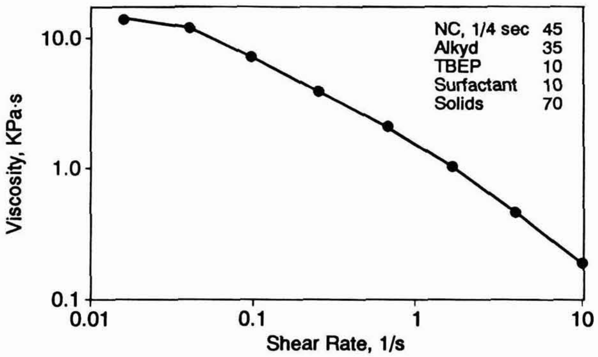

Figure 5—Lacquer phase viscosity profile—25°C

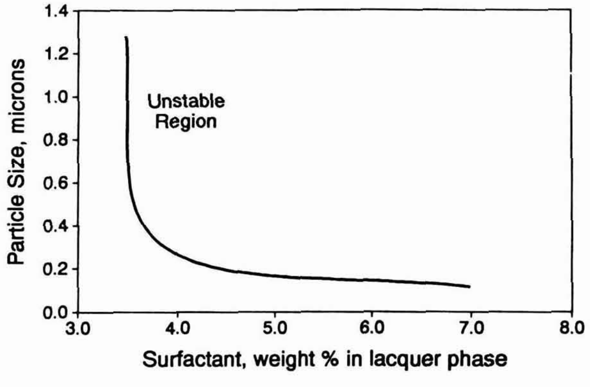

Figure 6—Surfactant level vs particle size—NC/alkyd/TBEP

Table 4—Solvent Composition[a]

Solvent Blend	Average Solubility In Water	Emulsion Particle Size, μ	Emulsion Stability Days @ 140°F
IPA/C8A 50/50	1.5	0.19	10+
IPA/EHA 50/50	1.5	0.19	10+
IPA/EBA 50/50	2.0	0.25	0
IPA/EEP 50/50	2.9	0.21	0
IPA 100	2.9	0.20	0
IPA/EHA/DBE 48/24/24[b]	2.7	0.35	0
IPA/EHA/IDB 48/24/24[b]	1.4	0.20	10+

Key
IPA—Isopropyl acetate
C8A—C_8 alkyl acetate
EHA—2-Ethylhexyl acetate
EBA—Ethylene glycol butyl ether acetate
EEP—Ethyl 3-ethoxypropionate
DBE—Mixed dibasic esters
IDB—Isodecyl benzoate

(a) System: NC/Alkyd/TBEP/Surf., 45/35/10/7.5; Calc. VOC 400 g/L.
(b) Plus four parts Xylene from alkyd.

dle speeds (0.3 and 0.6 rpm) at 60°C, approximately the batch temperatures. Values up to an instrumental limit of two KPa·s were obtained. There is no relationship between this apparent viscosity and the particle size of the final emulsion.

The viscosity profile of a typical lacquer phase was determined using a Bohlin VOR rheometer. The solids portion of the lacquer phase was composed of ¼-sec nitrocellulose, 45 parts (by weight); coconut-oil alkyd, 35 parts; TBEP, 10 parts; and surfactant, 10 parts. The lacquer phase was 70% solids by weight with a calculated VOC of 350 g/L. Rheological measurements were made at 25°C using parallel plates at a 1 mm gap.

As shown in *Figure* 5, the material is pseudoplastic. In the region of one to 10 reciprocal seconds, which covers most plant mixing equipment, the viscosity at 25°C ranges from 1.5 to 0.2 Kpa·s.

Emulsification Factors

The compositional factors affecting the formation of a stable, small particle size emulsion are the choice of surfactant, the surfactant level, the solvent composition, and the solids composition. Previous work had shown that the surfactant should be compatible with nitrocellulose, and that an anionic type with a hydrophilic lipophilic balance (HLB) of 18-25 is best.[3] For the first half of the project, the surfactant used was a phosphoric acid ester of an ethoxylated nonylphenol with the free acid groups neutralized with sodium hydroxide to a pH of 5-7. When field evaluation showed yellowing of the applied coating on exposure to heat or ultraviolet radiation, the surfactant was switched to a similar phosphate ester, but with an aliphatic hydrocarbon base thus eliminating the aromatic group. Again, the free acid groups were neutralized with sodium hydroxide.

The amount of surfactant in the lacquer phase determines the particle size. *Figure* 6 shows the relationship between particle size and surfactant concentration for the system nitrocellulose/coconut alkyd/TBEP/surfactant in isopropyl acetate/C_8 alkyl acetate or 2-ethylhexyl acetate. Surfactant is required at a minimum of 4½% by weight of the lacquer phase to reduce particle size to below 0.2 μm. Below 0.2 μm particle size, the emulsions are usually stable. As the surfactant is increased from 4½ to 7%, the particle size becomes only slightly smaller. Higher levels of surfactant were not used to avoid making the coating softer and more water sensitive.

Table 4 shows a series of emulsions evaluating different solvent combinations with the solids composition constant at nitrocellulose/alkyd/TBEP/surfactant, 45/35/10/7.5. The solvent compositions are one part isopropyl acetate to one part various coalescing solvent. C_8 alkyl acetate (C8A) and 2-ethylhexyl acetate (EHA) form stable emulsions, whereas ethylene glycol butyl ether acetate (EBA) and ethyl 3-ethoxypropionate (EEP) do not. If half of the EHA portion is replaced by mixed dibasic esters (DBE) the emulsion is unstable, but if one-half of the EHA portion is replaced by isodecyl benzoate the emulsion is stable. Finally, if the solvent is all isopropyl acetate the emulsion is unstable. The solvent systems of the stable emulsions all have average water solubility of 1.5% or less, whereas the unstable solvent systems all have average water solubility of 2.0% or greater.

The major influences on the viscosity (at a given solids level) of a solventborne lacquer also apply to the lacquer phase of a lacquer emulsion. These influences are the viscosity grade and the level of nitrocellulose used. Two examples of the effect of changing the nitrocellulose viscosity grade are given in *Table* 5. In the first example, with the solids system nitrocellulose/TBEP/surfactant, 60/30/10, replacing ½-sec nitrocellulose with ¼-sec and keeping the solvent level constant (same VOC), a tenfold decrease in viscosity of the lacquer phase is obtained. When the nitrocellulose viscosity grade is again reduced by replacing ¼ sec with 18 to 25 cP, sufficient solvent can be omitted to lower the VOC to 300 g/L. With the ¼ sec formulation, the solvent content can probably be reduced to achieve a VOC of 350 g/L. This is indeed the case in the second example where ½ sec is replaced with ¼ sec in the system nitrocellulose/alkyd/TBEP/surfactant, 45/35/10/10, and the VOC is lowered from 400 g/L to 350 g/L. Using lower viscosity grades of nitrocellulose to gain reduced VOC, however, can affect ultimate film properties such as resistance to cold checking.

In *Table* 6, the effect of increasing the nitrocellulose content in the system nitrocellulose/dibutyl phthalate/surfactant is shown. As the nitrocellulose portion of the solids is increased from 60 to 67.5 and 75%, more solvent is needed for a workable viscosity, and the solids portion

Table 5—Nitrocellulose Viscosity Grade

Solids Composition	NC Viscosity	Lacquer Phase Solids, %	W/O Visc. Pa·s	Calc. VOC, g/L	Particle Size, μ
NC/TBEP/Surf.					
60/30/10	½ Sec	65	1,030	400	0.18
Same	¼ Sec	65	100	400	0.17
Same	18-25 cps	75	980	300	0.17
NC/Alkyd/TBEP/Surf.					
45/35/10/10	½ Sec	65	300	400	0.17
Same	¼ Sec	70	580	350	0.16

Table 6—Nitrocellulose Ratio

	Solids Composition NC/DBP/Surfactant		
	60/30/10	67.5/22.5/10	75/15/10
Solvent, IPA/C8A	1/1	1.5/1	2/1
Lacquer phase			
Solids, %	65	60	55
Viscosity, Pa·s	480	1,500	640
Calc. VOC, g/L	400	460	500
Film coalesce	Yes	No	No
Added C8A to coalesce[a]	0	9	14
NC/DBP + C8A	51/49	51/49	53/47

Key
IPA—Isopropyl acetate
C8A—C_8 alkyl acetate
NC—EG™ Nitrocellulose, ½ sec
DBP—Dibutyl phthalate
Surf.—Gafac RS-710

(a) gms/100 gms emulsion.

Table 7—Nitrocellulose Lacquer Emulsion CTG D-856A

Ingredients	Wt %
Aroplaz® EA-6101 (70%)	16.0
Tributoxyethyl phosphate	3.2
Surfactant	3.2
Isopropyl acetate	4.5
2-Ethylhexyl acetate	8.1
EG™ nitrocellulose, grade 100 (75%)	19.2
Water	45.8
Total	100.00

Typical Properties

Appearance	Milky white liquid
Solids (wt %)	32
pH	6.7
Brookfield viscosity, mPa·s[a]	400-500
Density at 25°C, g/L (lb/gal)	1.07 (8.9)
Freeze-thaw stability	Protect from freezing
Heat stability (10 days at 140°F)	Pass
VOC, g/L	400

(a) #2 spindle, 12 rpm.

of the lacquer phase is lowered. This raises the VOC from 400 to 460 and 500 g/L, respectively. In this experiment, the coalescing solvent is held at a constant ratio to the lacquer solids. At the higher levels of nitrocellulose in the solvent portion, however, film formation is poor unless solubilizing plasticizer, DBP, and additional coalescing solvent is used. Counting the added solvent as part of the coalescing system, the ratio of nitrocellulose to DBP plus coalescing solvent is comparable for all three levels of nitrocellulose. Hence, as the nitrocellulose level is increased, the coalescing system should be held at a constant ratio to the nitrocellulose to maintain good film formation.

Waterborne Nitrocellulose Lacquer Properties

The waterborne nitrocellulose lacquer for wood that has evolved from this work is designated CTG D-856A. Its solids are comprised of nitrocellulose, ½ sec 45 parts (by weight); coconut alkyd, 35 parts; TBEP, 10 parts; and surfactant, 10 parts. The solvent composition is 2-ethylhexyl acetate, 50 parts; isopropyl acetate, 46 parts; and xylene, 4 parts. The coconut alkyd is the same resin chemically as one commercially available cut in xylene. By special arrangement, it was obtained cut in ester solvent with a small residue of the xylene used for reflux in the alkyd preparation. The typical properties of the emulsion are given in *Table* 7.

In *Table* 8, the film properties of CTG D-856A are compared with those of conventional solventborne lacquer and two waterborne acrylics. None of the waterborne coatings have the speed of dry of the solventborne lacquer. Dry-time values were determined by a Gardner drying time recorder using the "no-tear" end-point. To evaluate early print resistance, the production schedule for a major U.S. furniture plant was simulated. The waterborne lacquer is not quite as good as the conventional solution lacquer for early print resistance. One of the acrylics is very poor for early print, the resistance of the other is comparable to the conventional solution lacquer.

The waterborne lacquer is much easier to rub and polish than the acrylics, and comparable to the ease of rubbing of the conventional solventborne lacquer. There are times when a manufacturer wants to reclaim a piece of furniture with an unacceptable finish. The waterborne lacquer film is as easy to wash off with stripper as conventional lacquer, whereas the acrylic films become quite gummy and require hard scraping to remove. The waterborne lacquer is as resistant to alcohol as a solventborne lacquer. Alcohol resistance was tested by exposing the film to 50% ethyl alcohol under glass for one hour. After this exposure, the spot was wiped clean, and allowed to recover. There is no effect with either nitrocellulose-based coating, but both acrylics developed a permanent white spot.

Finally, what sells furniture is appearance. The waterborne lacquer film is close to the appearance of traditional lacquer coatings, whereas that of the waterborne acylic is quite inferior. This is shown in *Figure* 7 comparing halves of two cherry cabinet doors each first coated with the same nongrain-raising stain before applying two coats of the respective waterborne coatings. The waterborne nitrocellulose lacquer coating on the right has a much brighter, richer look than the acrylic on the left.

Table 8—Formulated Wood Coatings

Property	Solventborne Lacquer	Waterborne Lacquer CTG D-856A	Waterborne Acrylic Supplier A	Waterborne Acrylic Supplier B
Gardner dry time, min[a]	5-10	16	16	14
Early print resistance[b]	10	7	10	4
Rub & Polish[c]	10	8	3	3
Strippability[d]	Easy	Easy	Difficult	Difficult
Alcohol spot[e]	None	None	White	White
Appearance[f]	10	8	4	4

(a) 1 mil dry film spray-applied to glass, no-tear end-point.
(b) Simulated furniture plant schedule, 3 mil dry film on wood. Rating Scale 0 to 10; 10 = no print, 0 = very heavy print.
(c) 10 = easiest, 0 = can't be rubbed.
(d) Ease of removing finish to rework case.
(e) 50% ethanol applied, covered 1 hr, wiped clean, allowed to recover.
(f) 10 = best, 0 = totally unacceptable.

hol resistance, and above all, the superior appearance of a conventional lacquer finish are retained.

Raw Materials

KP-140	Tributoxyethyl phosphate	FMC Corporation
EG™ nitrocellulose, Grade 100	—	Aqualon Company
Gafac® RE-610	Phosphoric acid ester of an ethoxylated nonylphenol	Rhone-Poulenc Incorporated
Gafac RS-710	Phosphoric acid ester of an ethoxylated c-c aliphatic hydrocarbon	Rhone-Poulenc Incorporated
Exxate® 800	C_8 Alkyl acetate	Exxon Chemical Company
2-ethylhexylacetate	—	Eastman Chemical Products, Inc.
DBE dibasic ester	—	E.I. du Pont de Nemours & Co., Inc.
Velate® 262	Isodecyl benzoate	Velsicol Chemical Corporation
Aroplaz® EA-6101	Coconut alkyd	Reichhold Chemicals, Inc.
Pentrex® 28	Maleic-modified rosin ester.	Hercules Incorporated

Summary

The technology of making nitrocellulose lacquer emulsions has been significantly improved. Nitrocellulose lacquers with 65-70 wt% solids and viscosities up to 2 Kpa·s can be emulsified by the inversion process to produce waterborne lacquers for wood furniture with VOCs of 300 to 420 g/L. The compositional factors affecting the formation of a stable, small particle size emulsion are the choice of surfactant, the surfactant level, the solvent composition, and the solids composition. Because traditional components for solventborne lacquers are used, the dry film properties of waterborne nitrocellulose lacquers are quite similar to the dry film properties of conventional nitrocellulose solution lacquers. The advantages of ease of rubbing and polishing, easy removal for refinish, good alcohol resistance, and above all, the superior appearance of a conventional lacquer finish are retained.

Acknowledgments

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References

(1) Hercules Powder Company, "The Application of Nitrocellulose Emulsions to Paper" (1936).
(2) Hercules Powder Company, "Lacquer Emulsions Formulation and Use" (1953).
(3) Hercules Incorporated, "CSL-225, Preparation Procedures for Nitrocellulose Waterborne Coatings or Inks" (1980).

These subcommittees reports are for the use of the membership of ASTM Committee D-1 in continuing its work and for the interest of readers in the activities of ASTM Committee D-1. The reports are not official actions of ASTM and may not be quoted as representing any action or policy of the American Society for Testing and Materials.

June 1991 Subcommittee Reports of ASTM Committee D-1

The June meeting of ASTM Committee D-1 on Paints and Related Coatings was held June 16-19, 1991 at the Chateau Laurier, Ottawa, Ontario, Canada. In the three and one-half days preceding the final session and general meeting of Committee D-1, 153 members and guests met in 176 scheduled meetings of D-1 subcommittees and working task groups. The current membership of D-1 is 595.

Highlights

Awards	January 1990	January 1991
D-1 Honorary Member..........	W.C. Golton	R.A. Orr
Award of Merit................	C.K. Schoff	M.E. McKnight
Certificate of Appreciation.......	D. VanderWeide	J.C. Burke
Henry A. Gardner Award........		L. Schaeffer
Paul Gardner Task Group Chairman Award.............		T.J. Sliva

Memorials—Resolutions were read on the passing of three Committee D-1 members: William S. Engle, Richard S. Henry, and Robert J. Martell. A moment of silence was observed in their memory.

D01.08—A "lead ban bill" that would limit lead in paint to 0.06% is expected to pass Congress by year's end.

D01.21.14—The next VOC workshop is scheduled for November 7 and 8 in Toronto, Ontario, Canada. This will be held in conjunction with the Federation's Annual Meeting and Paint Industries' Show.

D01.24.30—A final draft of the "Standard Practice for Calculating Formula Physical Constants of Liquid Paints and Coatings," was approved as revised and sent forward to society ballot.

D01.41—A prior negative on D 4717, held to be nonpursuasive by the subcommittee, was overturned by subcommittee ballot. A new draft will be prepared specifically addressing the negative voters comments and those submitted by another member in support of the negative.

Future Meetings

January 19-23, 1992—Ft. Lauderdale, FL, Crown Sterling Suites.

June 28-July 1, 1992—Minneapolis, MN, Marriot Downtown.

January 17-20, 1993—Ft. Lauderdale, FL.

New Standards

New D-1 standards approved by the ASTM Committee on Standards:

Approved November 30, 1990

D 5137-90, Specification for Hexyl Acetate.

Approved December, 1990

D 5108-90, Test Method for Organotin Release Rates of Antifouling Coating Systems in Sea Water.

D 5145-90, Test Method for Nonvolatile and Pigment Content of Electrocoat Baths.

Approved February 22, 1991

D 1978-91, Guide for Analysis of Electrocoat Bath Samples.

D 1979-91, Test Method for Free Formaldehyde Content of Amino Resin.

Approved May 15, 1991

D 1969-91, Specification for 2-Ethylhexanol.

D 2064-91, Test Method for Print Resistance of Architectural.

D 2065-91, Method for Determination of Edge Performance of Composit Wood Products under Surfactant Accelerated Moisture Stress.

D 2066-91, Test Method for Relative Titting Strength of Printing Ink Dispersions.

D 5010-91, Index of Methods for Testing Printing Inks and Related Materials.

Approved June 12, 1991

D 5150-91, Test Method for Hiding Power of Architectural Paints Applied by Roller.

Committee D-1 Sponsors

Alltech Associates, Inc.
Elcometer Instruments Ltd.
EZ Paintr Corp.
Hercules Inc.
ICI Resins US
International Paint Powder Coatings
KTA-Tator, Inc.
The Leneta Co.
The O'Brien Corp. (Powder Coatings)
Paul N. Gardner Co.
Pave-Mark Corp.
South Florida Test Services
Suga Test Instruments Co. Ltd.
R.T. Vanderbuilt Co., Inc.
Union Carbide Chemicals and Plastics Co., Inc.
Unocal Chemicals Distribution

DIVISION 1
ADMINISTRATION

SUBCOMMITTEE D01.08 ENVIRONMENTAL CONCERNS

J.J. Brezinski, Chairman

VOC Related Issues—New proposed EPA regulations directed toward implementing the Clean Air Act Amendments of 1990 include a guide to the State Operating Permit Program, considered by EPA as a key provision of the new amendments. Of importance to coatings, all volatile organic compounds (VOC) are included as regulated pollutants.

Actions in ASTM Committee D-1 pertaining to the VOC issue include:

- Advancement to society ballot of a revision of D 3960, "Determination of VOC Content in Paints and Coatings," in a form that, it is believed, will be referenced by Federal EPA.
- A proposed revision of D 2369 "Volatile Content of Coatings," to incorporate directions for use with multi-component coatings and to remove unnecessary information.
- Assistance was provided to EPA personnel planning a revision of Federal Reference Method 24 to incorporate instructions for dealing with exempt solvents and multi-component coatings.
- Round-robin studies are planned on two procedures for the determination of VOC content of radiation-cured coatings.
- Development of a proposed practice for the determination of transfer efficiency under general production conditions of spray-applied paints.
- Development of proposed methods for the determination of the weight percent volatile content of solvent-borne and water-reducible aerosol paints.

Lead Issues—A "lead ban bill" is expected to pass Congress by year's end. As presently constituted, lead content of virtually all paints would be limited to 0.06%. Spearheaded by EPA, several federal agencies, ASTM Committees E-06 and D-1, and industry trade associations, including NPCA and AIHA, are participating in various programs related to testing and abatement of lead. Recent studies implicate lead in household dust as the major hazard, suggesting the need for methods for sampling and testing for lead in dust (including lead species identification).

An EPA Advance Notice of Proposed Rulemaking (ANPR) under TSCA Section 6 suggests possible future control of lead pigment use in water tower, bridge, and traffic coatings.

Chromate Pigments—Arguments will be developed to overcome objections in Committee E-34 to a request for transfer of jurisdiction to Committee D-1 of E 848, Practice for "Safety and Health Requirements Relating to Occupational Exposure to Water-Insoluble Chromates."

D01.08.01—Durability and VOC—Comments on the draft survey form developed by SSPC as part of the program in Task Group D01.08.01 were considered and incorporated. The survey is designed to assemble data on the practical performance (e.g., durability) of professionally applied industrial maintenance coatings and VOC content. Distribution is planned in late July. The results will be analyzed, then submitted as a voluntary contribution to Federal EPA.

DIVISION 20
RESEARCH AND GENERAL MEETING

SUBCOMMITTEE D01.21 CHEMICAL ANALYSIS OF PAINTS AND PAINT MATERIALS

H.K. Fujimoto, Chairman

D01.21.10—Lead in Paints—J.C. Weaver, Chairman, coordinated with ASTM Committee E-6 on Building Structures which formed on March 11, 1991 a Sub. E06.22 on Standards for Abatement of Hazards from Lead-Based Paint in Buildings. Ad hoc Chairman Geoffrey Frohnsdorff, of the National Institute for Standards and Technology (NIST), and ad hoc colleagues developed its scope as:

"Development of standards needed for abatement of hazards from lead-based paint in buildings, including detection of lead-based paint, assessment of lead levels in paint, evaluation of procedure for removal of lead-based paint, evaluation and use of encapsulents for lead-based paint, and techniques for in-place management; liaison shall be maintained with Committee D-1 on Paint and Related Coatings and Materials, and committees concerned with the environment."

Frohnsdorff listed twelve tasks therein to be organized into three task groups to meet with Committee E-6 in San Diego, CA, on October 15 and 16, 1991. J. Weaver will coordinate this effort.

The NPCA has an active program in Lead in Paint reported by NPCA/Committee D-1 liaison J. John Brezinski.

- A "ban the lead" bill is expected to pass in the U.S. Senate during the present session and a similar bill in the House later this year. NPCA's position paper advocating exemptions of selected industrial coatings from the proposed 0.06% lead level for all paints has been discussed with a Senate subcommittee staff personnel.
- NPCA is participating in a task group in the EPA/industry program to address testing for lead in paint and encapsulation of old lead paint surfaces.
- AIHA has assigned high priority to a new task group to develop among other documents, guidelines for monitoring airborne lead.
- Several states, including California and Minnesota, are considering charging fees for retail or wholesale distribution of all paints to provide for state lead abatement programs.
- Consumer Products Safety Commission (CPSC) plans to prepare a document for homeowners on the lead pollution issue.
- EPA has issued an Advance Notice of Proposed Rulemaking (ANPR), that initiates a TSCA Section 6a action relating to lead product uses.

Lead and other metals are included in ASTM D 4236, a Practice on hazards of artists materials, which has been incorporated into U.S. Federal law which requires CPSC implementation thereof. CPSC via a Federal Register notice invites comments thereon.

X-ray Fluorescence (XRF), determination on and in homes should be incorporated into an ASTM standard which both delineates and delimits the precision and bias of the method. Task group D01.21.10 recommends that this standard be developed in Committee E-6 in order to include housing and general environmental as well as paint interests, with close collaboration with Committee D-1's analytical expertise. A starting point is the completed NIST report to HUD on evaluation of commercial XRF instruments on both laboratory and field tests which showed severe limitations. Critically important are the sampling protocols which will distinguish XRF estimates of lead in (1) dried paints; (2) their substrates; (3) dirt between layers of paint; and (4) superficial dust and dirt on the paint, on floors and other home interior and exterior unpainted surfaces and surroundings. Currently mounting evidence of the all pervasive fallout of the seven million tons of lead from gasoline from 1940 versus only 0.8 million tons or less lead in paints after 1940 across the United States mandates a strategic reassessment of the limitations of XRF devices in hand held inspections of homes.

Spot tests for lead in paint films and various nonpaint surfaces are proposed as XRF alternates by several commercial vendors. M.E. McKnight and coworkers at NIST are collaborating with EPA and CPSC in evaluating spot tests. Ms.

McKnight will recruit a task group, D01.21.73, with intent to achieve by the January 1992 meeting of Committee D-1, a draft of a spot test at the 0.1 mg/cm^2 to 1 mg/cm^2 lead levels in HUD's 1990 report to the Congress which estimates that 57 million homes have lead levels higher than 1 mg/cm^2.

Of special concern is the subjectivity (repeatability) of these spot tests for lead in the hands of poorly trained testers.

Dust and dirt rather than paint chips or flakes as a primary source of excess lead in the blood of small children has belatedly drawn the attention of most of the activist, militant environmentalists, regulators, and legislators. But they still attribute this lead mainly to old paint and either disbelieve or are ignorant of J.C. Weaver's "White Paper on White Lead" thesis that (1) about 90% of that lead comes from gasoline and (2) frequent cleaning of floors and other surfaces accessible to small children is a lower cost and citizen mandate to solve the whole problem of excess lead in the blood of small children.

A "White Paper on White Lead" sequel is needed to reach more of the lead hazard community and make them more aware of ongoing research on the dust and dirt sources of lead, including these literature citations:

(1) 1974-87, J.W. Sayre in Rochester pioneered the correlation between excess blood lead and wet-wipable dust containing lead in children's home surroundings.

(2) 1986, Professor J.J. Chisholm in Baltimore recognized dust as a major source of lead.

(3) 1978-86, Professors P. Hammond, S. Clark et al., in Cincinnati (Kettering Lab) evolved lead-in-dust concepts up to HUD recognition of statistical correlations with inner city traffic and swelling patterns.

(4) 1985, Professor P.R. Buseck, at Arizona State University, speciated the lead chloride and decay products therefrom in airborne dust at three locations in Phoenix, using XRD and related spectrometric techniques.

(5) 1987, Professor H. Meinke while at University of Minnesota correlated lead-in dust with high blood lead in children and with dwelling and traffic patterns in Minneapolis and four other cities, coming closer to gasoline lead/blood lead primary correlation.

(6) 1987, Professor W. Stopford at Duke continues to investigate patterns of partial bioavailability of lead and other toxic metals from art materials.

(7) 1991, June ES&T, Professor T.E. Clevenger at University of Missouri at Columbia has speciated lead sulfate, etc., by XRD and related spectrometric techniques on smelter dust and plans to extend this to other sites, including street dust.

(8) 1991, June ES&T, K.C. Jones and A.E. Johnston at Lancaster University, UK, have measured atmospheric lead fall out over grasslands, from 1861 of solid fuel combustion and in recent decades from petrol (gasoline) combustion.

(9) 1987-91, J.W. Roberts in Seattle has evolved vacuum cleaner sampling of dust from carpets and bare floors and close correlation with excess blood lead and the simple dictum: leave shoes at the door and reduce lead dramatically.

How can we overcome the dogma, the mind set that lead-in-paint is the sole source of high blood lead levels?

D01.21.13—Update on VOC Regulatory Action/Federal Regulations—J. Brezinski, Cochairman, summarized the major features of the state operating permit program under the Clean Air Act, under which all Federal and state air pollution controls regulations are being combined in a single federally enforceable document. All states must provide to EPA their overall permit program by November 1993.

All major sources emitting regulated pollutants will be required to pay to the states an annual minimum fee of $25 per ton of emission. Major sources are those that emit 10 tons/year of a single hazardous air pollutant or 25 tons/year of a combination of such pollutants; sources operating under a New Source Performance standard and those emitting above set amounts of VOC.

The permit will be granted for a five-year period. The public and neighboring states will have an opportunity to review and object to both the application and modification of specific state permits.

The program will provide the states with more than $300 million annually—the funds to be used to support the state air pollution control programs.

All state operating permits are to be in place and enforceable by the end of 1997. The significant funds available will likely motivate some states to implement programs at an earlier date. The operating permit program will have a significant impact on the coatings industry.

ASTM Committee D-1/EPA Meeting—H. Fujimoto reviewed the highlights of the very successful meeting on June 5 and 6, with 12 persons from Committee D-1 and 13 members of the Federal EPA at Research Triangle Park. EPA personnel were updated on the progress of various studies in Sub. D01.21 related to VOC measurement and also were provided guidance on their ongoing planned revision of Federal Reference Method 24 that will incorporate instructions in VOC content measurement of multi-component coatings. On the second day, B. Klesper led a presentation and discussion of the basic principles of paint formulation that was much appreciated by EPA personnel.

State Development—M. Harding summarized some of the recent developments in California regarding VOC control.

D01.21.14—VOC New Publications and Workshops—H. Fujimoto, Chairman, reported on the latest VOC workshop held May 7 and 8 in Ontario, CA. There were 20 attendees. The host laboratory was the South Coast Air Quality Management District in El Monte, CA. They did an excellent job demonstrating the laboratory portion of the workshop and are to be complimented.

The next workshop will be held in Toronto, Ont., Canada, on November 7 and 8, in conjunction with the Federation's Annual Meeting and Paint Industries' Show. Chairman Fujimoto requested members to suggest locations where future workshops should be held. Suggestions were Detroit, Baltimore, Cleveland, and New Jersey.

J.J. Brezinski stated that the Manual on the "Determination of Volatile Organic Compounds in Paints, Inks and Related Coatings Products," will be revised and updated. It is expected to be issued in late 1992. It has not yet been decided what form the manual will take. A loose leaf binder was suggested so additions of revised methods would be easier. This is being studied.

D01.21.24—Revision of D 2369, Volatile Content of Coatings—Met in conjunction with TG 27, VOC of Multiple Component Coatings. The lastest revision of D 2369-90 was presented. This was the revision discussed at the ASTM-EPA meeting in Research Triangle Park.

The scope of the method was broadened to include multi-component paint systems based on results obtained in round-robin testing by Task Group D01.21.24 and Section 7.3 addresses running multi-component systems.

Section 7.1 was revised to clarify the instructions on specimen size. The long sentence was removed and replaced with a table as shown.

Expected % Non volatile	Expected % volatile	Sample Wt, g.
60% or more	40% or less	0.3 ± 0.1
less than 60%	more than 40%	0.5 ± 0.1

In addition, Sections 5, Apparatus, and 7, Procedures were revised to incorporate additional directions and instructions taught in the VOC workshops to help users of this method improve their results.

Task Group 24 voted unanimously to remove Note 2 and the appendix which referred to the original D 2369 method which was a 20′ at 110°C bake, to clarify the procedure and eliminate all vestiges of the old method.

If there is opposition to this deletion, it is suggested that the 20′ at 110°C be issued as a new test method.

D01.21.24A—Ion Chromotography of E-coat Samples—Acting Task Group Chairman, M. Mahon, reviewed the difficulties with sample preparation methods prior to ion chromatography analysis for anions. To date, no satisfactory method for sample prep has been identified. M. Mahon (Du Pont) will prepare a summary of work completed to date on ion chromotography (IC) analysis of E-coat both samples for distribution to all task group members.

In response to a question from J. Weaver, the Dionex Corporation will be contacted by M. Mahon to obtain their technical advice on lead determination by IC on paint chip or dust samples.

The focus of Task Group 24A will shift to analysis of E-coat ultrafiltrate samples by IC. Once suitable sources for ultrafiltrate samples are identified, a procedure will be drafted and a round-robin study will be initiated.

D01.21.25A—VOC Release from Applied Coatings—J. Komjathy, Chairman, reviewed the status of D 5087. The method was to have been written to include both VOC release from solventborne coatings and VOC release from waterborne coatings. This was done, but the combined document is very unwieldly and has been rewritten by separating the two methods.

The new proposed method for VOC release from waterborne coatings was presented, copies distributed, and reviewed; comments received were as follows:

(1) Butyl cellosolve is considered a hazardous material and should not be used in this method. A substitute material such as propylene glycol ether was suggested.

(2) In Section 12.1, the bake temperature needs to be changed from 100° to 110°C ± 5°.

(3) In Section 12.2, the reference to weight fraction solids per Reference Method 24 needs to be verified.

(4) The diagram used to help explain the method to the attendees should be included in the published method.

J. Benga, of PPG Industries, has postponed organizing and running a round-robin on D 5087 until the status of combining the two methods was clarified. He has agreed to now organize and run two separate round-robins, one for each method.

D01.21.27—VOC of Multiple Component Coatings—W.C. Golton, Chairman, reported that appropriate changes have been made to D 3960 and D 2369 to add instructions for handling multiple component permits and to include precision data from a multilaboratory study. The EPA has also acted to revise Reference Method 24 to incorporate these changes, and at the suggestion of Sub. 21, to add reference to D 4457, Analysis of Halohydrocarbons, for subtraction from VOC content.

D01.21.27A—VOC's of Aerosol Coatings—R. Osterman, Chairman, distributed and reviewed the method balloted for solventborne aerosols. The third draft contains editorial and terminology changes that brought about one of the negatives. That negative was withdrawn. The second negative was moved and seconded to be nonpersuasive.

The VOC method on waterborne aerosols was reviewed and the results of the round-robin were presented. Data was received from five participating labs. It was found that the repeatability was 5.26% and the reproducibility was 71.6%. A motion was made, seconded, and passed to submit this method for ballot.

A letter was received from SCAQMD requesting assistance to obtain grant money for the analysis of exempt solvents and exempt propellant not addressed by the two previously mentioned methods. Further discussion will take place at the Sub. D01.21 meeting.

D01.21.41—Detection of Lead in Paint—Met in the absence of Chairman M. McKnight. K.H. Fujimoto acted as temporary chairman to report the activities of Task Group 41. The chairman has been actively evaluating kits to detect lead in paints at the 600 ppm level. Both the EPA and CPSC are also evaluating these kits. Draft reports have been prepared by Research Triangle Institute and Georgia Tech on the ability of the kits to detect lead in paint films. Preliminary indications are that these kits are not extremely sensitive to lead in paint even though they are sensitive in detection of soluble lead compounds. In addition, the use of these kits is difficult for the layman.

Since manufacturers have requested performance requirements, the EPA is working to develop detailed performance requirements for field test kits for lead in paint, dust, and soil. The EPA is very hopeful that a chemical report test or other procedure for lead detection can be developed since the number of potential lead analysis is large.

The chairman's plans are to: (1) Obtain samples of available Pb test kits; (2) Send to volunteers lead samples and test kits for evaluation; (3) Bring the kits to the January 1992 meeting for attendees to examine; and (4) Review potential field test procedures which involve simple leaching procedures.

It was suggested that since the chairman's department in the NIST has evaluated portable XRF equipment for the detection of lead in old homes, a white paper should be written to make Congress and regulatory bodies aware of the limitations of this X-ray instrument.

D01.21.26—Revision of D 2697—Determination of Volume Non-Volatile—R. Brockhaus, Chairman, reviewed results obtained using the helium gas pycnometer method for VNV. An agenda covering the following was distributed: A list of issues concerning the test; A one page title summary of data; Examples of raw data analysis; A table of data on tests using aluminum foil; A list of acknowledgements; and A copy of the trial procedure.

Copies of this may be obtained by contacting the task group chairman through ASTM.

The data obtained in a mini round-robin including three laboratories and three separate instruments are close, and suggests we can continue on with a full round-robin after incorporating several upgrades to the proposed procedure. The data also suggests volumes solids values closer to theoretical are possible.

The question was asked if we should try to review and upgrade the present D 2697 liquid buoyancy method. This task was placed on hold by Sub. D01.21 Chairman H. Fujimoto.

Information on instrument costs, time spent in testing, and status of a new prototype gas pycnometer was shared in the handout. This will change if the new instrument is made in volume and the upgrades may shorten our testing time.

D01.21.46—X-Ray Analysis of Pigments—Chairman Mahon presented a proposed method for analysis of phosphorus in E-coat baths by X-ray fluorescence. Based on comments at the task group meeting, this procedure will be clarified, then used to conduct a round-robin study for phosphorus concentration in E-coat samples. Results from this study are slated for presentation in January 1992.

D01.21.51—Determination of Formaldehyde in Paints—K. Plecity, Chairman, indicated that a library search failed to identify any available techniques which are applicable to determination of formaldehyde in paint.

J. Hunkle briefly discussed the difficulty in measuring "free formaldehyde." He described a method which involves silinization followed by GC separation and quantitation.

K. Smith presented detailed information on a GC/mass selective detector test method developed for determination of formaldehyde in architectural coatings containing ammonia. The method is not applicable to samples where formaldehyde can be thermally regenerated. Advantages of the method include ease of sample preparation and the fact that it does not upset the hexamethylenetetramine method/formaldehyde equilibrium. Disadvantages include instrument cost and high injection port temperature.

A decision was made to conduct a mini round-robin to further study the GC/mass selective detector test method. These attendees (J. Binger, K. Smith, and K. Plecity) agreed to participate in the round-robin. Further direction will be determined after the data is collected.

D01.21.53—Trace Levels of Monomers in Paints—R.G. Eritano, Chairman, reviewed the last round-robin results and statistical analysis of their results. The continued development of an HPLC method for diisocyanate monomer was transferred to Task Group D01.33.12. P. Guevin will be Chairman.

It was voted by the members to have the task group become inactive due to the transfer of the diisocyanate monomer method to Task Group D01.33.12.

D01.21.56—Revision of D 3960 Standard Test Method for Determination of Volatile Organic Compound (VOC) Content of Paints and Related Coatings—M.E. Sites, Chairman, discussed the ballot results on the latest revision of D 3960, (Version II, March 5, 1991). This was the version presented at the joint ASTM/EPA meeting held at Research Triangle Park on June 7 and 8, 1991. It is a revision of D 3960-91 (balloted 90-4) which changes symbols, terms, and equations to be compatible with EPA Reference Method 24. These changes were made to make D 3960 clearer and easier to use and ultimately be considered consistent with the EPA system and be referenced by them.

This revision incorporated editorial comments by J. Berry, of EPA, as well as guidance for treatment of multi-component systems.

This ballot item received three negative and three comments. The negatives were resolved and appropriate comments included:

Sub. D01.47 requested that D 5095-90, "Standard Test Method for the Determination of Nonvolatile Content in Silanes, Siloxanes, and Silane/Siloxane Blends used in Masonary Water Repellent Treatments," be referenced in D 3960. This provides a method for correctly determining the nonvolatile content of penetrating sealers and their corresponding VOC levels, which D 3960 does not.

It was agreed that this will be referenced in D 2832 immediately. A letter will be written to the EPA to get approved for this method for nonvolatiles of Silanes and Siloxanes. If they approve this method, it will be included as a revision to D 3960.

This revision should replace the previous 1991 revision and pass society ballot for inclusion in the 1992 *Book of Standards*.

D01.21.57—Revision of D 4457 Analysis of Halohydrocarbons—J. Benga, Chairman, reported that method D 4457 was reballoted in May 1991 as part of the normal five year method cycle. There were no negatives or comments received related to this method.

Due to general lack of interest and uncertain government regulations related to exempt solvents, Task Group D01.21.57 will go on the inactive status. It will be reactivated as the need arises.

D01.21.80—Exploratory Analytical Research—W.C. Golton, Chairman, explained that this group considers and evaluates proposals for new analytical methods relating to paint.

At the last meeting, Dr. M. Mahon, of Du Pont, proposed the development of new AA or ICP methods for trace inorganics in paints. At this meeting he reported that no response had been received to an item soliciting interest in *Standardization News*.

Dr. Mahon reported on work in his lab to evaluate various methods to decompose paint sample and get trace metals into solution. The best dry ash and wet oxidation methods were identified. Suggestions were made to evaluate microwave dissolution, and standard addition procedures. Dr. Mahon will work with PPG and Glidden to develop a complete method by the next meeting.

Dr. J. Weaver solicited help on the analytical part of the updated Gardner Manual. W. Golton volunteered to represent Sub. 21 and assist Dr. Weaver.

Mr. Fujimoto reported that the EPA is willing to give credit for ammonia against VOC content, if a standard method of ammonia content is developed.

SUBCOMMITTEE D01.22 HEALTH AND SAFETY

J.J. Brezinski, Chairman

The new Department of Transportation Rule regarding shipment of combustible/flammable liquids lists the minimum flashpoint of 140°F for export shipments while retaining the present 100°F threshold for domestic shipments.

Concern remains about the relevance of the flammability classification for shipment of waterborne paints with the actual flammability and related flashpoint and other tests. The issue will be reviewed for possible subcommittee action.

Flashpoint methods D 56 and others, such as the Setaflash and Pensky Martens procedures, can be used to determine the flash point of mixtures of flammable and nonflammable liquids: the type of mixture affects the flash point to be expected with different concentrations of two or more liquids. Details are available from H. Wray.

Members are encouraged to contribute funds (through CCFP) to pay for a series of higher temperature calibrating fluids for flash point testing, the fluids to be distributed through the National Institute for Standards and Technology (NIST).

SUBCOMMITTEE D01.23 PHYSICAL PROPERTIES OF APPLIED PAINT FILMS

P.R. Guevin, Jr., Chairman

D01.23.10—Adhesion—G. Nelson, Chairman, reported the "New Standard Test Method for Measuring Adhesion of Organic Coatings to Plastic Substrates by Direct Tensile Testing," had completed Sub. D01.23/Committee D-1 letter ballot receiving one negative vote.

The voter, H. Stoner, submitted a three part negative. Part of the negative was accommodated by editorial revision. The other parts of his negative objected to the use of the specified adhesive, the cleaning procedure for the substrate, and the area designated for measuring adhesion. The chairman reviewed each of the points and the task group found the negative to be nonpersuasive. The method will be submitted to society ballot.

The chairman reported that the reapproval of D 2197-86, "Test Methods for Adhesion of Organic Films by Scrape Adhesion Tester," had completed Sub. D01.23/Committee D-1 letter ballot with one negative vote. The voter agreed to withdraw his negative based upon editorial revision. The method will be submitted to society ballot.

The chairman reported that the revision of D 3359-90, "Test Methods for Adhesion of Organic Coating Films," had completed Committee D-1 letter ballot without receiving any negative votes. The method will be submitted to society ballot.

D01.23.12—Dry Film Thickness—K.A. Trimber, Chairman, reported that the revisions of D 1186-87, "Method for Non-Destructive Measurement of Dry-Film Thickness of Non-Magnetic Coatings Applied to a Ferrous Base," and D 1400-87, "Method for Non-Destructive Measurement of Dry-Film Thickness of Non-Conductive Coatings Applied to a Non-Ferrous Metal Base," had completed Sub. D01.23/Committee D-1 letter ballot each receiving two negative votes on both methods. Various editorial comments were also received. The negative votes were found to be persuasive and the items were withdrawn from ballot.

A discussion ensued as to whether a new round-robin should be initiated to evaluate the newer instruments that are available and to utilize both the plastic and NIST methods of calibration. It was agreed that plans should be undertaken to initiate this work in the future.

D01.23.14—Hardness, Abrasion and Mar Resistance—D.J. Wilverding, Chairman, reported that the proposed revision of D 1474-85, "Test Method for Indentation Hardness of Organic Coatings," to delete any reference to the Pfund Indentation Hardness Tester as outlined in Method B of the method, had completed Sub. D01.23/

Committee D-1 letter ballot and received one negative vote. The negative vote was found to be persuasive and the item will be removed from ballot. The new "Standard Test Method for Mar Resistance of Organic Coatings Using the Balanced Beam Scrape Adhesion and Mar Tester," has completed Sub. D01.23/Committee D-1 letter ballot receiving one negative vote from R. Boni. The negative was withdrawn after discussions with the chairman based upon editorial revision of the method. Other comments received were editorial in nature and will be included in a revision to the method. The method will be submitted to society ballot.

The chairman distributed the results of his survey of hardness test equipment being used by the industry. The survey included references to hardness testers for scratch, pendulum, and indentation hardness. The results will aid the task group in future work.

A new method of measuring mar resistance using a taber abraser and measuring gloss retention was introduced by Dr. B. Gregorovich. Five cooperators have agreed to participate in a round-robin with the method. The results will be reported upon at the next meeting.

D01.23.15—Slip Resistance—P.R. Guevin, Chairman, reported the revision to D 4518-87, "Test Methods for Measuring Static Friction of Coating Surfaces," had completed Sub. D01.23/Committee D-1 ballot without receiving any negative votes. Editorial comments will be included in the method and it will be sent to society ballot in August.

The chairman reported on slip testing activities in Committees D-21, F-6, and F-13, as well as the workshop on slip testing to be held by Committee F-13 next month. The group also reviewed the recent NCEL Technical Report R-932, "Slipmeter for Floor Coatings." M. Euverard, of Gardco, reported on a new slip tester with variable speeds being developed.

At the suggestion of M. Morse, a round-robin was initiated to evaluate the precision of the drop sled inclined plane test procedure and the horizontal pull slipmeter under wet conditions. Five cooperators have agreed to participate. The results will be reported at the next meeting.

D01.23.16—Water Vapor Transmission—T. Sliva, Chairman, reported that the revision to D 1653-85, "Test Methods for Water Vapor Transmission of Organic Coating Films," had completed Sub. D01.27/Committee D-1 ballot without receiving any negative votes. The method will go on to society ballot.

A discussion followed on reviewing the current ASTM procedures for water vapor transmission to see whether they are compatible with current ISO methods. Task group members have agreed to forward information to the chairman.

D01.23.18—Flexibility—P.R. Guevin, Chairman, reported that the proposed revision of ASTM D 522-88, "Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings" had completed Sub. D01.23/Committee D-1 ballot receiving one negative vote. The negative was found persuasive by the task group and the item was withdrawn from balloting.

The chairman reported that the Precision and Bias statement has been developed for the method. This data will be included in the next revision of the method before balloting.

Sub. D01.23—The chairman reported that the two new task groups have been formed. One task group will evaluate various methods for determining drying time and the second task group will serve as a "exploratory research" group.

SUBCOMMITTEE D01.24 PHYSICAL PROPERTIES OF LIQUID PAINTS

C.K. Schoff, Chairman

D01.24.26—Electrical Properties of Liquid Paints—reviewed the latest draft of the proposed "Method for Electrical Resistivity of Liquid Paint and Related Materials," which needed to be revised due to two negatives and several comments. Additional editorial changes were made at this meeting and the method will be reballoted. We still have not carried out a new round of interlaboratory tests, but interest in the method appears to be dropping off rapidly as we go on and on without completing it. Therefore, we will ballot the method as is and look for interest in the future in trying to improve the precision via new interlaboratory tests.

D01.24.28—Evaporation Rates—reviewed D 3539, "Evaporation Rates of Volatile Liquids by Shell Thin-Film Evaporometer," which is up for revision or reapproval. No new evaporometers have appeared on the market and the one competitor to the Shell Instrument is no longer being made. The latter instrument will be removed from the equipment footnote. Other than that, the method appears to be acceptable for reapproval. A question came up as to whether this method still was used and, if so, how much. It appears that rather than actually measuring evaporation rates, most people now depend on computer programs that model evaporation behavior.

D01.24.30—Calculation of VOC and Volume Solids—reviewed the final draft of the "Standard Practice for Calculating Formula Physical Constants of Liquid Paints and Coatings." After some discussion and a review of recent corrections and other editorial changes, a motion was passed to accept the method and put it forward for society ballot. There were two editorial negatives on the Committee D-1 ballot, but one has been withdrawn and other soon will be.

D01.24.33—Odor Evaluation—discussed a possible guide or standard practice on odor evaluation. Photocopies of articles on odor were passed out for information. The group has not yet begun to write a document as it was decided to first bring together test methods, references, and other odor information before tackling the job. At this meeting it was suggested that we look into possible ISO, DIN, or other methods or practices on odor to make sure that we were not trying to do something that had already been done. We also will contact Eastern Michigan University to find out about their odor program. There were also questions as to whether there were any U.S. or other government regulations in this area or whether there had been government research on odor and odor evaluation.

D01.24.34—Viscosity by Falling Needle Viscometer—reviewed the latest draft on the proposed "Standard Test Method for Viscosity of Materials by a Falling Needle Viscometer," which included editorial changes based on comments from the recent successful Sub. D01.24 ballot. Key words and additional editorial changes were suggested at this meeting. The changes will be made and the method will be submitted for the next Committee D-1 ballot.

In other business, Sub. D01.24 addressed a society ballot negative from R. Gast on D 5125 "Test Method for Viscosity of Paints and Related Materials by ISO Flow Cups." Mr. Gast based his negative on the conversion of metric units (actually S.I. units) into customary units when this method was adapted from ISO 2431. Sub. D01.24 voted the negative to be nonpersuasive because both kinds of units were included in the method as is customary in Committee D-1 methods.

At the Sub. D01.24 meeting there was a request for reactivation of Task Group D01.24.18 on Dispersion Phenomena for the purpose of discussing a new pigment paste texture or cleanliness gauge. The task group will meet during the January 1992 Committee D-1 meeting and R. Morrison will be the Chairman.

SUBCOMMITTEE D01.26 OPTICAL PROPERTIES

R. Kumar, Chairman

D01.26.02—Color Measurement—R.T. Marcus, Chairman, advised that this task group did not meet at the Anaheim meeting and there was nothing new to report. However, E. Extract submitted a revised copy of ASTM D 1544, "Test Method for Color of Transparent Liquids." This procedure was discussed and will be submitted for ballot later this year.

D01.26.06—Hiding Power—L. Schaeffer, Chairman. The task group met in Ottawa on June 18, 1991, with seven members and three visitors in attendance. Results were distributed of the latest round-robin of the proposed method for hiding power of powder coatings, that had been conducted by Sub. D01.51 on Powder Coatings. The group agreed that these results showed good correlation and that a precision statement should be prepared and the proposed method balloted. This is the same conclusion drawn from the preceding round-robin, which conclusion the new round-robin was intended to confirm.

At the subsequent meeting of Task Group D01.51.02 on the same day, the round-robin results were likewise perceived to be satisfactory. However, it was the feeling of some members of that group that the film thickness determination should be made with a magnetic or Eddy current gage, rather than by the weigh-area-density procedure used in the round-robins. The group therefore decided that balloting should be delayed until the validity of the alternative film thickness procedure was evaluated and since development of this method is a joint effort of Task Group D01.26.06 and Task Group D01.52.02 that decision prevails. It is expected that results will be available for discussion at the next Committee D-1 meeting.

D01.26.11—Gloss and Goniophotometry—A.F. Rutkievic, Chairman. Because the chairman was unable to attend this meeting, R. Kumar presided. Ten members and guests were present. The minutes of the January meeting were approved.

A revised new method for "Instrumental Measurement of Distinctness-of-Image Gloss of Coating Surfaces," was discussed. Members felt that they would review it and then it would be submitted for Sub. D01.26 ballot.

A revised D 4039-87, "Standard Test Method for Reflection Haze of High-Gloss Surfaces," was discussed. Members will review it further and mail any comments to the chairman. Then it will be submitted for Subcommittee and Committee ballot. All present mentioned their appreciation for all the work done by A. Rutkievic in revising these methods.

D01.26.46—Tinting Strength—R. Morrison, Chairman, reported that D 387, "Test Method for Color and Strength Color Pigments with a Mechanical Muller," received one negative and several comments on the last ballot. The first negative of F. Billmeyer concerned the references to E 1347 and E 308. It was agreed that E 308 was not relevant to this method, and should be eliminated, but 12.4.1 specifically allows the use of a tristimulus instrument, so the suggestion to eliminate E 1347 was voted nonpersuasive. F. Billmeyer's second negative dealt with the fact that 12.4.1 does not deal with the adjustment of amount of chromatic pigment used. This negative was found to be persuasive. The method will be revised to meet these negatives and submitted for concurrent Sub. D01.26/Committee D-1 ballot.

R. Morrison reported that the proposed Method of Test for Evaluating the Tint Undertone of Titanium Dioxide Pigments has been revised, and will be submitted for Sub. D01.26 ballot. J. Aviles has agreed to be a co-operator in the round-robin testing. E. Extract has agreed to work with F. Billmeyer on the revisions to test method D 1544.

Test method D 332 is ready to go to printing with the elimination of references to bias (since there is no standard) and the addition of a keywords section.

Other Business—The chairman and the members expressed their appreciation for past Chairman C. Sherman for his support and participation in Sub. D01.26. The following new members were welcomed: Amy Abe, of Sherwin Williams Co.; Richard Harold, of Hunter Lab; Julio Aviles, of Kronos Inc.; and Lynn Bement, of LB Enterprises.

Note that these new members bring a lot of expertise from their industrial experience which will benefit Sub. D01.26. Also, C. Sherman was elected Secretary of Sub. D01. 26 by unanimous vote.

SUBCOMMITTEE D01.27 ACCELERATED TESTS FOR PROTECTIVE COATINGS

D. Grossman, Chairman

D01.27.02—Water Tests—D. Grossman, Chairman. Subcommittee ballot on four very similar water tests, D 870, "Immersion," D 1735, "Water Fog," D 2247, "100% Humidity," and D 4585, "Controlled Condensation," resulted in one negative from W. Johnson regarding adding a reference to D 4541, "Pull Off Strength," and D 1654 "Evaluating Corroded Specimens." The methods will be sent to concurrent Sub. D01.27/Committee D-1 ballot with these new references.

D01.27.04—Light and Water Exposure Apparatus—L.E. Thieben, Chairman. D 3361, "Unfiltered Open-flame Carbon-Arc Dew Cycle," will be balloted for reapproval with revisions. Several members expressed concern that the extreme short wavelength UV from the unfiltered carbon arc makes this test very unrealistic. Wording to reflect this will be included in the draft.

D01.27.09—Evaluation of Corroded Specimens—F. Lutze, Chairman. G. Rommal presented a draft of D 1654, "Evaluating Corroded Specimens," which will be sent to Sub. D01. 27 ballot. The draft addresses areas such as scribe tool, scraping tool, air compressor requirements, and methods for evaluating unscribed areas. These revisions will make the method applicable to coil and automotive, as well as other industries.

D01.27.10—Accelerated Outdoor Weathering—J. Robbins III, Chairman. This task group continued to discuss reports prepared by M. Morse concerning the work performed from 1975-1990. A second draft of Volume 1 (1975-1983) was presented and discussed which had been retyped and edited. The members of the group will review this volume, and write or call the chairman with their questions and comments before the final draft is prepared. Because of the number of questions concerning the report, it was the consensus of this task group to send D 4141 to concurrent Sub. D01.27/Committee D-1 ballot for reapproval without an appendix describing the research reports. This appendix will be added at a later date.

Within the next month or so, test laboratories and users having an interest in other outdoor accelerated methods, not covered by D 4141, should send a list of these methods to the chairman so that a questionaire may be prepared for sending to Sub. D01.27 members.

D01.27.12—Detergent—F. Lutze, Chairman. D 2248, "Detergent Resistance," needs to be revised because the "sodium salt of a linear alkylarylsulfonate" specified is no longer available from the manufacturer. A. Hanson has found a suitable equivalent, and a draft revision will be sent to Sub. D01.27 ballot.

D01.27.17—Evaluation of Weathering Effects—J. Martin, Chairman. The results of D 714, "Evaluation of Blistering," and D 772, "Evaluation of Flaking," ballots were discussed. Three negatives were received on D 714. S. Boocock agreed to withdraw his negative with revision to Section 6.4. The negative from J. Mantle was discussed, found nonpersuasive by unanimous subcommittee vote of 8-0-0. A very similar negative from M. Crewdson was discussed. Since Mr. Crewdson was not at the meeting, J. Martin will call him and discuss the possible withdrawal of his negative based on the group's discussion.

One negative was received from M. Crewdson on D 772. Changes were made to Table Z and the reference figures will be included in response to the negative. D 772 will be re-balloted. Also, the key words for these standards were switched and will be corrected. Several comments for both ballots were also discussed.

D 1006, "Conducting Outdoor Weathering Tests on Wood Coatings," will be submitted to concurrent Sub. D01.27/Committee D-1 ballot.

D 1150, "Multi-Panel Forms for Exposure Records," will be balloted for withdrawal.

D 660, "Evaluation of Checking," D 661, "Evaluating of Cracking," and D 662, "Evaluating Erosion," will be reviewed for reapproval or revision and discussed at the next meeting.

An instantaneous round-robin will be conducted at the next meeting in order to establish precision and bias statements for D 714, "Evaluation of Blistering," D 772, "Evaluation of Flaking," and D 4214, "Evaluation of Chalking."

R. Morrison stated that the tape required for the two chalking methods in D 4214 was not easily available in the U.S. Mr. Morrison has found what he thinks is a suitable substitute. This substitute tape (3M, #480) will be compared to the required tape (Sellotape 1401) at the next meeting by this group.

D01.27.30—Filiform Corrosion—F. Lutze, Chairman. D 2803, "Filiform Corrosion Resistance of Organic Coatings on Metal," was reviewed. It was suggested that other filiform test conditions used should be included, and the document balloted as a practice or guide. A draft will be presented at the meeting in January.

D01.27.29—Test Substrates—D. Grossman, Chairman. The revision to D 2201, "Galvanized Test Panels," passed Sub. D01.27 ballot with no negatives and will be sent to Committee D-1 ballot with editorial changes.

D01.27.30—Corrosion Tests—Automotive—F. Lutze, Chairman. The AISI/SAE outdoor scab corrosion exposures continue at nine sites with approximately 18 months completed. Preliminary results indicate most indoor accelerated corrosion tests do not correlate with field service, proving ground or outdoor scab. AISI/SAE is preparing to evaluate several modified cyclic tests. Papers detailing the results of all phases of this project will be presented at the 1991 SAE Automotive Corrosion & Prevention Conference, October 21-23, at the Ritz Carlton in Dearborn, MI.

D 1540, "Effect of Chemical Agents or Organic Finishes Used in the Transportation Industry," will be sent to Sub. D01.27/Committee D-1 ballot to withdrawal.

D01.27.31—Corrosion Tests—Non-Automotive—S. Boocock, Chairman. Progress has been made on the cyclic corrosion test round-robin. Eight prepainted steel coils remaining from the AISI study on performance testing of building metal products have been shipped to Q-Panel Company in Cleveland, OH. These will be cut into panels of a suitable size for exterior and laboratory exposure. A letter of agreement between AISI and the ASTM task group to govern the use of these samples has been found suitable as to form and content by AISI.

It was decided that all exterior exposures be initiated as soon as possible. A tentative deadline for initiation of exterior exposures is February-March 1992. This would allow for all panel preparation and distribution.

It was decided that either A-36 panels or commercial grade steel of thickness close to ⅛ in. be used for the industrial maintenance coatings. Mill test reports will be obtained for the test panels. All panels will be prepared for painting by abrasive blast cleaning to SSPC-SP 10, "Near White Metal Blast Cleaning," the profile to be obtained will nominally be 1-5-2-0 mils.

A discussion of the ideal number of replicates for outdoor and laboratory exposure samples took place. It was recognized that space constraints in the laboratory cabinets might limit the numbers of replicates for each system. The group requested that an optimum number of replicates be devised for the outdoor exposures. This optimum number would be devised by determination of the standard deviation and expected statistical attainable with increasing replication.

The group leader was requested to develop a matrix showing the degree of discrimination between replicate sets at different sites and exposure conditions with increasing replication. Feed back from the task group will be sought as to the approximate degree of replication, based on this information.

It was agreed that at least five outdoor test sites would be used in the evaluation program. The task group reviewed the list of candidate sites and suggested two severe marine sites maintained by La Que Corrosion Center and South Florida Test Service. A third mild marine site maintained by La Que was also selected. Tentative selections for industrial exposure sites included SSPC, Neville Island (mild industrial), and The Sherwin-Williams Co., Cleveland, OH (severe industrial). Other candidate exterior exposure sites to be approached included a severe gulf coast site near Houston maintained by Rohm & Haas Co. and an offer of an industrial site in Japan by Shigeru Suga.

The ratings frequency was discussed and it was agreed that all exterior exposures would be rated on six-month intervals. All laboratory exposures would be rated at weekly intervals, unless otherwise demanded by the individual test.

Evaluation criteria for the industrial maintenance coatings ratings would be evaluation of rusting per D 610, blistering per D 714, scribe undercutting per D 1654.

For the coil coating materials ratings would be made of rusting per D 610, blistering per D 714, scribe undercutting and edgecreep per D 1654. In addition, ratings of the panels for undercutting from the point of a deliberate defect (reverse impact) will be made. All data will be recorded in a numerical format to facilitate computerized data analysis.

Panel size for outdoor exposures will be 4 in. × 12 in. Panels will all have a scribe placed on the surface in accordance with D 1654. Industrial maintenance coating panels will be provided with additional edge protection. Coil coated panels will be sheared to provide a burr down condition. All coil coated panels would be subjected to reverse impact at 80-100 in./lbs at a location remote from the edges and the scribe. Currently, it is suggested that all panel preparation for each set be at one site. The Q-Panel Co. has volunteered to prepare the coil coated panel sets. SSPC will coordinate preparation of the industrial maintenance panels.

To ease data gathering, it was agreed that spreadsheet proforma be developed for each recording site which delineates the evaluation intervals, all panel identifications and nature/type of evaluation criteria. The sample proforma spreadsheets in Lotus 1,2,3 and Excel 2.2 (or higher) format, will be made available for review prior to the next meeting.

It was agreed that the data be analyzed using ranking correlation methods. Rankings will be developed for each evaluation criteria and a ranking made based on a combined rating.

Due to lack of time, discussion and revision of the list of industrial maintenance coatings did not take place. Task group members will be polled by mail for agreement with current list or to determine the need for revision.

Selection of Laboratory Cyclic Exposure Tests. It was decided that lack of time and the desire to initiate outdoor exposures precluded addressing of this topic. Task group members will be asked to comment on suggested cyclic exposures in a subsequent mailing.

Other Standards to Be Balloted—D 2246, "Humidity/Thermal Cycle Cracking" will be sent to concurrent Sub. D01.27/Committee D-1 ballot for withdrawal, since it was the concensus that this method is not used anymore.

DIVISION 30
PAINT MATERIALS

SUBCOMMITTEE D01.31 PIGMENT SPECIFICATIONS

D.H. Ruddick, Chairman

D01.31.15—Micaceous Iron Oxide—M. Hendry reported that significant progress had been made in identifying existing standards (Australia, U.K.); in identifying various characteristics of micaceous iron oxides, etc. This has allowed for a first draft of a micaceous iron oxide standard to be distributed for comments among the task group members.

The goal at this time is to complete a standard suitable for review by the subcommittee in January 1992; with the completed standard ready for balloting after the June 1992 meeting. Dr. Hendry described this agenda as optimistic, but it appears feasible based on the progress made to date.

Other pigments currently under review:

D 081, "Basic Carbonate of White Lead (BCWL)." No report since the last meeting. It will be reviewed by W. Spangenberg.

D 267, "Gold Bronze Powder." No report since the last meeting. It will be reviewed by D. Ruddick.

D 607, "Wet Ground Mica." To be balloted as currently written.

D 1649, "Strontium Chromate." No report since the last meeting. Standard is to be reviewed by Wayne Chemical personnel.

Chairpersons are needed for the following task groups: D01.31.09, Carbon Pigments; D01.31.13, Practices and Procedures; and D01.31.64, Coordination with ASTM E-34.

A chairperson for Task Group D01.31.04, Anti-Fouling Pigments, may also be needed as A. Chasan has been unable to attend the Sub. D01.31 meeting for more than two years. At least one standard, cuprous oxide, is on hold for lack of a task group chairperson.

All standards reballoted this spring passed with no negatives with the exception of bone black. The negative for bone black regarded the use of carbon black in the key words section of the standard. The concern was that bone black and carbon black could be interpreted as synonymous terms. As the bone black standard is clear on its method of production, the key word "carbon black" was removed.

Task group chairpersons and/or standard reviewers have yet to be found for toluidine red (D 656); cuprous oxide (D 912); copper pthalocyanine blue (D 867); chrome green (D 212); copper pthalocyanine green (D 3021); and pumice (D 867). If no interested parties are available to review these standards, it may become necessary to remove those pigments from the list of materials reviewed by Sub. D01.31.

New Business—C. Tatman asked about a review date for titanium dioxide pigments. They are not due for review until 1994.

SUBCOMMITTEE D01.32
DRYING OILS

P.C. Stievater, Chairman

The following items received negatives from P. Stievater to consider H. Ashton's comments from the 87-1 ballot which were received too late to be considered at that meeting: D 1392-87 (Item 35) and D 1462-87 (Item 36).

These items were removed from the ballot for further study and will be reballotted on the next main/subcommittee ballot for revision. Edited copies were submitted to ASTM for ballot.

The following items received negatives from P. Guevin, Jr. because they lack keywords and precision and bias sections: D 2072-66 (Item 41), D 2073-66 (Item 42), D 2074-66 (Item 43), D 2076-64 (Item 44), D 2077-64 (Item 45), D 2079-82 (Item 46), D 2080-64 (Item 47), D 2081-64 (Item 48), D 2082-82 (Item 49), D 2083-66 (Item 50), and D 2800-87 (Item 52).

As discussed previously, keywords will be added editorially when these items are reprinted. Regarding precision and bias, it was voted upon by the subcommittee to withdraw those items from ballot and ballot a generic precision and bias statement that has been used previously for inclusion in these items rather than to ballot the items for withdrawal. A generic precision and bias statement was submitted to ASTM to be ballotted for use in the previously mentioned items, as well as in D 2075-89, "Standard Test Method for Iodine Value of Fatty Amines, Amidioamines and Diamines," which was not on the latest ballot.

A revision of D 2071 was also submitted to ASTM for the next ballot to change the title from "Standard Test Methods for Fatty Nitrogen Products" to "Guide for Testing Fatty Nitrogen Products."

SUBCOMMITTEE D01.33
POLYMERS AND RESINS

M.J. Mahon, Chairman

D01.33—Resins—M.J. Mahon, Chairman, reviewed the status of all standards up for review or revision in the balance of 1991. Standards for each method were assigned with the agreement all revisions would be forwarded for main and subcommittee ballot this summer. W. Golton discussed adding a precaution in D 1545, "Test Method for Viscosity of Transparent Liquids by Bubble Time Method," to check Gardner Holdt standards "M" to Z10" with a stopwatch once per year. The possibility of adding this statement will be discussed with J. Peters, of BYK-Chemie Inc.

Chairman Mahon announced that responsibility for Standard D 1544 on the Gardner Color Scale is being shifted to Sub. D01.26 on Optical Properties.

Chairman Mahon related that membership in Sub. D01.33 has a continuing concern. Meeting attendance in Sub. D01.33 has undergone a significant decline in recent years. All subcommittee members were asked to redouble their efforts to bring new members into Sub. D01.33.

D01.33.12—Urethanes—P. Guevin, Chairman, reported on the draft of an ASTM proposed test method to measure unreacted isocyanate monomers in urethane resins and prepolymers using HPLC. He used test methods submitted by Du Pont and Mobay as guidelines. He indicated his inability to get answers from Mobay on technical questions raised by PPG on the proposed test method. R. Eritano will attempt to get answers and pass them on. Mr. Guevin will revise the test method accordingly.

Mr. Guevin reported on his attempt to contact collaborators to participate in a Task Group D01.33.12 round-robin study. To date, Du Pont, Mobay, and PPG have agreed to participate. He will contact others to determine their interest in participating in this round-robin study. R. Eritano will supply representative samples. Results are expected for the January 1992 meeting.

Sub. D01.33 Chairman Mahon reported the revision D 2572, "Test Method for Isocyanate Groups in Urethane Materials or Prepolymers," received no negative votes in the concurrent Sub. D01.33/Committee D-1 ballot. The revised test method now goes to society ballot.

D01.33.14—Alkyds—R. Lowrance, Chairman, reported D 2455 "Method for Identification of Carboxyli Acids in Alkyd Resins," is to be reballoted to resolve the negative submitted by R. Janusz and improperly resolved at the January meeting.

D 1398, "Test Method for Fatty Acid Content of Alkyd Resins and Alkyd Resin Solutions," D 1615, "Test Methods for Glycerol, Ethylene Glycol and Pentaerythritol in Alkyd Resins," and D 3733, "Test Method for Silicon Content of Silicone Polymers and Silicone-Modified Alkyds by Atomic Absorption," are to be submitted for reapproval following editorial changes by R. Lowrance.

A request for information about a test method to determine compatibility of alkyd resins with mineral spirits was received from H. Werner. R. Osterman is to follow-up to determine what is needed for such a test method.

D01.33.23—Epoxies—In the absence of Chairman, F. Esch, M. Mahon conducted the brief meeting. ASTM Standards D 4301 and D 1847 will be submitted for concurrent ballot during June 1991. Round-robin results on residual epichlorohydrin determination in epoxy resins will be reviewed at the January 1992 Task Group D01.33.23 meeting.

D01.33.27—Phenolics—In the absence of Chairman, E. May, M. Mahon conducted the meeting. Two methods up for review D 1312, "Test Method for Apparent Free Phenols in Synthetic Phenolic Resins or Solutions Used for Coating Purposes," and D 4706, "Test Method for Determining Qualitatively Methylol Group in Phenolic Resins," were discussed and will be forwarded for concurrent Sub. D01.33/ Committee D-1 ballot.

This task group will be inactivated until more work for Phenolics is identified by ASTM Membership.

D01.33.28—Turbidity—W.C. Golton, Chairman, reported the new standard method for Turbidity of Resins and Clear Liquids was reballoted this spring. Several affirmatives with comment and one negative were received. The comments will be incorporated as editorial changes where appropriate.

The negative vote was cast by M. Snider. He objected to the suggestion of warming as a technique to remove bubbles, since warming might cause something to dissolve, thus reducing actual turbidity. The group agreed and decided to add a precaution that in cases where temperature is thought to be a factor, supplier and consumer should agree on a temperature for the measurement. M. Snider withdrew his negative in anticipation of a revision of the procedure.

Since all changes are editorial in nature and will not affect the procedure or the statistics obtained, the new standard will be submitted for publication in the 1992 *Book of Standards*.

SUBCOMMITTEE D01.34 NAVAL STORES

J. Russell, Chairman

The subcommittee is continuing its review of all the 22 standard methods that are its responsibility. Since the January meeting in Fort Lauderdale, a task group meeting was held in Charleston, SC, and another will be held in October 1991. It is anticipated that all 22 standard methods will have been submitted for subcommittee ballots by the end of 1991.

D 464—Saponification Number of Naval Stores Products Including Tall Oil and Other Related Products—S. Whitfield, Chairman, reported that the subcommittee and main committee ballots had been completed on the revised procedure and there were no negatives. Three comments were received and discussed and it was decided to delete the word "frequently" from Section 7.4. This will require that section be resubmitted for a main committee ballot.

S. Whitfield also reported on the status of the round-robin recently carried out on a sample of tall oil fatty acids. Of the 12 laboratories cooperating in the round-robin, three obtained unusually poor repeatability. These three results will be investigated further, before a precision statement is included in the standard method.

D 465—Acid Number of Naval Stores Including Tall Oil and Related Products—W. Trainor, Chairman, reported that the subcommittee ballot had been completed on the revised method and that no negative votes had been cast. A few minor comments had been made and after some discussion these were incorporated into the text. This method is now ready for a main committee ballot.

W. Trainor also reported on the results of the round-robin and it was agreed that these results would be used to develop a new precision statement for inclusion in the method. Mr. Trainor reported that the repeatability within a laboratory was ± 0.6 and the reproducibility between laboratories was ± 1.8. These findings were about as expected.

D 1065—Unsaponifiable Matter in Naval Stores Products Including Tall Oil and Related Products—J. Bowers, Chairman, reported that a subcommittee ballot on the revised method had been completed and no negatives had been received. One or two very minor changes were suggested at the meeting and these will be incorporated into the method and then it will be submitted for a main committee ballot.

J. Bowers also reported on the results of a round-robin carried out on a sample of tall oil fatty acid. The repeatability within a laboratory was found to be ± .14 and the reproducibility from laboratory to laboratory was found to be ± .17. Although this reproducibility is about ± 10% of the level of unsaponifiables in the test sample, the committee agreed that this reproducibility was reasonable for this complex method. A precision statement will be developed based on the results obtained and incorporated into the text prior to the main committee ballot.

D 804—Terms Relating to Naval Stores and Related Products—J. Russell, Chairman, submitted the revised terminology standard to the subcommittee. Discussion on this standard had been deferred in order to include CAS registration numbers wherever possible. It has now been concluded that unanimous committee agreement on CASRNs would result in a lengthy delay and so it has been decided to submit the standard for subcommittee ballot without CASRNs.

Subcommittee members were asked to submit any comments to the chairman prior to July 1, 1991, in order that they could be considered for inclusion in a subcommittee ballot planned for early July.

D 1240—Rosin Acid Content of Naval Stores Products Including Tall Oil and Related Products—R. Humphrey, Chairman, was unable to attend the meeting because of other priorities. He had submitted a revised method prior to the meeting but the subcommittee felt that it was not practical to discuss this write-up in his absence. It was agreed to ask W. Mark to work closely with Mr. Humphrey on the revised method and to ask Dr. Mark to chair this method should Mr. Humphrey be unable to complete the task.

D 1585—Fatty Acid Content of Naval Stores Products Including Tall Oil and Related Products—W. Mark, Chairman, was unable to attend the subcommittee meeting because of a prior commitment. However, he had submitted his revised standard method to the subcommittee chairman prior to the meeting.

The text appears to be ready for a subcommittee ballot, however, it relies heavily on D 1240 and so the committee decided to delay a ballot on D 1585 until it could be submitted at the same time as D 1240. Consequently, no action was taken on D 1585 at this time.

D 3009—Composition of Turpentine by Gas Chromatography—D. Stewart, Chairman, was unable to attend the meeting. However, in his absence, Chairman J. Russell reported that Mr. Stewart's revision had been submitted for a subcommittee ballot. This ballot is currently underway, and if no negative votes are received, this method will be submitted for a main committee ballot.

E 28—Softening Point by Ring and Ball Apparatus—P. Zawislak, Chairman, reported that the subcommittee ballot on the revised procedure was complete and no negative votes were received. This procedure will be submitted for a main committee ballot.

P. Zawislak also reported the final conclusions of the round-robin carried out on three samples of widely differing softening points. Two methods were used, a manual method and the automated Herzog method. The results using the manual method showed the expected level of variation and a precision statement based on these results will be included in the revised method.

The results obtained using the Herzog apparatus were less consistent and the subcommittee agreed that this equipment requires careful and regular standardization. It was agreed that a recommended standardization procedure would be developed and a round-robin, incorporating the standardization procedure, would be carried out at a later date.

D 269—Toluene Insoluble in Resin—J. Daust, Chairman, reported that he had studied the existing standard method and recommended that the method be retained but be rewritten to reflect current practice. He agreed to revise the method following a timetable that will allow it to be submitted for a subcommittee ballot in the third quarter of 1991.

D 801—Sampling and Testing Dipentene and D 802—Sampling and Testing Pine Oil—D. Stewart, Chairman, was unable to attend the meeting but submitted his comments on these methods in writing. It was agreed that Ms. Zawislak would review his comments and work with Mr. Stewart on the final text so that these methods can be submitted for a subcommittee ballot during the third quarter of 1991.

One major recommendation was that a separate standard method be written for the gas chromatographic analysis of these materials. The gas chromatographic analysis should not be included in the current methods.

New Methods:

Gas Chromatography of Rosin and Fatty Acids using Capillary Columns—It was reported that the current chairman of this task group, W. Grady, had resigned from the subcommittee and so it was necessary to select a new chairman. R. Raney and W. Trainor were chosen as co-chairmen. They will collect all data previously submitted to Dr. Grady and present an outline of a new method at the next subcommittee meeting.

Crystallization of Rosin—J. Daust agreed to review and evaluate a rosin crystallization test currently in use by Hercules Inc. He will report his findings at the next subcommittee meeting.

DIVISION 40
PAINT PRODUCTS APPLIED ON SITE

SUBCOMMITTEE D01.41 PURCHASE OF PAINTS AND RELATED COATINGS

L.E. Rogers, Chairman

Sub. D01.41 and D01.41.01—Alternate Methods of Purchase—Joint Meeting—L.E. Rogers, Chairman, reported on the March 28, 1991 meeting of Task Group D01.41.01 at NIST. A proposed revision to the scope was developed, as well as a full discussion of the government's use of Multiple Award Schedules instead of Military and Federal Specifications for the procurement of architectural/consumer paints. S. Orthey reported on the withdrawal of D 3927-87 (ballot 91-01, item 40) with 140 affirmative, 0 negatives, and 235 abstentions) and that it would be on the August society ballot. L. Rogers reported that the Sub. D01.41 decision to find L. Schaeffer's negative on D 4717 nonpersuasive had been overturned by Sub. D01.41 ballot. Forty-three ballots had been mailed and only 14 returned with 6 affirmatives, 6 negatives, and 2 abstentions. With only 50% affirmative on this confirmatory letter ballot, the ballot failed and the negative vote is considered to be persuasive and the item is withdrawn from ballot. The proposal was made and the chair directed that a new draft be prepared addressing L. Schaeffer's negative and more specifically the revised wording proposed by T. Sliva in his response in support of the negative. Staff agreed to prepare a new draft standard based on D 4717 with T. Sliva's proposed rewording, and submit for Sub. D01.41 ballot. L. Rogers presented the proposed rewording of the Sub. D01.41 Scope which was prepared at the Task Group D01.41.01 meeting. After discussion, the following was approved (10 affirmatives, 0 negatives, 1 abstention) and directed it be passed to Sub. D01.91 for action. "SCOPE—To develop guides for the selection of finished whole paint and related coatings including trade sales and industrial products for individual consumers, and for government and general industry use; and to serve as a forum to address the needs and concerns of these users for matters under the jurisdiction of Committee D-1." It was further recommended that Sub. D01.91 consider combining Sub. D01.13 on Consumer Affairs and Sub. D01.07 on Government Standards into Sub. D01.41 as the scope is approved.

SUBCOMMITTEE D01.42 ARCHITECTURAL FINISHES

L. Schaeffer, Chairman

D01.42.01—Soil and Stain Removal—T.J. Sliva, Chairman, reported that the proposed revision of D 4828, Practical Washability had completed concurrent Sub. D01.42/Committee D-1 balloting and received no negatives. Affirmatives with comments were reviewed from A. Landrock, S. Lauren, and H. Ashton. All comments were editorial in nature and will be incorporated into the text without further balloting. The method next goes to society ballot.

D01.42.03—Porosity of Paint Films—C. Tatman, Chairman, discussed the results of round-robin #2, in which film porosity measurements were made of a series of latex flat paints prepared at PVC levels of 40, 50, 60, and 70%. It was originally intended to test a similar series of alkyd flats, but this type of coating was eliminated from further consideration by the task group due to the general decline in its use. With the exception of one cooperator, the measured values showed very good repeatability and reproducibility. The chairman will work with that cooperator to determine how to prevent repetition of the problem. Forthcoming round-robin #3 will use the same series of latex paints, with films cast at 2-mil and 4-mil wet film thickness. As with round-robin #2, the saturant will be mineral oil and the amount absorbed will be reported as a percentage of the dry film weight, which value is a direct function of the film porosity.

D01.42.04—Wet Adhesion of Latex Paints—C.W. Vanderslice, Chairman, passed around data from his lab showing the continued correct ranking of three different paints by the method under consideration. The problem of persistent loss-of-adhesion of the gloss alkyd primer to its substrate will be investigated by preparing panels at more than one laboratory, and by again trying alkyd-coated steel panels and vinyl panels as possible substrates. A second round-robin will be run using the substrate of choice from these tests.

D01.42.09—Color Development—The task group met in the absence of Chairman F. Marschall with L. Schaeffer presiding. Results of the subcommittee ballot on the proposed method for measurement of color development in tinted latex paints, were reported as 23 affirmative, 1 negative, and 19 abstentions. The negative voter, L. Rogers, felt that the brushout procedure instructions were not sufficiently definite, which criticism was considered persuasive. Alternate wordings were discussed. Useful comments were received from R. Modrak, H. Ashton, T. Sliva, D. MacGregor, and J. Weaver. It was agreed that the method would be revised accordingly and submitted to concurrent Sub. D01.42/Committee D-1 ballot.

D01.42.13—Brushability—C.W. Vanderslice, Chairman, distributed a copy of an amendment to test method D 4958 that just completed concurrent Sub. D01.42/Committee D-1 ballot without negatives. Additional changes of a minor editorial nature are to be made based on task group and ballot return comments, which changes will not require reballoting. The revised standard will next proceed to society ballot.

D01.42.16—Hiding Power by Roller Application—J. Price, Chairman, reported that the society ballot appeal by J. Csernica against new standard D 5150 had been voted nonpersuasive by the subcommittee, and the standard can therefore now proceed to printing and publication without further delay. The chairman presented revisions agreed upon in June 1990, but not yet implemented due to the previously uncertain status of D 5150. It was agreed that these revisions would now be submitted to concurrent Sub. D01.42/Committee D-1 ballot.

D01.42.18—Long Range Planning—S. LeSota, Chairman, held its inaugural meeting with four members and three guests in attendance. The immediate purpose of this new group is to review ASTM guides and test method lists to determine which test methods Sub. D01.42 should work on next. The group was surprised to find that many of the test methods once considered as lacking have since been developed and are already published or will be in the next annual *Book of Standards*. W. Vanderslice suggested that a test method for burnish resistance (polishing) should be developed and agreed to serve as chairman of a task group for that purpose. This will be Task Group D01.42.26. S. LeSota will send him the test method used by Rohm & Haas as a starting point. Other potential burnish resistance methods are solicited. The task group on Long Range Planning will attempt to develop a substantial backlog of desirable test projects. Sub. D01.42 members and others are invited to send their ideas to the chairman. A meeting of this task group will be scheduled for next January. Subsequent meetings will be scheduled as they appear useful.

D01.42.20—Water Repellents on Wood—V. Scarborough, Chairman. This group did not meet due to the absence of its chairman, but at the subcommittee meeting, the results were reviewed of the recent Sub. D01.42/Committee D-1 ballot on the proposed method for evaluating water repellent coatings. Two negatives and several useful editorial comments had been received. One of the negatives called for a specified exposure time when exterior exposure of test specimens is required. The other was concerned about possible difficulty in obtaining Ponderosa pine sapwood as called for in the method. The negatives and comments will be addressed as needed and a suitable revision submitted again to concurrent Sub. D01.42/Committee D-1 ballot.

D01.42.22—Guides for Testing Waterborne Architectural Coatings—H. Ashton, Chairman, reported that on concurrent letter ballot, D 3129, Exterior House Paints and D 4540, Interior Semi-Gloss and Gloss Paints, each received one negative vote and a few comments. The negative voter agreed to withdraw his negative on D 4540 so that it can proceed to society ballot, provided that a reference to D 4707, Roller Spatter Resistance was included. L. Gutman stated that the negative on D 3129 could be resolved by an editorial change. The chairman reported that a proposed brush-drag statement that was to be added to both D 3129 and D 4540, requires further revision because it incorrectly implies that increasing the brush-drag of a paint is always beneficial. The statement will be revised to cover the possibility of excessive brush-drag and this will be included in the combined guide for waterborne coatings as well as other standards. The proposed combined guide, which had been revised on the basis of the comments submitted prior to the last meeting, was reviewed at the present meeting and agreement reached on several further changes. The chairman will collate the comments submitted by the meeting participants and prepare a revised draft for Sub. D01.42 or possibly concurrent Sub. D01.42/Committee D-1 ballot.

D01.42.23—Gloss Level Definitions—L. Schaeffer, Chairman, met jointly with Sub. D01.16 on Definitions, S. LeSota, Chairman. The results of the Sub. D01.16 ballot of gloss definitions proposed by Task Group D01.42.23 were reviewed. The ballot had two phases: a general definition of the gloss phenomenon; and gloss level definitions for the terms: flat, low-lustre, satin, semi-gloss, gloss (regular), and high-gloss based on 60° and 85° gloss measurements. Many valuable comments were received with respect to both phases. There were also several negatives with regard to the proposed gloss level definitions, which though few were very emphatic. A. Abe submitted graphs showing that few commercial paint gloss values agreed with the balloted numerical values. She argued that we should delete the gloss level definitions and consider only the general definition. M.K. Harding used essentially the same argument, stating that gloss level terminology should not be defined numerically by ASTM because it is primarily promotional rather than technical, and that commercial practices in this connection would be unjustifiably inhibited by the existence of ASTM definitions. These arguments were tentatively accepted and a new gloss definition ballot will be prepared accordingly by Sub. D01.16 that will be related only to the general concept. The task group will reassess its function and seek further instructions.

D01.42.24—Application Properties of Paints—J. Price, Chairman, explained that the purpose of this task group is to find and develop meaningful methods to replace those in the Federal Test Method Standard No. 141C related to practical paint application and applicators. Also, to investigate and develop meaningful methods relating to such concepts as natural spreading rate. The chairman passed out copies of pertinent sections of the Federal standard, and of a proposed method for "The Determination of the Discharge Capacity of Paints when Applied by Roller." The chairman will evaluate this method using a variety of paints and report on its effectiveness at the January 1992, meeting. If the results justify it, he will then ask for cooperators and will plan a work session for the meeting in June 1992.

D01.42.25—Scrub Resistance of Latex Paints—D. Licata, Chairman, reviewed data from a recent round-robin and expressed concern about the lack of direct correlation. The chairman asked for a statistical analysis of the data collected to this point. Four cooperators agreed to continue the round-robin work on D 2486 with the inclusion of Leneta calibration panels. Experimental test panels were distributed to the cooperators. Information on this phase of the round-robin will be reported at the next meeting.

D01.42.26—Burnish Resistance of Coatings—C.W. Vanderslice, Chairman, reported the formation of this new task group. A candidate test method will be forwarded to him from Rohm & Haas and others are solicited. Members with an interest in this task group are encouraged to become involved.

Sub. D01.42—An appeal at the society ballot stage against new standard D 5150, Hiding Power by Roller Application, was unsuccessful and this standard will therefore now proceed to printing and publication. Successful main committee ballot actions on revisions of existing standards were as follows: D 2354, Minimum Film Formation Temperature; D 4707, Roller Spatter Resistance; D 3129, Guide for Test Exterior Latex Paints; D 4540, Guide for Testing Interior Latex Semi-Gloss and Gloss Paints; D 4828, Practical Washability of Organic Coatings; and D 4958, Brush Drag of Latex Paints, all of which are now scheduled for society ballot. Of these, D 3129 and D 4540 are to be balloted again for small additional revisions. Unsuccessful main committee ballots occurred with D 1849, Package Stability of Paint, and a proposed new standard, Evaluation of Clear Water Repellents on Wood. These will be revised and resubmitted to concurrent ballot. On subcommittee ballot, a proposed new method, Color Development in Latex Paints, received one negative and many useful comments, based on which it will be revised for submission to concurrent ballot. Standards scheduled for review in 1991, on which no action has yet been taken are, D 3258, Porosity of Paint Films and D 4213, Wet Abrasion Resistance.

SUBCOMMITTEE D01.46 INDUSTRIAL PROTECTIVE PAINTING

K.A. Trimber, Chairman

D01.46.02—Surface Preparation—K.A. Trimber, Chairman, reported that the proposed revision of D 2200 "Standard Pictorial Surface Preparation Standards for Painting Steel Surfaces," completed a concurrent Sub. D01.46/Committee D-1 spring 1991 ballot with no negatives. It will be placed on the August 1991 society ballot. The change between the new version and the original involves the addition of the new SSPC Vis-1-89 standard, and changing the Swedish Pictorial Standards to the ISO Standards.

D 4417, "Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel," completed a concurrent Sub. D01.46/Committee D-1 spring 1991 ballot. No negatives were issued, but comments were provided from three affirmative voters. Two of the comments were editorial, with comments from H.E. Ashton found to result in technical changes to the precision and bias data. Because of the technical nature of the changes, a revised draft will be sent to a concurrent Sub. D01.46/Committee D-1 fall 1991 ballot.

D 2092, "Standard Practice for Preparation of Zinc-Coated (Galvanize) Steel Surfaces for Painting," falls under the jurisdiction of Sub. D01.46. At the January 1991 meeting, Sub. D01.46 recommended that it did not have adequate expertise to pursue revisions to this standard, and that Sub. D01.53, "Coil Coated Metal," be contacted to determine their interest in overseeing D 2092. R.J. Tucker will present his committee's decision prior to the January 1992 meeting. Preliminarily, it appears as if Sub. D01.53 may be interested in pursuing a standard that includes a few of the treatment methods, but that some of the methods are outside of the scope of their knowledge. Any subcommittees having knowledge in some, or all of the treatment methods addressed in D 2092, are asked to contact K.A. Trimber.

The task group agreed that Sub. D01.46 should pursue the development of a new standard for the preparation of galvanized surfaces for industrial painting to include abrasive blast cleaning, phosphate pretreatments, and solvent or detergent cleaning.

D01.46.03—Repainting—G.W. Gardner, Chairman, reported that Draft #3 of the proposed "Standard Test Method for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs," had been submitted to a Sub. D01.46 spring 1991 ballot. Two negatives were received (L. Smith, and H. Ashton), with comments from eight others. The negatives and comments were incorporated into the document, except for one that requested that a chart of solvents be included for use on the various coating types. This request was determined to be inappropriate as the solvent must be selected by the manufacturer of the coating or by the user depending upon the purpose for running the test. The significance and use section will be improved to better indicate that the purpose of this method is to provide a uniform means for conducting a solvent resistance test of coatings and for uniformly reporting the results of the tests, and is not intended to select the specific solvent to be used.

The task group agreed that the document should be changed from a test method to a recommended practice. A revised Draft #4 will be sent to a Sub. D01.46 fall 1991 ballot.

D 4752, "Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primer by Solvent Rub," is due for reapproval in 1991. The method will be redrafted to benefit from the procedures being developed for the newly proposed method previously mentioned and will be sent to a Sub. D01.46 fall 1991 reapproval ballot.

D01.46.04—"Pull-Off Adhesion"—M.E. McKnight, Chairman, was unable to attend, but provided a draft of a proposed revision to D 4541, "Standard Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers." The revision included a precision and bias statement for the four testers included in the method: Dyna Z5 Pull-Off Tester, Elcometer Model 106, HATE Mark VII, and Patti Pneumatic Adhesion Tester. The task group suggested minor corrections and recommended that the revised standard be submitted to a Sub. D01.46 fall 1991 ballot.

D01.46—K.A. Trimber reported that R. Martell, the Chairman of Task Group D01.46.07, inspection, passed away this year. Mr. Martell also served as the Secretary of Sub. D01.46. The entire subcommittee extends its condolences to the Martell family and wishes to acknowledge his many years of active participation and contributions to the subcommittee. The subcommittee recommended that G.W. Gardner be appointed to the position of Secretary.

SUBCOMMITTEE D01.47 MASONRY TREATMENTS

F. Gale, Chairman

D01.47.01—Water Repellency of Treated Brick—T. Sliva chaired the meeting in the absence of Chairman B. Modrak. Mr. Sliva reported on the results of screening tests conducted on the method. Two different substrates and three methods of application were used. The data showed great variability in the absorbency of substrates obtained by the cooperators. After discussion based upon these findings, it was the decision of the task group to change the title and scope of the method to "Determination of Water Repellency on Treated Masonry," and future round-robins will be run with a standardized substrate.

Discussion followed on the absorbency and specified methods of drying the test substrate. An additional limited screening test will be run. Four cooperators agreed to cooperate. V. Scarborough has agreed to chair the task group and will report on the results at the next task group meeting.

D01.47.02—Chemical Resistance of Treated Masonry—P. Thibaudeau, Chairman, distributed Draft #2 of the proposed, "Test Method for Determination of the Chemical Resistance of Concrete or Masonry Treated with Water Repellent Coatings," and reported on the results of his initial screening of the test method. The initial tests were run using penetrating type silane and siloxane type sealers only. Solutions used included nitric:sulfuric acid solutions to simulate acid rain, dilute hydrochloric acid, motor oil, brake fluid, gasoline, and salt solutions.

The group then discussed various issues not addressed in the method including the relevance of weight gain as a measure of chemical resistance, the need to include controls immersed only in water, the applicability of the method to determine the effectiveness of penetrating versus film-forming sealers, the conditioning and drying of the test units, and methods of application of the test coatings.

The chairman will organize another limited test of the method and report on its results with recommendations for revisions to the method at the January meeting.

D01.47.05—Permeability of Treated Masonry Substrates—V. Mertz, Chairman, distributed copies of the results of the limited tests run on the method. The tests were performed using a latex concrete sealer. The uncoated face of each test substrate was sealed in two manners; namely by dipping in wax and by sealing with aluminum foil and sealant.

It was agreed that a "standardized" substrate would be used in the next series of tests. The substrate will be dried using three suggested conditioning methods and the uncoated face of the test substrates would be immersed in water to a depth of ½ in. to allow the water to enter the substrate by capillary action, rather than by completely submersing the coated substrates in water. The chairman will report the results of these tests and distribute Draft #3 of the revised method at the January meeting.

D01.47.06—Freeze/Thaw Resistance of Treated Masonry—R. Woodward, Chairman, reviewed the objectives of the task group and discussed suggested revisions to the draft of the proposed "Test Method for Determination of the Freeze/Thaw Resistance of Masonry Units Treated with Masonry Water Repellent Treatments." Key issues discussed at the meeting included the drying procedure for and the moisture content of the test substrates, problems involved with continuous submersion and freeze-rate control. Three cooperators agreed to begin a screening test on the 2 in. cubes to determine the effects of different drying conditions.

The results of the screening tests and a revision of the method incorporating suggested changes from the task group members will be distributed at the January meeting.

D01.47.07—Alkali Resistance of Masonry Treatments—V. Repkin, Chairman, distributed the results of the first round-robin and the revised Draft #2 of the method. Six cooperators tested three different materials for alkali resistance. The materials were applied to five—2 in. mortar substrates for each treatment and immersed in a 0.1 N KOH solution. The percent water pick-up reduction was determined after 7, 14, and 21 days.

A discussion followed on the need to revise the calculations used in the method and include a set of control specimens immersed in water only. A discussion followed on various procedural techniques in the method including method of application, cure times for both test substrates and coated specimens, frequency of changing the alkali test solution, size of the test container, and storage of the test specimens.

It was the decision of the task group to initiate a second round-robin. The chairman will revise the method to incorporate suggested changes and report on the results of the tests at the January meeting.

D01.47.08—Rapid Chloride Ion Intrusion—C. Coletta has agreed to serve as acting Chairman of the task group as the current Chairman, T. Fernandez, has taken a leave of absence from the company. Mr. Coletta distributed Draft #2 of the proposed, "Test Method for Rapid Total Chloride Ion Penetration Resistance Determination for Masonry Coatings," and reported on the results of in-house testing performed on the method. Tests were run on 2 in. mortar cubes which had been immersed in a silane repellent. After curing, a set of coated and uncoated control substrates were soaked in a calcium chloride salt solution for 24, 48, and 72 hr, a section of each immersed specimen and an additional set of untested controls were drilled and the powder analyzed. Acid digestion was used to enable measurement of the total chlorides rather than water soluble chlorides only.

Future variables to be evaluated in this method may include additional testing for chloride ion penetration resistance following abrasion and testing after wet and dry cycling. Five cooperators have agreed to participate in a round-robin and the chairman will report on their results at the June meeting.

Sub. D01.47—Masonry Treatments—F. Gale, Chairman, reported that members of Sub. D01.47 had conducted a tour of the facilities at the National Research Council of Canada in Ottawa under the auspices of G. Litvan to evaluate experimental methods being used in evaluating masonry treatments.

A new task group, D01.47.03, Research and Liaison, to evaluate various problems in substrate conditioning, storage, preparation, and methods of application when evaluating masonry treatments was established.

T. Sliva distributed Draft #3 of the revision of D 1734, "Standard Method of Preparing Masonry Panels for Testing Paint Finishes." The method will be submitted for Sub. D01.47 balloting before the next meeting. Chairman Gale reported that the revision to D 5095 had successfully completed concurrent Sub. D01.47/Committee D-1 balloting and would be on society ballot in July.

DIVISION 50 PAINTS FOR FACTORY APPLICATION

SUBCOMMITTEE D01.52 FACTORY COATED WOOD BUILDING PRODUCTS

S.B. Schroeder, Chairman

D01.52B—Hardboard—S.B. Schroeder, Chairman. There was some discussion of the effect of excessive change of the controls in the Cobb ring water permeability method. It was decided that an additional paragraph of explanation should be included before reballot of this method.

Revision of D 2793, Standard Test Method for Block Resistance of Organic Coatings on Wood Substrates, continued, but was not completed. S. Schroeder agreed to rewrite Section 5 and T. Rieth will rewrite Section B prior to the winter meeting. The revised D 2793 method should be ready for ballot in 1992.

D01.52.13—Prefinished Hardboard—T. Rieth, Acting Chairman. Review of test panels reinforced the previous conclusions that the proposed concentrated sunlight/soak/freeze/thaw accelerated weathering method provides a good film integrity correlation for the tested prefinish coatings over hardboard. Acceleration factors range from 0 to 13 relative to 45° facing south exposure in Northeastern Pennsylvania. At the January 1992 meeting we expect to have a summary of historical results using this procedure, an initial evaluation of some primed hardboard specimens, a draft of a proposed standard practice, and comparative results of two other accelerated methods utilizing QUV and xenon arc in place of the concentrated sunlight.

D01.52.15—Film Thickness—R. Matejka, Chairman. The subcommittee ballot on withdrawal of D 2691-88 received no negatives. However, the subcommittee ballot on the new Standard Test method for Microscopical Measurement of Dry Film Thickness of Coatings on Wood Products received one negative ballot from C. Winchester. This negative was found persuasive and editorial in nature. Concurrent balloting on the new method is planned.

Round-robin tests for precision and bias determination will be conducted over the next 12 months.

D01.52—The rather poor attendance by wood product producers was discussed, and it was decided that the chairman will contact industry associations and again attempt to promote increased involvement by their members.

D 3719-87, Standard Test Method for Quantifying Dirt Collection on Coated Exterior Panels, will be balloted for reapproval.

SUBCOMMITTEE D01.55 FACTORY APPLIED COATINGS ON PREFORMED PRODUCTS

G.R. Pilcher, Chairman

D01.55.06—Coatings on Plastics—H. Haag has been appointed Chairman. Work will center on the extensive revision of D 3002, "Practice for Evaluation of Coatings for Plastics," which is out-of-date. Mr. Haag will be recruiting an appropriate task force membership prior to January.

D01.55.08—Transfer Efficiency—Laboratory Conditions—R.S. Diem, Chairman, was not able to be present, and the meeting was re-scheduled for January.

D01.55.09—Transfer Efficiency—Production Conditions—J. Komjathy, conducting the meeting in place of absent Chairman B.T. Prylon, reported that the revision of D 5066 on "Practice for the Determination of the Transfer Efficiency Under Production Conditions for Spray Application of Automotive Paints—Weight Basis," has passed the society ballot and been published. A new "Practice for Determination of the Transfer Efficiency Under Production Conditions for Spray Application of Paints," was reviewed in detail, and will be submitted for Sub. D01.55/Committee D-1 ballot.

D01.55.10—VOC of Radiation-Cured Coatings—J.J. Brezinski, Ad Hoc Chairman, reported that two test procedures were discussed—one for systems with less than 3% solvent, and one for systems with more than 3%. Arrangements will be made for a suitably publicized round-robin to take place.

D01.55—Subcommittee on Factory Applied Coatings—G.R. Pilcher, Chairman, indicated that—of the eleven methods/practices up for review in 1991—two have passed the Committee D-1 ballot, and four others have been reapproved on society ballot. Two are on hold, pending an industry survey, and the remaining three need to be reviewed by the stewards. The stewards list has been recently revised and is now current. Contact will be made with the American Furniture Manufacturers Association (AFMA) in late summer, with the intent of initiating their involvement in Sub. D01.55 activities. J. Komjathy is canvassing the automotive community for any heretofore unspoken needs which may be filled by Sub. D01.55 activity, and will report in January.

SUBCOMMITTEE D01.56 PRINTING INKS

J.M. Fetsko, Chairman

D01.56.01—Fineness of Grind—J. Cichon, Chairman, reported that test method D 1316, "Fineness of Grind of Printing Inks by the NPIRI Grindometer," is up for review in 1991. There are no suggested changes other than the addition of keywords.

D01.56.02—Lightfastness of Prints—J. Daugherty, Chairman, reported that the Committee D-1 ballot of the revised test method D 3424, "Light and Weather Fastness of Printed Matter," received three negative votes and two sets of comments. W. Ketola agreed to coordinate the necessary changes.

D01.56.09—Tinting Strength—J. Fetsko, Chairman, reported that the new test method, "Relative Tinting Strength of Printing Ink Dispersions," has been assigned the number D 2066 and will appear in Vol. 06.01 of the next *ASTM Book of Standards*.

D01.56.11—Nonvolatile Content—B. Blom, Chairman, reported that test method D 4713, "Nonvolatile Content of Printing Inks," is up for review in 1991. It was agreed that the title should include "heatset and liquid" and the sequence of paragraphs altered to conform to the proposed VOC method for non-heatset paste inks.

D01.56.12—Viscosity of Liquid Inks—J. Daughterty, new Chairman, will review existing test methods to ascertain their appropriateness for liquid inks.

D01.56.17—Guide for Printing Inks—A. Scarlatti, Chairman, reported that the new standard, "Guide for Testing Printing Inks and Related Materials," has been assigned the number D 5010 and will appear in Vol. 06.01 of the next *ASTM Book of Standards*.

D01.56.19—Printing Strength and Opacity—B. Blom, Chairman, reported that black and white coated paper strips have been obtained for printing on the IGT and Prufbau Printability Testers. Exploratory studies will be undertaken on a test method, which will involve making densitometer readings on weighed prints.

D01.56.20—Technical Coordination—B. Blom, Chairman, reported that he is following the activities of a number of other ASTM task forces concerned with VOC of radiation-cured coatings, volatile convent of microwaved packaging, Sutherland Rub Tester, recycling, and opacity.

D01.56.21—Print Abrasion—G. Bien, Chairman, reported that the proposed new test method, "Abrasion of Printed Matter by the CAT Comprehensive Abrasion Tester," passed the combined Sub. D01.56 and Committee D-1 ballot and will be submitted for society ballot.

D01.56.22—Drying of Oxidizable Inks—B. Blom, new Chairman, reported that a modified Sutherland Rub Tester has been found useful for determining drying time of oxidizable inks by squalene resistance of freshly prepared prints. Four labs have agreed to pariticpate in a round-robin.

D01.56.24—Grit Determination—M. Fuchs, Chairman, reported that the Sub. D01.56 ballot of the proposed new test method, "Coarse Particles in Printing Ink Dispersions," received one negative regarding the precision statement. J. Cichon will investigate.

D01.56.26—Chemical Resistance—J. Cichon, new Chairman, will make a survey of various test methods now in use.

D01.56.27—VOC of Non-Heatset Paste Inks—P. Ford, Chairman, reported that the Committee D-1 ballot of the proposed new test method, "VOC of Non-Heatset Paste Inks," received one negative and two sets of comments. The subcommittee ruled by a vote of 13-0 that the negative was nonpersuasive, but agreed to use the term VOC_{40} throughout in deference to the 40°C heating temperature specified in the method.

D01.56.28—Tinting Strength of Liquid Inks—D. Ness, Chairman, reported that a survey uncovered several instrumental approaches to tinting strength of liquid inks. Attendees agreed to send in methods utilizing visual approaches.

D01.56.29—Membership—J. Daugherty, new Chairman, will make a concerted effort to attract new members from the printing ink, printing, and allied industries.

SUBCOMMITTEE D01.57 ARTISTS' PAINTS AND RELATED MATERIALS

M.D. Gottsegen, Chairman

D01.57.02—Lightfastness of Pigments—T. Vonderbrink, Chairman. A negative by R. Kinmonth on the concurrent Sub. D01.57/Committee D-1 ballot D-1 (91-1), a revision of D 4303, was resolved: M. Gottsegen will contact K. Scott and J. Robbins and ask them to get together and produce a suggestion for a *caveat* responding to the negative, to be added to a revision of D 4303. They will send this suggestion to M. Gottsegen, who will forward it to H. Müller. After H. Müller's comments are received, the *caveat* will be balloted at Sub. D01.57 level as a further revision of D 4303.

T. Vonderbrink reported that as of April 25, 1991, the Atlas test of eight sample emulsion paints using the HPUV apparatus is continuing, "Test 1," in which the sample of PR 170 reached a ΔE of 4.11 has been completed, and "test II" will continue to the specified end point. One anomaly was reported: PY 3 is fading faster than in the original tests.

A discussion about adding Category IV lightfastness to D 4303 for the proposed gouache specification ensued. The reasoning is that additional categories will provide more information to artists about colorants used in paints.

A motion to add Category IV, with a ΔE range of 16-24, to D 4303 was offered and passed.

There was further inconclusive discussion regarding the ranking of ΔEs.

D01.57.04—Specification for Artists' Paints—A. Spizzo, Chairman. New and old business was brought to the subcommittee by B. Gavett, concerning the lightfastness of interference pigments, two items in D 5098, and an anomaly discussed at the January 1991 meeting.

Interference pigments may be subject to degradation linked to the photoactivity of titanium dioxide-containing pigments, the loss of pigment-binder adhesion, and/or partial delamination of the titanium and mica composing the colorant. The latter two losses are due to humidity penetrating the coating, and therefore the particular binder used may effect longevity. B. Gavett reported that he has been working with B. Putnam to measure exposed and unexposed samples of Golden acrylic emulsion paints using interference pigments on their integrating sphere spectrophotometer. Mr. Gavett further reported that he had been told about goniometers as a possible instrument for measuring interference pigments.

D5098—The primer coating specified in 7.3.2 presents a formulation problem. T. Vonderbrink agreed that the formula looks incorrect, and reported that it had been printed as written for the last 10 years. B. Gavett's attempts to make the formula have resulted in a coating that chalks. It was generally agreed that the second coating is needed for complete hiding. A. Spizzo of the Standard Steward, will try regular silica in the formula, and will otherwise work on its revision for the next meeting.

A question of anomalies in color changes in mass tones versus tints was reintroduced. B. Gavett reports this as a characteristic of Ultramarine blue and Ultramarine violet samples, but notes that the anomaly may be a trait of Golden's exposure apparatus (QUV, with UVA-351 lamps), which is not approved for the lightfastness test method, in combination with that class of colorants. M. Golden will check on automotive paint testing and talk to K. Scott regarding these anomalies.

Darkening, another effect of masstone exposures in strong light, is still of some concern. B. Gavett reports that tests of the quinacridones, naphthols, benzimadazolone naphthamide, ultramarine blue, and vat orange show darkening of masstones to varying degrees. There is a provision for indicating this anomaly in Table 1 of D 5098 (the "DL" notation), but no pigments now appear with this note. There may be a need to develop a masstone exposure test considering pigment/volume concentrations, and A. Spizzo agreed to look into it.

Another anomaly discussed in January 1991 was further reported on: lightfastness test results differing from D 5098's Table 1 categorization. Based on the Florida exposure alone, the anomalies show up in Hansa yellow medium, which had a ΔE of 5.3 but is listed as a Category I pigment, and Hansa yellow light, naphthol red light, naphthol red medium, and dioxazine purple, which all had ΔEs of less than 4 but are listed as Category II pigments. B. Gavett reported that the Florida exposure is being repeated, and that Golden is also running the xenon-arc test.

In D 5098 there is a provision for assigning lightfastness categories to mixed pigments. Due to the potential for differences between pigment manufacturers and paint manufacturers, B. Gavett and M. Golden wonder whether the Subcommittee should allow paint manufacturers to label products following similar protocol.

There was further discussion about the perceived need for a bleeding test method. Mr. Golden reports that quinacridone pigments, as a class, have a tendency to bleed. Producer members are to report their opinions on whether they are interested in incorporating or adapting D 279-87, Standard Test Method for Bleeding of Pigments, into D 4303.

D01.57.07—Physical Properties—S. Sheehan, Chairman, reported that the Ralph Mayer Learning Center at Yale consists of a room full of boxes of Ralph Mayer's archives and that the center has no funding. The center will be funded from the sales of Mayer's books following Mrs. Mayer's death. Currently, the archives are slowly being placed in display cases as time and financial constraints allow.

S. Sheehan also reported that a survey of existing paintings concerning adhesion is being conducted at the Museum of Modern Art, but he had no details about the specifics. It was suggested that he contact Hilton Brown at the Art Conservation Program of the University of Delaware for a copy of his survey on adhesion, and that he contact J.T. Luke for a copy of Henry Levinson's reports about the test methods he developed to assess adhesion.

Mr. Sheehan agreed to prepare a plan for developing at least one test method concerning the physical properties of paints for the January 1992 subcommittee meeting.

D01.57.08—Toxicity Labeling—W. Stopford, M.D., Chairman. In Dr. Stopford's absence, M. Gottsegen presided. Dr. Stopford recommended the addition of three phases to Annex A1, Chronic Hazard Statements, of D 4236-89, as follows: Possible Cancer Hazard Based on Experimental Data; Cancer Hazard Based on Experimental Data; and Cancer Hazard by Inhalation Based on Experimental Data.

A motion to accept Dr. Stopford's recommendation was seconded and passed. This addition will be forwarded for Sub. D01.57 balloting.

D01.57.09—Watercolors—T. Vonderbrink, Chairman, reported that D 5067-90 has been published in volume 06.01 of the *Annual Book of ASTM Standards*.

D01.57.10—Consumer Evaluation—J.T. Luke, Chairman. In Mrs. Luke's absence, M. Gottsegen presided. M. Gottsegen reported that Draft #12 of the proposed, "Standard Practice for the Visual Determination by Art Technologists of the Relative Lightfastness of Art Materials," and Draft #13 of the proposed, "Standard Practice for the Visual Determination by Artists of the Relative Lightfastness of Art Materials," have been forwarded to him by J.T. Luke. They will be forwarded for Sub. D01.57 balloting as recommended at the January 1991 meeting.

M. Gottsegen described a study to be conducted at the meeting of the two alternative Hale Masks proposed for the lightfastness practice. He distributed the description of the study and the instructions and set up a portable light booth with D65 lamps. Seventeen members of the subcommittee participated in the study. Approximately 15 other subjects in North Carolina and Boston have participated in the study.

The data collected from this study will be sent to J.T. Luke, who will report to the subcommittee on the results.

D01.57.11—Gouache Paints—T. Takigawa, Chairman, presented for discussion a report on the chalking of mixing whites to be used in the proposed gouache standard. He has concluded, and the Task Group agreed based on the data supplied in his report, that TiPure R960 made by Du Pont, in a gum Arabic vehicle without ZnO or $BaSO_4$, produced the best results.

T. Takigawa also presented a report and led discussion about determining the borderline between Categories IV and V in the proposed gouache standard. The task group agreed, based on the data supplied in this report, that a ΔE of 24 seems to be a reasonable borderline value between Categories IV and V.

D01.57.12—Determination of Toxicity—W. Stopford, Chairman, reported that this group is considering adopting EN71(3), the European standard on heavy metals in consumer products in place of the method they have developed for the proposed "Standard Practice for Extracting Art Materials for Metal Analyses." A 50-page validation of the EN71(3) test method is being sent to Dr. Stopford and he will draft a procedure for review by the subcommittee after studying the validation.

In reference to the proposed, "Standard Practice for Extracting Art Materials for Nitroaromatic Amine Analyses," Dr. Stopford also reported that when he has received the DCMA's interlaboratory validation of a test for bioavailability test using synthetic intestinal juice he will draft a procedure for consideration by the subcommittee.

M. Gottsegen reported on an exchange of letters between D. Van Kampen and L. Robinson, in which D. Van Kampen requests the assistance of the DCMA in managing an interlaboratory study of the "Analytical Method for Extraction and Determination of Aromatic Nitroamines in Organic Pigments Using Simulated Intestinal Juice." Mr. Robinson replied that the association has reviewed the request and asked that D. Van Kampen expand on what would be involved in "managing" the study, clarify what laboratories would be used, and describe the funding for the study. M. Gottsegen wrote to Dr. Stopford and asked him to contact the DCMA to answer L. Robinson's questions. D. Van Kampen has agreed to coordinate activities between Sub. D01.57 and the DCMA.

D01.57—M. Gottsegen, Chairman, reported that the DCMA has requested that, "Analytical Method for Extraction and Determination of Aromatic Nitroamines in Organic Pigments Using Simulated Intestinal Juice," *not* be referred to as "the DCMA method," and that the subcommittee will comply with this request.

M. Gottsegen reported on the results received from C. Sathre regarding the "Cleanability Standard Survey." Eight responses were sent to C. Sathre: six felt that Sub. D01.57 is the proper place to develop a washability standard, one didn't, one said maybe, and five are willing to help in various capacities. C. Sathre has agreed to ask those that responded, and any others that are interested, to submit ideas to him. He will report a summary of the ideas at the next meeting of the subcommittee.

M. Gottsegen recommended subcommittee member M. Rossol's new book *The Artist's Complete Health and Safety Guide* (Allworth Press, NY, 1990) to the subcommittee.

M. Gottsegen reported on the ACMI meeting in Durham, NC, on April 8, 1991, and on an Ad Hoc meeting with J.T. Luke, A. Haney, and J. Sedeski. The subject of this meeting was how the reorganized and strengthened American Craft Council can help provide much needed publicity and information to artists regarding the subcommittee's health and quality standards.

R. Jaeger, Environmental Medicine, Inc., was introduced and spoke about his company's toxicological certification program, and about his ideas concerning the evaluation of chronic health hazards.

DIVISION 60
PAINT APPLICATION

SUBCOMMITTEE D01.61 PAINT APPLICATION TOOLS

F.B. Burns, Chairman

JANUARY 1991, REPORT

D01.61.01—Paint Brushes—T. Sliva, Chairman, distributed copies of D 5068, "Standard Practice for Preparation of Paint Brushes for Evaluation," which has recently completed society ballot. The need to add an addendum to include a temperature/humidity caveat was discussed.

The chairman also distributed copies of, "Proposed Test Method for Leveling Efficiency of Paint Brushes," and asked for cooperators to begin a round-robin on the method before the June meeting. J. Price has agreed to submit three 2 in. and 4 in. brushes with varying finishes. The chairman will supply the 9 in. interior flat and semigloss test coatings and the "Levelness Standards" for evaluation of the paintouts. It is planned that the results of the round-robin will be reported at the next meeting.

At the June 1990 meeting, the chairman passed out a copy of, "Proposed Practice for the Physical Characterization of Paint Brushes." Extensive comments were received from B. Bond and J. Price. These comments were discussed and suggested changes will be incorporated into the method. Time will be set aside at the June meeting to discuss these revisions to this proposed standard.

D01.61.02—Paint Rollers—J.F. Price, Chairman, reported that the task group met in two sessions; the first on January 20, 1991 and the second on January 21, 1991.

The first session was a working session in which three cooperators actually performed the tests and observations were made to determine difficulties in the tests and what improvements could be made.

The second session started with a discussion of the work done in the first session. The two areas of difficulty encountered were the roller break-in procedure and the weighing of the loaded paint roller. The first difficulty was essentially solved by observations and an understanding as to what constituted a fully broken-in roller cover. As for the weighing procedure, two cooperators will be working on two variants of the procedure to be reported on at the next meeting, at which time Round-Robin #3 will be initiated.

Prior to the next meeting, environmental conditions will be added to D 5069-90. This additional reference to D 3924 will be proposed for balloting simultaneously in Sub. D01.61/Committee D-1.

Finally, the chairman will put the panel preparation method, D01.61.02.03B, in final form for discussion at the next meeting and then it will be submitted to ballot.

D01.61.04—Nomenclature and Definitions—E.C. Harsch, Chairman. The latest revisions of the (16) definitions have been approved by Committee D-1 and will be included in the next printing of the *Listing of Definitions*. F. Burns reported that all the negative voters had withdrawn their negative votes. The definition for a Foam Paint Roller Cover was considered by the group and a tentative definition was suggested as follows, "a cover in which the paint applicating material is manmade flexible cellular material.' No other items for "Definition" were proposed for consideration.

D01.61.05—Bulk Density of Filaments and Bristle—F.B. Burns substituted for the Chairman, T. O'Brien. It was announced that T.S. Simms Company was in the process of shipping the special test units to five cooperators. Another cooperator (Du Pont) already had a unit. The most recent draft for a test method (Draft #2—December 4, 1989) was read to the group and it was agreed to use it for a familiarization round-robin prior to the next meeting. J. Moriarty volunteered to send two to four filament bundles cut from the same production lot to each cooperator. These would include .010 hollow and solid filaments, 3 in. long in 2-in. diameter bundles. It was the consensus that the cooperators would measure each bundle a minimum of three times or until the reading was stabilized. An updated drawing of the test unit was presented by F. Burns, which should be suitable for attachment to the test method.

D01.61.06—Buckling Resistance of Filaments—W.B. Bond, Chairman, reported that two test devices were compared on seven hollow filaments—some tapered, some level—of three polymers; nylon, polyester, and polyolefin. There was more difference between filaments of the same type than between testing devices. The task group agreed the next test should be with a different type tester to be provided by Ketema (T. O'Brien), not at this meeting. Mr. Bond will contact T. O'Brien to find out the status of the drawing of this tester. The proposed advantages of this device are that it tests a group of filaments rather than a single filament and that it takes less time. Buckling force is applied to tightening a loop of filaments held at each end in the Ketema device. The force is applied by axial compression in the Du Pont device.

D01.61—F. Burns, Chairman, led a discussion on the title of D01, and the logo drawing used to identify work of the committee. It was the consensus of the group to recommend expanding/changing the title of D01 to include the word "tools." It was noted that this inclusion is already in the D01 scope. It was also suggested that revised logo art be proposed that would replace the present printing style roller with a conventional paint roller to better identify D01 with paints and painting. The chairman agreed to have replacement art developed and to contact the executive committee with these proposals. This subcommittee also discussed plans to submit revisions to standards D 5068-90 and D 5069-90 to include reference to D 3924 to cover temperature—humidity conditions. Based on prior discussion with the D01 chairman, these will be submitted to simultaneous subcommittee and committee ballots.

JUNE 1991, REPORT

D01.61.01—Paint Applicators—T. Sliva, Chairman, proposed and it was the decision of the task group by a vote of 8-0-0 to submit a revision to D 5068, "Standard Practice for Preparation of Paint Brushes for Evaluation," to include a new Section 2. "Referenced Documents" to specify the use of D 3924, "Standard Environment for Conditioning and Testing," into the practice.

The chairman discussed work conducted on the proposed test method for leveling efficiency of paint brushes. Resulting paintouts were distributed and compared with Leneta brushout standards. After review, it was decided that the Leneta brushout standards, as now produced, are not applicable to the scope of the method under study. Three manufacturers will submit brushes to produce differences in leveling. The chairman will initiate a round-robin using a control latex flat paint and also a separate standardized paint brush. Six cooperators have agreed to prepare paintouts and bring them to the January meeting. A decision will be made at that time to pursue making "levelness standards" or rate leveling using a subjective scale.

The chairman distributed copies of Draft #3, "Proposed Practice for Physical Characterization of Paint Brushes." The revised draft was reviewed in part by the group. The members were asked to submit other suggestions to the chairman by mail. The chairman will incorporate changes suggested and Draft #4 will be distributed before the next meeting.

D01.61.02—Paint Rollers—J.F. Price, Chairman, proposed that the first item of business was to insert the environmental conditions section (D 3924) into the Standard Practice for Preparation of Paint Roller Covers for Evaluation, D 5069-90. It was agreed to insert it as Section 2, and move all subsequent sections up one number. This proposal will be submitted to simultaneous subcommittee and main committee ballot as a revision to the practice.

The minutes of the last meeting were read. Based on plans in these minutes, G. Harsch submitted excellent test data which will be analyzed by the task group chairman and reported upon. The task group chairman will also test an alternate weighing method and report thereon. An effort will also be made to find more cooperators. After conferring with each cooperator, the chairman will initiate a new round-robin.

D01.61.04—Nomenclature and Definitions—E.C. Harsch, Chairman. The definition for a Foam Paint Roller Cover: "a cover in which the paint applicating material is manmade, flexible, cellular material" was approved by the group. This definition will be sent to D1.16 for balloting. No new definitions were proposed by the task group. It was the consensus that there will not be need for a formal meeting of the task group in January 1992.

D01.61.05—Bulk Density of Filaments and Bristle—T. O'Brien was unable to attend and submitted his resignation as Chairman but indicated willingness to continue as a cooperator. W.B. Bond agreed to take over as Chairman. Four cooperators reported bulk density measurements on level hollow and solid polyester filament supplied by Polymers (J. Moriarty) using the device manufactured by T.S. Simms (W. McLaggan). Agreement between various cooperators was good. There was discussion concerning the proper pressure to be used. Revisions to the method were suggested, and the chairman agreed to issue a new draft. A second round-robin will be completed by January based on new samples of level filament (J. Moriarty) using the new draft at pressures of 25 and 50 psig.

D01.61.06—Buckling Resistance of Filaments—W.B. Bond, Chairman, distributed drawings of the Ketema device proposed by T. O'Brien for determination of fracturing tendency of filaments. W. McLaggan agreed to estimate the cost and timing of making the device. Several members plan to equip themselves to carry out the test. By the January 1992 meeting, we should be able to test filaments with a tester brought to Fort Lauderdale. The chairman agreed to draft a test method in ASTM format based on the Ketema procedure which will be used for the January testing.

D01.61—F. Burns, Chairman, reported that this subcommittee's recommendations for an expansion in title of D-1 and a change in the D-1 logo to recognize application tools were presented to Sub. D01.91 on By-Laws. After consideration, that subcommittee proposed adding the word "Applications" to the title to recognize tools and other applications related activities. The logo was accepted as presented showing a paint roller and an angular sash brush. Both of these proposals were then unanimously accepted by the executive committee. The title change will require a Committee D-1 ballot. This subcommittee also agreed to submit revisions to Standards D 5068-90 and D 5069-90 to include reference to D 3924 to cover temperature—humidity conditions. Based on prior discussion with the Committee D-1 chairman, these will be submitted to simultaneous subcommittee and committee ballots.

June 1991 Subcommittee Reports of ASTM Committee G-3

The June meeting of G-3 on Durability of Nonmetallic Materials was held on June 18 and 19, 1991 at the Chateau Laurier, Ottawa, Ont., Canada. In the two days of meetings a total of 20 members and guests attended. The present membership of Committee G-3 is 83.

Highlights

Joint sponsorship of the symposium planned for the January 1993 meeting was approved by both Committees D-1 and G-3, W.D. Ketola will chair, assisted by D.M. Grossman. It will present the results of a number of recent research programs dealing with durability testing devices, techniques, and results.

A new subcommittee was authorized to deal with liaison between Committee G-3 and other ASTM committees as well as standards-creating groups outside of ASTM who may be referencing G-3 standards or developing standards in areas paralleling G-3 activities. The goal is to assure that references to G-3 standards are correct and that new standards proposed in other bodies are compatible with G-3 standards. The interim chair is R. Kinmonth. Committee title and a draft scope will be developed at the January 1992 meeting.

Future Meetings

January 21-22, 1992—Fort Lauderdale, FL.
June 30-July 1, 1992—Minneapolis, MN.
January 20-21, 1993—Fort Lauderdale, FL.

Standards Action

Committee G-3 Standards approved or reapproved by the ASTM Committee on standards since the June 1990 meetings of D-1:

G 8-90, "Test Methods for Cathodic Disbonding of Pipeline Coatings."

G 23-90, "Practice for Operating Light-Exposure Apparatus (Carbon-arc Type) with and without Water for Exposure of Nonmetallic Materials."

G 26-90, "Practice for Operating Light-Exposure Apparatus (Xenon-arc Type) with and without Water for Exposure of Nonmetallic Materials."

G 42-90, "Methods for Cathodic Disbonding of Pipeline Coatings Subjected to Elevated Temperatures."

SUBCOMMITTEE G03.02 NATURAL ENVIRONMENTAL TESTING

J.S. Robbins, III, Chairman

A negative vote on a concurrent Sub. G03.02/Committee G-3 ballot was discussed, which concerned a proposed revision to G 90, "Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight." The negative vote was withdrawn and the proposed revision will proceed to society ballot. Also, a more complete revision to G 90 will be submitted for subcommittee ballot. A round-robin between two different laboratories was started on May 1, 1991 to test the interlab variability of G 90.

A new standard on the transfer of calibrations from reference to field radiometers will be submitted for Sub. G03.02 ballot. Because of data presented by W.D. Ketola, a revised paragraph of G 24, "Conducting Exposures to Daylight Filtered Through Glass," will be submitted to Sub. G03.02 ballot which will require the transmittance measurement of the glass used to perform this practice. In January 1993, two year exposure data will be available on black panels being exposed in Arizona and Florida.

SUBCOMMITTEE G03.03 SIMULATED AND CONTROLLED ENVIRONMENTAL TESTING

R.M. Fischer, Chairman

The results of concurrent letter ballot 91-1, revision of G 53-88 "Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Non-Metallic Materials," were discussed. Sixty-three percent of the main commitee members responded with 31 affirmative, 0 negative, and 21 abstaining. Editorial comments by Shigeo and Shigeru Suga will be added before passing this revision on to society ballot. Comments by D. Grossman will be added to the "Lamp Application Index" revision that will be upcoming for G 53.

The subcommittee ballot (issue date—May 14, 1991, Item 1) of the new "Standard Practice for Conducting Cyclic Immersion/Atmospheric Exposure Tests for Non-Metallic Materials" returned with 13 affirmative, 3 negative, and 18 abstaining. The negative of D. Grossman was found persuasive. The proposed standard was withdrawn and will be redrafted by W. Ketola and R. Fischer. This redraft will be balloted at the subcommittee level this fall. Negatives and comments by other ballot respondents will be considered in the redraft.

D. Grossman presented a revised "Lamp Application Index" for Standard Practice G 53. This revision to G 53 will be submitted for subcommittee ballot.

R. Fischer presented data on water quality effects on sample spotting during accelerated exposure tests. Many ASTM standards require that water quality for exposure testing have a maximum of 20 ppm total dissolved solids (TDS). Reflective sheeting samples were exposed to water spray quality levels of <1, 5, 10, 20, 30, and 50 ppm TDS. After eight spray applications (each followed by room temperature drying) only the <1 ppm TDS sample exhibited no water spotting. The 20 ppm sample had highly visible water spots. W. Ketola presented a proposed revision for G 26 and G 23 recommending water quality levels of 1 ppm TDS or less. After incorporating suggested changes from the meeting attendees, this revision will be submitted for subcommittee ballot.

Time will be reserved at the January 1992 Committee G-3 meeting in Fort Lauderdale for a seminar concerning E 632, "Standard Practice for Developing Accelerated Tests to Aid Prediction of the Service Life of Building Components and Materials." L. Masters will coordinate the presentations.

The draft, "Guide for Device Inclusion in G03.03 Standards," will be balloted as an annex to the Committee G-3 By-Laws. In addition, a "Guide for Deciding Whether to Create a New Standard," submitted by D. Grossman will be rewritten based on input from meeting attendees and will also be balloted as an annex to Commitee G-3 By-Laws.

G03.03.01—Round-Robin Studies—R. Fischer, Chairman, presented an update on the round-robin for G 26, "Standard Practice for Operating Light-Exposure Apparatus (Xenon-arc Type) With and Without Water for Exposure of Non-Metallic Materials." Three laboratories have now completed the round-robin protocol. Variability between labs is quite high while replicate samples within labs gave generally similar results. Water quality may have played an important role in contributing to the variability between labs.

G03.03.03—Education—The draft, "Guide for Weathering and Related Durability Testing," originally prepared by R. Fischer is currently being updated by W. Ketola. This draft will be reviewed at the January 1992, Sub. G03.03 meeting.

SUBCOMMITTEE G03.05 REFERENCE MATERIALS FOR EXPOSURE TESTS

W.D. Ketola, Chairman

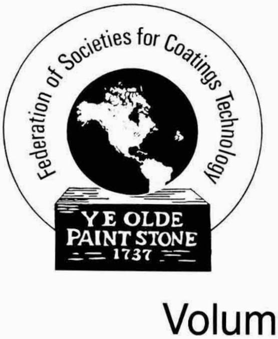
R. Fischer presented his results from evaluations of polystyrene, polysulfone, polyethylene, and a vinyl film exposed in a water cooled xenon arc device using the SAE J1960 exposure cycle. Results for the polystyrene chip showed that installation of a new xenon burner can cause a significant change in the rate of yellowing. The difference is large enough so that a simple change of lamps could cause a water cooled xenon arc device to fall outside the acceptable yellowness index tolerances provided by the polystyrene chip manufacturer. Therefore, it is important that age of the xenon arc light source be taken into consideration in the analysis of the results from the round-robin. Polysulfone showed a short period of very rapid change in 330 nm absorbance followed by a slower, linear rate of 330 nm absorbance increase. This is the same type of result reported at the January 1991 meeting for exposures to a UVA-340 fluorescent lamp. It appears that the polysulfone film could be used for exposures of between 20 and 100 KJ/m^2 at 340 nm. This may prove to be an attractive alternative or complement to the blue wools now being used. Exposure of the Union Carbide polyethylene film being considered for the round-robin in the SAE J1960 xenon arc cycle produced results similar to those reported by W. Ketola at the January meeting. There is a period of very slow change in the 1715/2030 cm^{-1} absorbance ratio followed by a more rapid linear change until film breakage produced by specimen spray. Exposure of a blue vinyl film (replicates #1 and #11 from the G03.03 round-robin) produced a linear loss of gloss through the entire exposure period.

W. Ketola presented a summary of results from filtered open flame carbon arc exposure of the Union Carbide polyethylene being considered for the round-robin. The change in 1715/2030 cm^{-1} absorbance ratio showed a period of very slow change followed by much more rapid increase. The carbon arc exposures appeared to produce a slower development of the 1715 cm^{-1} carbonyl absorption than the xenon arc exposures reported at the January meeting. This may have been caused by differences in specimen mounting procedures used in two exposures.

Based on the results from preliminary material evaluations presented at this and previous meetings and the responses from the subcommittee's questionnaire, the following were agreed on as material/test cycle combinations for the round-robin: (1) Fluorescent UV/condensation exposures will use polysulfone films provided by A. Davis of the U.K. Absorbance at 330 nm will be the property monitored. (2) Filtered open flame carbon arc exposures will use Union Carbide DFDA 1137NT polyethylene film. The ratio of absorbances at 1715 and 2030 cm^{-1} from transmission IR will be the property monitored. (3) Water-cooled xenon arc exposures will use polystyrene chips and a blue vinyl film. The SAE J1960 exposure cycle will be used. Yellowness changes will be used for the polystyrene and gloss will be determined on the vinyl film.

jct JOURNAL OF COATINGS TECHNOLOGY

Annual Index



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Prepared by Technical Information
Systems Committee

Alphabetical Listing of Papers

Open Forum

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Constituent Society Papers

MONTREAL SOCIETY—Use of an Image Analysis Technique to Quantify Pigment Dispersion, Oct., p. 111.
CLEVELAND SOCIETY—Changes in Hiding During Latex Film Formation: Part II. Particle Size and Pigment Packing Effects, Nov., p. 35.

Society Meetings

BALTIMORE .... SEPT.

"Crystalline Silica"

Educational Committee Chairman Albert Holder, of David Taylor Research Center, announced that the Society-sponsored coatings course would be held in the spring.

Technical Committee Chairman Mary Somerville, of Bruning Paint Company, has samples of paint for user evaluation of low-VOC paint versus non-VOC regulated paint. Anyone interested in obtaining information should contact Ms. Somerville.

The meeting's speaker was Joe Scarries, of U.S.Silica Company. Mr. Scarries' topic was "CRYSTALLINE SILICA—ADVANTAGES IN COATINGS AND POTENTIAL HEALTH RISKS."

The speaker discussed the properties of crystalline silica. He said it is used as a functional extender in coatings. The advantages of crystalline silica are high hardness, low reactivity, and low oil absorption. The disadvantages include causing silicosis and the possibility of being a carcinogen.

According to Mr. Scarries, current regulations for crystalline silica are 0.1 mg/m^3 of 10 micron or smaller dust. It has a status of a Group 2A carcinogen. The speaker stated that if a product contains over 0.1% crystalline silica, then labeling indicating the presence of silica is required.

Mr. Scarries said that detecting silica at levels less than 1% is very difficult. This is because 75% of the earth's crust is silica, making silica ubiquitous in minerals.

In conclusion, Mr. Scarries stated that regulations of silica are necessary for a healthy work environment. However, he pointed out that the regulations should not ruin the industry.

JOHN KURNAS, *Secretary*

CHICAGO .... SEPT.

"Kaolin"

The evening's technical speaker was Ashok Khokhani, of Engelhard Corporation. Mr. Khokhani discussed "KAOLIN: PROPERTIES AND APPLICATIONS."

The speaker described the types of kaolin available and what benefits each type give to various trade paint and industrial applications. The use of kaolin to extend TiO_2 was illustrated.

CLIFFORD O. SCHWAHN, *Publicity*

CHICAGO .... OCT.

"Modernizing Pigment Preparation"

The meeting's technical presentation, "MODERNIZING PIGMENT PREPARATION AND DISPERSION," was delivered by Mike Kenes, of M.P. Kenes, Inc.

The speaker explained that computers, materials handling technology, and various products are now available to improve the accuracy and efficiency of preparation and addition of raw materials into dispersers. Mr. Kenes described the benefits of using specific products to enable small to medium sized factories to produce their own pigment slurries.

CLIFFORD O. SCHWAHN, *Publicity*

KANSAS CITY .... SEPT.

"Peroxide Curable Coatings"

The newly elected Society Officers for the 1991-92 year are as follows: President—Craig Hughes, of Hallmark Cards; Vice President—Jeff Laurent, of F.R. Hall, Inc.; Secretary—Yvonne D'Arcy, of Cook Paint & Varnish Company; and Treasurer—Lawrence J. Murphy, of Tnemec Company, Inc.

Norman Hon, of Cook Paint & Varnish Company, will continue to serve as the Society Representative to the Federation's Board of Directors.

The Hüls Gavel was presented to Mr. Hughes by Bruce Holly, of Hüls America, Inc.

A Past-President's Pin was presented to Mr. Laurent by Mr. Hughes.

Dell Eslinger, of Freeman Polymers, Division of Cook Composites and Polymers, gave a talk on "PEROXIDE CURABLE COATINGS."

YVONNE D'ARCY, *Secretary*

KANSAS CITY .... OCT.

"Acrylic Resins"

A moment of silence was observed in memory of Meryl Bertrand, of Pratt and Lambert, Inc., who died recently.

"ALKALI SOLUBLE ACRYLIC RESINS" was the topic of a presentation given by Gary Wulf, of S.C. Johnson.

Mr. Wulf discussed the proper selection and optimal utilization of alkali soluble acrylic resins.

YVONNE D'ARCY, *Secretary*

LOS ANGELES .... OCT.

"Defoaming"

Environmental Affairs Committee Chairman Dave Muggee, of E.T. Horn Company, stated that the EPA is proposing new requirements for reporting toxic materials' inventory.

Also, he announced that the SCAQMD will no longer charge for samples taken into their laboratories for evaluation.

Joel Schwartz, of Air Products and Chemicals, presented a talk on "SURFACE WETTING AND DEFOAMING."

The speaker discussed equilibrium and dynamic surface tensions (E&DST), and the influence of these properties on the elimination of surface defects in application of liquid coatings.

Mr. Schwartz also described a technique for determining EST and DST indirectly by means of measurement of the minimum pressures of a gas necessary to produce bubbles in a liquid at specific rates.

The speaker's evaluations included four classes of surfactants: ethoxylated octylphenols (EOP), acetylenic diols (AD), ethoxylated alcohols (EOH), and sodium dioctylsulfosuccinates (SDSS). Anionics were not heavily studied because of their high foaming tendencies.

In conclusion, Mr. Schwartz said the surfactants which produce low DST and EST, such as AD and SDSS, will reduce coating defects caused by poor surface wetting such as craters, poor leveling, and poor adhesion. Also, they can reduce microfoam in coatings applied to bare wood.

KAOLIN: PROPERTIES AND APPLICATIONS—The Chicago Society's September meeting featured guest speaker Ashok Khokhani

Constituent Society Meetings and Secretaries

BALTIMORE (Third Thursday—Willow Grove Restaurant, Linthicum, MD). John Kurnas, Mineral Pigments Corp., 12116 Conway Rd., Beltsville, MD 20705.

BIRMINGHAM (First Thursday—Strathallan Hotel, Birmingham, England). D.C. Morris, PPG Industries (UK) Ltd., P.O. Box 359, Birmingham, B16 0AD, England.

CDIC (Second Monday—Location alternates between Columbus, Cincinnati, Dayton, and Indianapolis). Paul R. Guevin, Jr., P.R. Guevin Associates, P.O. Box 811, Westerville, OH 43081-0811.

CHICAGO (First Monday—Sharko's Restaurant, Villa Park, IL). Gregory E. McWright, ANGUS Chemical Co., 2911 Sanders., Northbrook, IL 60062.

CLEVELAND (Third Tuesday—Brown Derby, Independence, OH in Sept., Oct., Nov., Dec., Feb., March; Jan. and Apr. meetings, Landerhaven, Mayfield Heights, OH). Freidun Anwari, Coatings Research Group, Inc., 2340 Hamilton Ave., Cleveland, OH 44114.

DALLAS (Thursday following second Wednesday—The Harvey Hotel, Dallas, TX). Mike Evans, J.M. Huber Corp., 803 Pleasant Valley, Richardson, TX 75080.

DETROIT (Second Tuesday—meeting sites vary). Ron Andrus, BASF Corp., 5935 Milford Ave., Detroit, MI 48210.

GOLDEN GATE (Monday before third Wednesday—alternates between Francesco's in Oakland, CA, and Holiday Inn in S. San Franscisco). Donald Nolte, John K. Bice Co., 280 Missouri St., San Francisco, CA 94107.

HOUSTON (Second Wednesday—Sonny Look's Sirlion Inn, Houston, TX). Richard W. Ryan, Exxon Chemical Co., P.O. Box 5200, Baytown, TX 77520.

KANSAS CITY (Second Thursday—Cascone's Restaurant, Kansas City, MO). Yvonne D'Arcy, Cook Paint & Varnish Co., P.O. Box 419389, Kansas City, MO 64141.

LOS ANGELES (Second Wednesday—Steven's Steakhouse, Commerce, CA). V.C. Bud Jenkins, Consultant, 3366 Somis Dr., Riverside, CA 92507.

LOUISVILLE (Third Wednesday—Executive West Motor Hotel, Louisville, KY). Mike R. Moilanen, United Catalysts, Inc., P.O. Box 32370, Louisville, KY 40232.

MEXICO (Every fifteen days—Gabriel Mancera, Mexico City, Mexico). Sergio Rojas, Pinturas International, S.A. De C.V., Ganaderos 234, Col. Granjas Esmeralda, 09810 Mexico, D.F., Mexico.

MONTREAL (First Wednesday—Le Biftheque, Ville St. Laurent, Quebec). Jacques Brouillette, BAPCO, 1470 Nobel St., Boucherville, Que., J4B 5H3, Canada.

NEW ENGLAND (Third Thursday—Sheraton Lexington Hotel, Lexington, MA, alternate meetings twice a year in Sturbridge, MA and Providence, RI). Joanne E. Monique, Ashland Chemical Inc., 400 Main St., Tewksbury, MA 01876.

NEW YORK (Second Tuesday—Landmark II, East Rutherford, NJ). Armand J. Stolte, RHEOX Inc., P.O. Box 70, Hightstown, NJ 08520.

NORTHWESTERN (First Tuesday after first Monday—Jax Cafe, Minneapolis, MN). Sarah Oebser, H.B. Fuller Co., 3530 Lexington Ave., N., St. Paul, MN 55126.

PACIFIC NORTHWEST (Portland Section—Third Tuesday; Puget Sound Section—Third Wednesday; Vancouver Section— Third Thursday). Flora Wong, Saguaro Ltd., 106-150 E. Fifth St., N. Vancouver, B.C., V7N 1L5, Canada.

PHILADELPHIA (Second Thursday—Williamson's Restaurant, GSB Bldg., Bala Cynwyd, PA). Brian O'Connor, McWhorter Resins, Inc., 7600 State Rd., Philadelphia, PA 19136.

PIEDMONT (Third Wednesday—Ramada Inn Airport, Greensboro, NC). Dennis Gillespie, Lomas Minerals and Chemicals, P.O. Box 605, Indian Trails, NC 28079.

PITTSBURGH (Second Monday—Montemurro's Restaurant, Sharpsburg, PA). Timothy Zeffiro, J.M. Gillen Co., P.O. Box 588, Bridgeville, PA 15017.

ROCKY MOUNTAIN (Monday following first Wednesday—Zangs Brewery, Denver, CO). Louis Hartnell, Herr & Hartnell Co., 791 Chambers Rd., #555, Aurora, CO 80041.

ST. LOUIS (Third Tuesday—Salad Bowl Restaurant, St. Louis, MO). Michael Schnurman, Kop-Coat, Inc., 328 Henley Ind. Ct., St. Louis, MO 63144-1599.

SOUTHERN (Gulf Coast Section—third Thursday; Central Florida Section—third Thursday after first Monday; Atlanta Section—third Thursday; Memphis Section—bi-monthly on second Tuesday; and Miami Section—Tuesday prior to Central Florida Section). Mary G. Finnigan, Unocal Chemicals Div., 8901 Research Dr., Charlotte, NC 26845.

TORONTO (Second Monday—Cambridge Motor Hotel, Toronto). David Jack, Technical Coatings Co Ltd., 1164 Walkers Ln., Burlington, Ont., L7M 1V2, Canada.

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

Q. What is the minimum surface tension required to wet a typical substrate?

A. Surface tension of most substrates is in the 30-40 dynes/cm range. You can increase the viscosity of your coating to reduce retraction tendencies when you cannot lower surface tension of the coating below that of the substrate.

Q. If you vary the diameter of the bubble tube, does the relationship of 1 to 6 BPS rate change?

A. Yes, there is a slight change. However, there will always be an increase in the bubble size as the bubble rate increases from 1 BPS to 6 BPS, and the relative DST measurements will remain constant.

Philip C. Bremenstuhl, *Secretary*

LOUISVILLE .... SEPT.

"Color Is Money"

Past-President Ray Mudd, of Porter International, presented the President's Gavel to Kris Grauer, of Ashland Chemical Company.

Environmental Affairs Committee Chairman Joyce St. Clair, of Kentucky Partners, gave a brief presentation on the state of the environment. She discussed the following topics: hazardous waste minimization and household hazardous waste collection.

Gregory Schrider, of X-Rite Incorporated, gave a presentation entitled "Color Is Money."

The talk dealt with image, quality, recognition, customer sales, and the public. Topics addressed during the talk included the Additive Color Theory and the Subtractive Color Theory. Advantages achieved with various instruments and color processing equipment over human and color space recognition were explained.

Mike Moilanen, *Secretary*

TECHNICAL SPEAKER—Mike Kenes addresses the October meeting of the Chicago Society on "Modernizing Pigment Preparation and Dispersion"

PHILADELPHIA SOCIETY OFFICERS—Elected to serve in office for 1991-92 are, standing (l-r): Membership Committee Chairman—A. Marshall Jones; Honorary Board Member—Richard Kiefer; Society Representative—Wayne Kraus; Treasurer—Barrett C. Fisher III; Technical Committee Chairman—Julio J. Aviles; and Members-at-Large—Thomas G. Brown and Howard J. Salmon. Sitting: Past-President—Christopher H. Huhn; Secretary—Brian O'Conner; President—Peter C. Kuzma; and Vice President—William J. Fabiny

NORTHWESTERN ....OCT.

"Packaging Standards"

The first speaker was Paul Rankin, of NABADA, the association for the container reconditioning industry. The title of Mr. Rankin's presentation was "PERFORMANCE-ORIENTED PACKAGING STANDARDS."

The speaker said the new Performance-Oriented Packaging Standards (POP) for the transportation of hazardous materials went into effect on October 1. The new rule will be phased in over a five-year period. However, international shipments will be affected immediately because materials with a flash point of 100-140°F are considered flammable by international standards.

According to Mr. Rankin, under the five-year implementation, the drums being used currently will gradually disappear. Similar packaging with POP markings will replace the old drums. The old containers can be produced until October 1, 1994, with U.S. companies permitted to use these old containers until October 1, 1996.

The speaker explained that manufacturers are using dual markings on drums, listing both current specification and POP markings. He said that using both markings provides the maximum possible opportunity to use the drum.

Mr. Rankin said that California has introduced a bill which requires suppliers to accept empty containers, or to designate a third party to take the empty containers. He stated that the Chemical Manufacturers Association is developing a program as part of their Responsible Care agreement which requires participants to follow a container to its final disposition.

In conclusion, the speaker said environmental regulations are a major concern for drum reconditioners. Furthermore, he explained that it is important for drum users to become educated about the environmental impact of improper disposal. NABADA has developed standards and procedures which are enforced. As part of the program, member companies are audited to ensure compliance.

The video, "Good Tests, Bad Testing," was shown to the membership. The video, sponsored by the Federation's Professional Development Committee, is based on the 1990 Annual Meeting presentation, "Results of Good and Bad Testing," by Saul Spindel, of D/L Laboratories.

In the video, Mr. Spindel discusses the results of selected tests by several laboratories and the wide disparity among the results. Several laboratories, which followed the same test procedures on identical samples, produced varied results. The results often did not meet the specifications for which the samples were intended.

SARAH E. OEBSER, *Secretary*

Future Society Meetings

Baltimore

(Jan. 16)—"Precipitated Calcium Carbonates for Use in Coatings"—George Greene, Pfizer, Inc.

Birmingham

(Jan. 9)—"Non-Automotive Applications of Electropaint Technology"—Peter Hope, L.V.H. Coatings Limited.

(Feb. 6)—"The Impact of Environmental Legislation on the Coatings Industry"—Mini-Symposium. Various speakers.

CDIC

(Jan. 13)—"Drier Recommendations for High Solids-Low VOC Alkyd Resin Coatings"—Marvin Landau, Hüls America, Inc.

(Feb. 10)—"Non-Thixotropic Rheological Additives"—Robert Dey, RHEOX Inc.

Cleveland

(Jan. 21)—Joint Meeting with Cleveland PCA. "Improving the Return on Your R&D Dollar"—H. David Warren, Tremco, Inc.

(Feb. 18)—"The Use of Hansen Solubility Parameters in Reformulating Solvent-Based Coatings"—Wes Archer, The Dow Chemical Co.

(Mar. 17)—"Drier Systems for High Solids Coatings"—Marvin Landau, Hüls America, Inc.

(Apr. 21)—"The Adventures of a Chemist-Collector"—Dr. Alfred Bader, Aldrich Chemical Co.

(May 19)—"Advances in Resin Technology for Waterborne Stains"—Al Heitkamp, Cargill Inc.

Detroit

(Jan. 14)—"Automotive Specifications for Coatings"—Marilyn Perchard, Ford Motor Co.

(Feb. 11)—"Aluminum Pigments for Waterborne Coatings"—Frank Passen, Obron Atlantic.

(Mar. 10)—"UV Absorbers and Hindered Amine Light Stabilizers"—Mark Holt, CIBA-GEIGY Corp.

(Apr. 14)—"Polyvinyl Chloride Resins"—Speaker from ICI Chemicals, Inc.

(May 12)—"Color Theory"—Speaker from Byk-Gardner, Inc.

Golden Gate

(Jan. 13)—"The History and Future of Color Machines"—Jim DeGroff, Color Tec Co.

(Mar. 16)—"Smoothness of Clear Flat Finishes"—Sam Maskery, Crosfield Chemicals Co.

(Apr. 13)—"Waterborne Resins"—Rich Johnson, Cargill, Inc.

(May 18)—"Statistical Process Control"—Dan Baker, McWhorter, Inc.

(June 15)—Manufacturing Committee Seminar.

Los Angeles

(Jan. 8)—Federation Officers Visit. "The History and Future of Color Machines"—Jim DeGroff, Color Tec Co.

(Mar. 11)—Past-Presidents' Night. "Smoothness of Clear Flat Finishes"—Sam Maskery, Crosfield Chemicals Co.

(Apr. 8)—"Waterborne Resins"—Rich Johnson, Cargill, Inc.

Montreal

(Feb. 5)—Annual Mini-Symposium.

(Jan. 8)—Title and Speaker to Be Announced.

Philadelphia

(Jan. 9)—Joint Meeting with Philadelphia PCA. "Environmental Update"—Hugh M. Smith, Sun Chemical Co.

(Feb. 13)—"Surface Treated Pigments: A 90's Solution to Some Coating Problems"—D. Romesh Kumar, Hoechst Celanese Corp.

(Mar. 12)—"Wax Emulsions in Aqueous Polymeric Coatings: Contributions and Mechanisms"—Marty Reihemann, Michelmann Inc.

(Apr. 24)—Awards Night.

(May 14)—"The Malcolm Baldridge Process—A Framework for Improvement"—Ross C. Loeser, E.I. du Pont de Nemours & Co., Inc.

Piedmont

(Dec. 18)—"Economic Outlook for 1992"—Art Werts, Eastman Chemical Products.

Pittsburgh

(Jan. 13)—"Understanding the Difference in Associative Thickeners"—Emitt Partain, Union Carbide Corp.

(Feb. 10)—Federation Officers Visit.

(Mar. 9)—"High-Solids Coatings"—Bernie Taub, Reichhold Chemicals Corp.

(Apr. 13)—Title and Speaker to Be Announced.

(May 11)—Title and Speaker to Be Announced.

Elections

CDIC

Active

Esden, Robert J.—Yenkin Majestic Paint Co., Columbus, OH.
Gierman, Charles E.—The Sherwin-Williams Co., Columbus.
Montgomery, Donald R.—Hunting Industrial Coatings, Cincinnati, OH.
Vogelsang, Walter E.—Hunting Industrial Coatings, Cincinnati.
Zylla, Elizabeth G.—Yenkin Majestic Paint Co., Columbus.

CHICAGO

Active

Allie, Gregory S.—Crosfield Chemicals, Joliet, IL.
Anderson, Eugene A.—Moline Paint Mfg. Co., Moline, IL.
Bowman, John—Rust-Oleum Corp., Pleasant Prairie, WI.
Burkhard, D. Richard—Mid-States Resins, Genoa, IL.
Hodges, Steven A.—Halox Pigments, Hammond, IN.
Hoffman, Marina D.—ANGUS Chemical, Wood Dale, IL.
Leotsakos, George S.—Dexter Packaging Products, Waukegan, IL.
Migdal, Alex—Ace Hardware Paint Div., Matteson, IL.
Seelig, Stanley S.—La-Co Industries Inc., Chicago, IL.
Shah, Bharati A.—Tru-Test Manufacturing Co., Cary, IL.
Stevens, Rick B.—U.S.G. Corp., Libertyville, IL.
Tegtmeyer, Henry—Rust-Oleum Corp., Pleasant Prairie.
Thielmann, Jeannine H.—ANGUS Chemical Co., Wood Dale.
Van Heule, James G.—Moline Paint Manufacturing Co., Moline.

Associate

Housenga, Jon—McWhorter Inc., Carpentersville, IL.
Jogani, Manu D.—Rite Systems Inc., West Chicago, IL.
Johnson, Dale H.—Ashland Chemical, Inc., Countryside, IL.
McCreary, Bryan F.—Cabot Corp., Tuscola, IL.
Peto, Mark A.—Jensen-Souders Assoc., Itasca, IL.
Van Riessen, Edwin—Colwell/General, Schaumburg, IL.

DETROIT

Active

Dhake, Bhimashankar G.—Dhake Industries, Plymouth, MI.
Nagle, Margaret M.—Chrysler Corp., Royal Oak, MI.
Turner, Melwyn—Valspar, Fort Wayne, IN.

Associate

Fiedler, David M.—Office of Waste Reduction Services, Lansing, MI.
Morris, David A.—DA Campbell & Co., Solon, OH.
Passen, Frank J.—Obron Atlantic Corp., Painesville, OH.
Walz, Robert A.—Environmental Tech Group, Rochester Hills, MI.

HOUSTON

Active

Batchelor, Richard D.—Seamaster Marine Coatings, Channelview, TX.
Falcone, Michael G.—ITI Anti-Corrosion, Inc., Houston, TX.
Green, Joe A.—International Paint, Houston.
Kapadia, Jay M.—Vickers Industrial Coatings, Channelview.
Phan, Joe H.—Titan Chemical, Houston.
Reddy, Ramchandra M.—Witco Corp., Houston.

Associate

Dornstauder, Gregory J.—Witco Corp., Houston, TX.
Nelson, Craig—Cabot Corp., Richardson, TX.

Educator/Student

Chellappa, Vtish—Houston, TX.
Ishiba, Shota—Lake Jackson, TX.
Mostafa, Mona—Houston.

LOS ANGELES

Active

Rogers, James W. II—Custom Paint & Chemical Co., Inc. North Hollywood, CA.
Shellhammer, Steven P.—Cargill Inc., Lynwood, CA.

Associate

Haigh, Bill—Synergistic Performance Corp., Tustin, CA.
Jones, Gordon H.—Radcure Specialties, Thousand Oaks, CA.
Largent, Randy—United Environmental Technologies, Beverly Hills, CA.
Lutkus, Michael J.—Day-Glo Color, Cudahy, CA.
Lutz, Patrick B.—E.I. du Pont de Nemours & Co., Inc., Mission Viejo, CA.
McDaniel, Joe—Dowd & Guild, Inc., Playa Del Rey, CA.
Whitney, Wallace W.—Synergistic Performance Corp., Tustin.

NEW ENGLAND

Active

Anzuoni, Albert R.—C.L. Hauthaway & Sons, Lynn, MA.
Bell, Patricia B.—ICI Resins US, Wilmington, MA.
DiLiello, Luke M.—Samuel Cabot Inc., Newburyport, MA.
Fellows, Kenneth S.—Westfield Coatings, Westfield, MA.
Himmelstein, Allan—Rohm Tech Inc., Malden, MA.
Kim, Dae Sik—Kimat Paint, Newton, MA.
Kropp, Philip L.—Loctite Corp., Newington, CT.
Michaelipes, Paraskevas M.—ICI Resins US, Wilmington.
Steingraf-Boyko, Elena—Rohm Tech Inc., Peabody, MA.
Telman, Richard A.—Ensign-Bickford Coatings, Simsbury, CT.

Associate

Anderson, Gene C.—Chemcentral Corp., Nashua, NH.
Flanagan, Thomas J.—Chemcentral Corp., Litchfield, NH.
Penney, Debbie M.—The Truesdale Co., Brighton, MA.
Pihl, Lisa B.—Monson Chemicals Inc., Leominster, MA.
Smith, Greggory C.—Cabot Corp., Edison, NJ.

NEW YORK

Active

Anand, Harry—E-Beam Services, Plainview, NY.
Bator, Daniela—Cook & Dunn Paint Corp., N. Arlington, NJ.
Clemente, Arthur C.—Hoboken Paint Inc., Lodi, NJ.
Coughlin, Robert D.—King Industries, Norwalk, CT.
Cowell, Richard D.—Thibaut & Walker Co., Inc., Newark, NJ.
McGrath, James—Hoboken Paint Inc., Lodi.
Meyers, Ginger G.—Akzo Chemicals Inc., Dobbs Ferry, NY.
Ogbutor, Frederick C.—Daniel Products Co., Jersey City, NJ.
Webster, Joseph R.—American Cyanamid Co., Bridgewater, NJ.

Associate

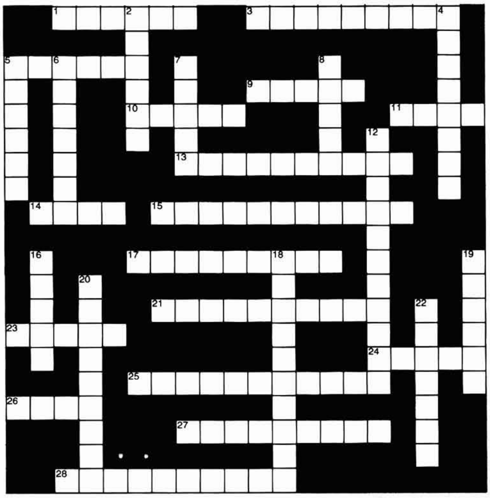
Duffy, Paul G.—Chemcentral Corp., Cedar Knolls, NJ.
Falconer, Arthur J.—Arthur Falconer Assoc., Englewood Cliffs, NJ.
Guiry, Dennis P.—General Electric, Princeton, NJ.
O'Donnell, Thomas J.—Southern Clay Products, Hazlet, NJ.
Przybylowski, Robert—Whittaker, Clark & Daniels, South Plainfield, NJ.
Shimkus, Edward J.—Omya Inc., Long Valley, NJ.
Skora, Alexander J.—Estron Chemical Inc., Mountain Lakes, NJ.

Retired

Young, Theodore—Coral Springs, FL.

CrossLinks

by Earl Hill



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No. 45

ACROSS

1. Vehicle or binder synonym depending on condition or state
3. To swell; particular coating type
5. Follower of test
9. To combine with, as in chemistry
10. Opposite of flat
11. Word with 5 Across
13. What is an instrument that measures liquid Sp. Gr.?
14. Apply by patting on
15. Something capable of absorbing water
17. A metal combined with water (Chem.)
21. What is an instrument that measures humidity?
23. A form of water
24. Poisonous, said of wastes (Ecol.)
25. What is color produced from light interference phenomenon?
26. A printing defect resulting from slippage
27. A material affecting chemical change
28. To saturate, as e.g. to ____________ a cloth with varnish

DOWN

2. Dark blue dye
4. To discharge into the air (Ecol.)
5. An adhesive composition, M________
6. Titanium dioxide (Syn.)
7. Follower of spray
8. Something used to weigh pigments
12. Chemical term for a compound partly composed of water, H________
16. A surface pattern or design produced via inserts
18. What do you call two fluids which are not mutually soluble?
19. Mineral compound, volcano derived
20. Chemical compounds having the same formula but different properties
22. Medium boiling solvent; AKA cyclohexanol

People

Federation Past-President **John C. Ballard** has been appointed National Coatings Manager for Burgess Pigment Company, Sandersville, GA. In this position, Mr. Ballard will be responsible for technical service and marketing in the paint and related industries. He previously held the post of Vice President/Research for Kurfees Coatings, Inc., Louisville, KY.

Mr. Ballard served as Federation President in 1989-90 and was Treasurer in 1987-88. He was Chairman of the Mattiello Lecture Committee and member of the Finance Committee in 1990. Mr. Ballard was an at-large-member on the Board of Directors from 1978 to 1980, and Chairman of the Paint Show Exhibits' Awards and Annual Meeting Program Committees. He is a Past-President of the Louisville Society (1976-77) and is a graduate of the University of Louisville.

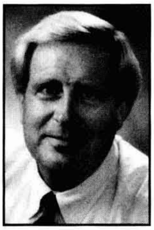
Thomas W. Grunstra has accepted the newly created position of Project Development Manager for Whittaker, Clark & Daniels, Inc., South Plainfield, NJ. Mr. Grunstra joined the company in 1975 as a Sales Representative and was promoted to positions of increasing responsibility, including Senior Account Manager.

Paul Herman has been appointed District Manager for the Tulsa branch of Harcros Chemicals Inc., Kansas City, KS. Prior to joining Harcros in 1988, Mr. Herman had been a Salesman for Delta Distributors Inc., Tulsa.

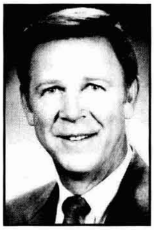
Also, **Max Wright** has been transferred from the Tulsa branch of Harcros to the company's Houston location where he will serve as District Manager. He had been District Manager/Tulsa since 1986.

Ronald Hunter has joined the Instrument Society of America (ISA), Research Triangle Park, NC, as Manager/Training Programs in the Society's Education and Training Services Department. In managing the Society's training programs, Mr. Hunter will be responsible for course development, marketing, and delivery.

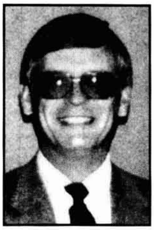
In addition, **H. Lynn Reese** has accepted the position of Director/Education and Training Services for ISA. In this capacity, Mr. Reese will direct and guide the development of training programs for industrial engineers and technicians.



J. C. Ballard



M. Raiteri



W. Fabiny

Datacolor International, Lawrenceville, NJ, has named **Mark Raiteri** Vice President of Sales. Mr. Raiteri was previously National Sales Manager and has served Datacolor and its predecessor, Applied Color Systems, Inc. (ACS) in senior sales management positions for 16 years. Before joining ACS in 1975, he held positions as Manager of a color laboratory for a major textile manufacturer, and as an executive with other companies in the color measurement and control industry.

Rodney J. Hicks has accepted the post of Eastern Regional Sales Manager for the Resin Products Division of Cargill, Inc., Forest Park, GA. Mr. Hicks will assume management of direct and agency sales for both the Southeast and Northeast.

George R. Hennigan has been named President of Kerr-McGee Chemical Corporation and Senior Vice President of Kerr-McGee Corporation, Oklahoma City, OK. Mr. Hennigan succeeds **W. Loy Johnson**, who will serve in an advisory capacity until his retirement at the end of the year.

The position of Sales Representative/Southeastern United States for Avecor, Inc., Vonore, TN, has been filled by **Jim Minchey**. Under this title, Mr. Minchey will be responsible for market coverage in South Carolina, Georgia, southern Alabama, southern Mississippi, and Florida.

Philadelphia Society Manufacturing Committee Chairman, **Russ Licciardello**, has been named Area Sales Manager within the Silanes and Silicones business unit of Hüls America Inc., Piscataway, NJ. Prior to joining Hüls, Mr. Licciardello had been a Regional Sales Manager with Cyprus Industrial Minerals, Engelwood, CO.

The position of Sales Manager/Coatings, Industrial Biocides Division for ISK Biotech Corporation, Mentor, OH, has been accepted by **Dennis L. Carlson**. In this capacity, Mr. Carlson will be responsible for the sales and marketing of all biocides sold to the domestic and international coatings industry. He previously served as Biocides Manager/Architectural Coatings, the Americas.

William Fabiny, of SermaGard, Wins Philadelphia Society Liberty Bell Award

William Fabiny, of SermaGard Coatings Division of Sermatech International Inc., Limerick, PA, is the 1991 recipient of the Philadelphia Society for Coatings Technology's Liberty Bell Award. The award is given in recognition for outstanding contributions to the advancement of the protective coatings industry and to the Philadelphia Society.

Mr. Fabiny, who has been with the Society for 15 years, currently serves as President-Elect of the Society; served as Society Technical Committee Secretary for three years and was Chairman for another three years; served as Society Educational Committee Chairman for three years; and was Chairman of the Society's technical seminar in 1987. Mr. Fabiny holds five patents in the coatings field.

Air Products and Chemicals, Inc., Allentown, PA, has announced the following executive appointments:

Arthur T. Katsaros has been named Vice President and General Manager/Electronics Business Area. Mr. Katsaros, who joined the company in 1973 as a Senior Process Engineer in the Process Systems Group, has extensive experience in business area management, planning, and business development.

The position of Vice President/Human Resources has been filled by **Joseph P. McAndrew**. Mr. McAndrew served as Corporate Director-Compensation and Human Resources prior to his new position.

Hermann Ortega has been appointed Vice President and General Manager/Manufacturing Division, Chemicals Group. In this capacity, Mr. Ortega will oversee the company's worldwide chemical manufacturing operations.

Richard Scott has joined the staff of Dar-Tech, Inc., Maple Heights, OH, as Sales Representative Color Specialist. At this post, Mr. Scott will be responsible for the sales of a line of color and lab instrumentation in northern Ohio, Michigan, western Pennsylvania, and West Virginia.

Research-Cottrell, a subsidiary of Air & Water Technologies Corporation, Branchburg, NJ, has announced that **Robert H. Cardell** has joined the firm as Vice President/Operations for the Air Pollution Control Division. Prior to joining Research-Cottrell, Dr. Cardell served in senior management operations within the construction, engineering/manufacturing, and environmental companies of Foster Wheeler Corporation.

The promotion of **John J. Gallagher** to Vice President/North American Sales has been announced by RHEOX, Inc., Hightstown, NJ. Mr. Gallagher joined RHEOX in 1964 as a Quality Control Technician. He was promoted to the sales department in 1967 and was appointed District Sales Manager in 1976. Mr. Gallagher most recently served as Regional Sales Manager.

In addition, **David A. Bryant** has been appointed Senior Technical Service Representative at the company's laboratory facility in Hightstown. In this position, Mr. Bryant will be responsible for all phases of technical support for RHEOX products in waterborne applications.

Andrew Mar has been named Business Director/Additives for Radiation Curing and Photography for the Additives Division of CIBA-GEIGY Corporation, Hawthorne, NY. In this position, Dr. Mar will be responsible for the sales, marketing, customer technical support, and research and development for current and new additives for radiation curing. He has been with the company for eight years. Dr. Mar is a member of the New York Society.

In addition, **Richard C. Wallace** has joined the coatings field sales force of The Plastics Division of CIBA-GEIGY as Senior Technical Sales Representative. He will be in charge of the company's major coatings accounts in Illinois, Wisconsin, Michigan, and Ohio.

M.A. Bruder & Sons, Inc., Broomall, PA, has named **John Ingram** Corporate Technical Director. Prior to this appointment, Mr. Ingram served as a Consultant with Consolidated Research, Inc., Mount Prospect, IL, and is a former Director of trade sales and consumer products research for DeSoto, Inc., Des Plaines, IL He is a member and a Past-President of the Chicago Society.

1992 Special Issue Schedule

Journal of Coatings Technology

January—Annual Meeting and Paint Show Wrap-up Issue

Featured is information on all exhibitors, with emphasis on exhibitor products and special booth features; photo displays of award-winning booths are presented; and a complete review of important Annual Meeting and Paint Show happenings is highlighted.

February—Education Issue

The extensive Educational Committee "Guide to Coatings Courses, Symposia, and Seminars" is highlighted. This compilation of courses, symposia, and seminars on coatings related topics is based on information obtained from Constituent Societies of the Federation, educators, and various industry sources. The contents are listed by geographic region, then alphabetically by Society.

March—Critical Pigment Volume Concentration Issue

This issue, introducing contemporary papers on CPVC, allows an opportunity to orient new work with ancient, medieval, and modern coatings crafts and technologies.

September—Pre-Paint Show Issue

The first official listing of the Preliminary Program of Technical Sessions is featured along with the floor plan of show exhibitors, registration forms, housing forms and hotel information, as well as general show information.

October—Paint Show Issue

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

For more information, contact Lorraine Ledford,
Journal of Coatings Technology,
492 Norristown Rd., Blue Bell, PA 19422
Phone: (215) 940-0777 • FAX: (215) 940-0292

jct JOURNAL OF COATINGS TECHNOLOGY
492 Norristown Rd., Blue Bell, PA 19422

Chicago Society for Coatings Technology to Present SYMCO '92, "Sharing Technology," on January 23

SYMCO '92, cosponsored by the Chicago Society for Coatings Technology and the Chicago Paint and Coatings Association, is scheduled for January 23, 1992, at the Holiday Inn Crowne Plaza, Lisle, IL. The theme for SYMCO '92 is "Sharing Technology."

The symposium will feature eight presentations focusing on trade sales and industrial coatings. The program's scheduled papers and speakers include:

"EPA Regulations and Their Impact on the Coatings Industry"—Ed Doty, of U.S. EPA Region 5;

"HEEU for Waterborne Coatings"—Fred Giles, of Union Carbide;

"New Vinyl Polymers and Monomers"—Ollie Smith, of Union Carbide;

"Water-Based Exterior Paints—Past, Present, and Future"—Walt Gozdan, of Rohm and Haas Company;

"The Effects of CCA-Treated Wood on the Performance of Surface Finishes"—William Feist, of U.S. Department of Agriculture Forest Service, Forest Products Laboratory;

"The Future of Aerosol Paint: Conventional High-Solids Versus Waterbase"—Patrick S. Gieske, of Seymour of Sycamore;

"Selecting the Best Approach to VOC Compliance in Epoxy Coatings"—George Roy, of Rhone-Poulenc, Inc.; and

"Two Component Waterborne Polyurethanes"—Richard Hergenrother, of Mobay Corporation, A Bayer USA Company.

Members of the SYMCO '92 Committee are: P.J. McGrath, of Ashland Chemical, Inc.; Michael Beland and Steve Hodges, of Halox Pigments; John Devaney, of Cabot Corporation, CAB-O-SIL Division; John Hanacek and Bill Heiden, of Ace Hardware, Paint Division; Lori Hilson-Gaede, of T.H. Hilson Company; Jim Salisbury, of Ucar Emulsion Systems; and Dave Stromberg, of Standard T Chemical Company Inc.

For more information, contact P.J. McGrath, Ashland Chemical, Inc., 6428 Joliet Rd., Countryside, IL 60525.

Applications Being Accepted For Third Annual Henkel Colloid and Surface Award

Applications are now being accepted for the third annual award of the Henkel Corporation Research Fellowship. Application for the fellowship must be made by February 1, 1992.

The award supports the advanced academic study of surface and colloid chemistry. Under the fellowship, Henkel contributes $20,000 for each of two years to students working toward Ph.D. Degrees in surface and colloid chemistry at graduate schools in the U.S.

Notice of the third annual award of the Henkel Corporation Research Fellowship is being transmitted to about 600 accredited departments of chemistry and chemical engineering at colleges and universities in the U.S.

Henkel is committed to funding the fellowship for at least five years, which means the company will make a contribution of at least $160,000. The fellowship is administered by the American Chemical Society's Division of Colloid and Surface Chemistry.

For more information on the fellowship, write Henkel Corp., 2200 Renaissance Blvd., Suite 200, Gulph Mills, PA 19406.

CALL FOR PAPERS

International Symposium on Surface Phenomena and Latexes in Water-Based Coatings and Printing Technology

Sponsored by
Fine Particle Society

July 13-17, 1992
Riviera Hotel, Las Vegas, NV

The Fine Particle Society will sponsor an international symposium on "Surface Phenomena and Latexes in Water-Based Coatings and Printing Technology," on July 13-17, 1992, at the Riviera Hotel, Las Vegas, NV.

The sponsors are seeking papers from all areas of fine particles, latexes, and coatings, as well as surface and colloid chemistry of additives related to coatings and ink formulations.

Papers which address the following topics will be considered:

Formulation, stabilization, and characterization of latexes and pseudolatexes;

Characterization of additives employed in all types of coating and printing formulations;

Role of particles and latexes in coating and printing processes;

Wettability in water-based coatings and printing processes;

Adhesion of coating films on different substrates;

Stability of coating and printing dispersions in aqueous medium;

Interactions between coating/printing materials and substrates;

Problems associated with water-based coatings and printing processes;

Role of particle size and size distribution on coating performance;

Dynamic and equilibrium surface properties of additives used in coatings and printing formulations; and

Analytical procedures related to additives in coating formulations.

Abstracts, not to exceed 200 words, are due March 1, 1992. Authors of selected abstracts will be notified by April 1. Full manuscripts for review and inclusion in an eventual proceedings book are due at the time of the meeting.

For more details, contact symposium organizers: Dr. M.K. Sharma, Research Laboratories, Eastman Chemical Co., P.O. Box 1955, Kingsport, TN 37662; or Dr. M.S. El-Aasser, Emulsion Polymers Institute, 111 Research Dr., Iacocca Hall, Lehigh University, Bethlehem, PA 18015.

Akzo Chemicals to Sponsor First Polyacrylates Symposium On March 17-18, at Walt Disney World, in Lake Buena Vista

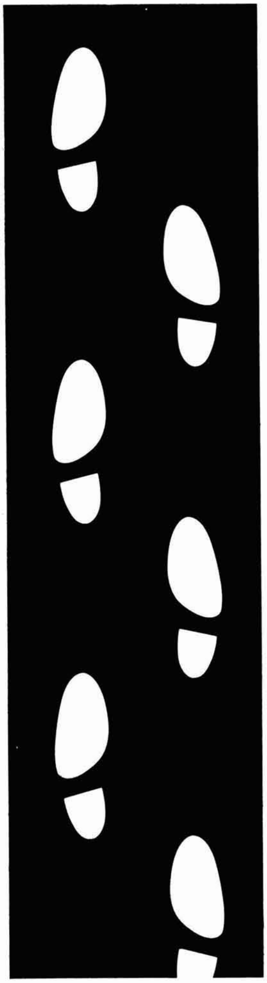
The first "Polyacrylates & Initiators" Symposium is scheduled for March 17-18, at Disney's Contemporary Resort in Walt Disney World, in Lake Buena Vista, FL. The symposium is being sponsored by Akzo Chemicals Inc., Chicago, IL.

The program will include technical presentations on subjects related to the polyacrylates industry. Special attention will be focused on initiator application and safety issues. Other topics to be included are: initiators for high solid resins; initiators for high conversion solvent and emulsion polymerization; alternative peroxides for tert-butyl peroxybenzoate; solvents in coatings; functional initiators in polyacrylates; safety review of peroxides in the industry; safety audit parameters for organic peroxides storage and handling; and statistical process control.

Featured speakers will include Dr. Francesco Ciardelli, of the Department of Chemistry and Industrial Chemistry, University of Pisa, Italy; Dr. A.E. Hamielec, of the Institute for Polymer Production Technology, McMaster University, Ontario, Canada; and William Ellis, an independent industry consultant.

In addition, Akzo technical specialists will cover relevant acrylate and initiator topics.

For more information, contact Ginger Myers, Technical Development Manager, Akzo Chemicals Inc., One Livingstone Ave., Dobbs Ferry, NY 10522.



Roof Coatings Conference Slated for January 19-22

The Annual Conference & Expo '92 of the Roof Coatings Manufacturers Association (RCMA) will be held on January 19-22, 1992, at the Orange Tree Resort and Conference Center, Scottsdale, AZ.

The theme of the 1992 Conference and Expo is "Roof Coatings in a Global Environment." The event will provide business and educational programming. Sessions are targeted in specialized areas, including marketing, technical, regulatory, management, and facility operations.

In addition, user presentations representing various roof coatings market segments will be demonstrated.

For more details on the Annual Conference & Expo '92, write RCMA, 6288 Montrose Rd., Rockville, MD 20852.

SUNY to Sponsor Two Short Coures in Spring

The Institute of Materials Science, State University of New York (SUNY), New Paltz, NY, has scheduled two short courses for the spring of 1992.

SUNY's featured courses, dates, and locations are as follows: "Polymer Blends and Alloys: Phase Behavior, Characterization, Morphology, Alloying, and Technology"—March 16-18, Orlando, FL; and "Advances in Polymer Colloids/Emulsion Polymers: Polymerization, Characterization, and Applications"—May 4-6, New Orleans, LA.

The "Polymer Blends" course is a series of selected lectures geared toward scientists and engineers who are, or will be, involved in the research and development, manufacturing, or application of polymer blends and alloys.

"Polymer Colloids" is designed primarily for the industrial researcher who is entering the field, or who has been working with polymer colloids and is searching for answers.

For more short course information, write CSB 209, SUNY, New Paltz, NY 12561.

Book Review

SILICONE-BASED POLYMER SCIENCE: A Comprehensive Resource (Advances in Chemistry Series 224)

Edited by
J.M. Zeigler and F.W.G. Fearon

Published by
American Chemical Society
1155-16th St., N.W.
Washington, D.C. 20036 (1989)
xxii + 801 Pages, $129.95

Reviewed by
Robert F. Brady, Jr.
Naval Research Laboratory
Washington, D.C.

Resins containing silicon, especially the silicones, are among the most proprietary areas of resin technology, and there are few texts which treat them in a comprehensive and definitive manner. This book, based on a 1987 international workshop, is a welcome collection of modern information on these materials. The book includes chapters on fundamentals as well as numerous specialist reports on the synthesis, structure, properties, and applications of all the major classes of polymers containing silicon.

The book is comprised of an Introduction and five sections. The Introduction to the book is written by Eugene Rochow, the inventor of major families of silicon-containing resins, and gives an engaging historical perspective to the first section on Fundamentals, which contains two tutorial chapters on silicon chemistry and polymers and serves as a primer for the rest of the volume. The second section contains 14 chapters on siloxane polymers. Detailed synthetic pathways are presented, and the thermal, rheological, and hydrolytic properties of the polymers are described.

The third part contains 14 chapters on polysilanes and related polymers. This section contains five chapters which treat such topics as electronic structure, optical absorption, and ionization energies by computer simulations. There are four chapters on preceramic polymers in the fourth section; these emphasize materials which may be converted to coatings and fibers with outstanding dimensional and thermal stability. The fifth section contains eight chapters on other silicon-based polymers. This section contains an intriguing chapter on the surface properties of silicones, and will be of great interest to coatings chemists who work, for example, with coatings to resist the adhesion of ice, dirt, or marine fouling.

The unusual properties of the polymers in this book suggest fertile areas for research on new coating materials. Industrial scientists wrote 22 of the 42 chapters, and thus this volume has a practical tone. It is filled with clear photographs, figures and tables, is sturdily bound, and contains comprehensive author and subject indexes. The book can be recommended with confidence to those who wish to develop intriguing new coatings which take advantage of the unusual properties of silicon-containing resins.

POLYMERS AS RHEOLOGY MODIFIERS

Edited by
Donald N. Schulz and
J. Edward Glass

Published by
American Chemical Society
1155-16th St., N.W.
Washington, D.C. 20036 (1991)
xii + 345 Pages, $79.95

Reviewed by
Paul R. Guevin, Jr.
P.R. Guevin Associates
Westerville, OH

This book covers the important area of polymers that can be used as rheology modifiers. On September 11-13, 1989, the American Chemical Society Division of Polymeric Materials: Science and Engineering sponsored the symposium "Polymers as Rheology Modifiers." Thirty-three papers were presented. The symposium was divided into the following groups: Extentional Viscosity and Related Phenomenon, Specialty Rheology Modifiers; Electrorheological (ER) and Other Fluids; Bulk Phase Modification, Hydrocarbon Rheology Modifiers in Crude Oil, Lubes, etc., Micro- and Macrogel Influences on Rheology, Surfactant Modified Water Soluble Polymer Rheology, and Coatings Rheology Modifiers. These papers constituted 158 pages of the preprint booklet.

Numerous books cover rheology. However, few are devoted primarily to polymers as materials for modifying or controlling rheology. Polymers at low levels have a profound effect on the rheology of fluids such as coatings, paints, lubricants, cosmetics, etc. This hardbound book is aimed to fill this void.

The authors expanded their papers and submitted them for review prior to publication. This book consists of 20 papers divided into five groups: Rheological Concepts, Gels and Lattices, Associating Polymers, Polymer-Polymer and Polymer-Solvent Interactions, and Deformation-Related Orientations. The resin chemistry involved should be useful to chemists designing new coating formulations for demanding applications.

Literature

Weathering Test Methods

Information has been released which details a laboratory instrument for weathering and lightfastness testing of textiles, paints, inks, plastics, elastomers, coatings, building products, and many other materials. Additional features of the weathering testing equipment include self-diagnostic controls, interchangeable light filters, constant irradiance control, and large specimen capacity. For more information, contact Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613

Mixer Maintenance

A revised 258-page book shows users how to recognize and handle most facets of mixer maintenance. "A Practical Guide to Mixer Maintenance" provides step-by-step instructions for most mixer maintenance operations from installation to troubleshooting of the company's line of mixers. Also included are recommended procedures for mixer storage, start-up, and lubrication. For more information, write Betty Felix, Lightnin, 135 Mt. Read Blvd., P.O. Box 1370, Rochester, NY 14603-1370.

Metering Pumps

A new, four-color, six-page brochure features a full range of metering pumps. Included are six new distinct series of modular diaphragm metering pumps. For Bulletin B-666, "Proportioneer Metering Pumps," write to Proportioneer, Div. of Mixing Equipment Co., 150 Elmgrove Park, Rochester, NY 14624.

Fillers and Extenders

Calcium carbonate fillers and extenders for use in latex paint systems are described in a full-color brochure. Included in the brochure are test results and typical formulations. For a copy of the publication, contact John Muller, Manager/Marketing Services, J.M. Huber Corp., 2029 Woodlands Pkwy., Ste. 107, St. Louis, MO 63146.

Rheometer/Viscometer Printer

A new 80-column line printer which allows viscosity instruments to print out measurement results every second in real time is the subject of a technical data sheet. For complete details, contact Brookfield Engineering Laboratories, Inc., 240 Cushing St., Stoughton, MA 02072.

Dimer Acids

A new four-page brochure describes the features of recently introduced dimer acids. Used as building blocks or modifying dibasic acids, the dimer acids contain low levels of both C18 monomers and C54 trimers. For additional information, contact Guillermo Schnitzler, Technical Service Representative, Unichema North America, 4650 S. Racine Ave., Chicago, IL 60609.

Aqueous High-Solids Polyurethane Dispersion

A high-solids aqueous polyurethane dispersion suited for use as a base for the formulation of coatings used to protect wood floors and other wood products is the subject of literature. Further information on the Witcobond® W-236 polyurethane dispersion, may be obtained from the Polyurethane Specialties Group, Witco Corp., 2701 Lake St., Melrose Park, IL 60160-3041.

Filtration Products

A recently published 28-page catalog includes basic filtration information, a representation of a company's media products, a product selection guide, and information about the history of the company. For copies, order catalog CIF.001.590 from Cuno, Inc., Process Filtration Products, 400 Research Pkwy., Meriden, CT 06450.

Crosslinking Agents

A new, four-color brochure highlights two crosslinking agents. Included are property comparisons, typical characteristics charts, as well as details on the stabilization, FDA status, storage conditions, and safety in handling of the resins. For more information, contact American Cyanamid Co., One Cyanamid Plaza, Wayne, NJ 07470.

UV/VIS, Fluorescence and Polarimetry Systems

A new, 12-page, black-and-white pamphlet provides a brief profile on a company's line of ultraviolet/visible (UV/VIS), fluorescence, and polarimetry systems. Titled "Guide to UV/VIS, Fluorescence, and Polarimetry Systems," the pamphlet is designed to familiarize readers with the key features and benefits of the products offered in these application areas. For a copy of Order No. L-1429, contact The Perkin-Elmer Corp., M/S 012, 761 Maine Ave., Norwalk, CT 06859-0012.

Zinc-Rich Coating

Information has been released which details the features of a VOC compliant, two-component zinc-rich organic epoxy coating developed for the steel fabrication market. The primer meets SSPC paint specification No. 20 for zinc rich primers as well as federally defined VOC job shop application requirements. Inquiries for additional information should be identified as "Zinc Clad IV (SWS-3573)," and sent to The Sherwin-Williams Co., c/o HKM Direct, 5501 Cass Ave., Cleveland, OH 44102.

Color Control Technologies

Recently released technical information details a fully integrated line of computer color control systems, instruments, and software for paints and coatings. The products are designed for consistent computer control of color from the manufacturer of raw materials through manufacturing and quality inspection to the retail marketing of paints and coatings. Contact Datacolor International, 5 Princess Rd., Lawrenceville, NJ 08648 for complete details.

Cellulose-Based Fiber

Literature has been published which introduces two grades of fiber materials designed for use in crack fillers. The fillers contain medium-length cellulose fibers with an interwoven matrix. They have been tested specifically for asphaltic emulsion, cold pour crack fillers and can be used to replace asbestos fibers. Direct inquiries to John Sullivan, Interfibe Corp., 6001 Cochran Rd., #A-202, Solon, OH 44139.

CLASSIFIED ADVERTISING

Technical Director

Excellent career opportunity for experienced chemist: Supervise lab chemists, technicians. Quality Assurance. Key executive position in prosperous Chicagoland firm. Knowledge of urethane, epoxy formulation in floor coating market helpful. Secure position with excellent and negotiable compensation. Position reports to President of firm. Relocation and interview expenses paid. Call Richard Peacock 515-424-8344 or send resumes to Amerilink, 810 12th NW, Mason City, IA 50401.

Vacuum Breakers

The development of a line of molded thermoplastic vacuum breakers for use in industrial applications has been announced. The breakers are available in sizes $^1/_2$, $^3/_4$, and 1 in. NPT, with standard body material of PVC, Polypropylene, Teflon®, or PVDF (Kynar®) and diaphragms of Buna-N, EPDM, or Viton®. For further information, write Plast-O-Matic Valves, Inc., 430 Rte. 46, Totowa, NJ 07512.

Peel Tester

A quantitative adherence peel tester for thin film coating adherence, direct peel of self supporting films, or adhesion of tapes and labels is the subject of literature. The instrument includes auto-plotting and analysis plus other interchangeable test heads. For more details on the P-Module quantitative adherence peel tester, contact Quad Group, South 1815 Lewis, Spokane, WA 99204.

Systems for Finishing Wood Cabinets

A new brochure, "Systems and Services for Finishing Wood Cabinets," provides information on a broad line of coatings for cabinetmakers, and describes a company's national distribution and technical support systems. The six-page, four-color brochure details a variety of finishing systems, including VOC-compliant products. For additional information, identify "Systems and Services for Finishing Wood Cabinets" (SWS-3650), to The Sherwin-Williams Co., c/o HKM Direct, 5501 Cass Ave., Cleveland, OH 44102.

Falling Weight Impact Tester

A data sheet announcing a falling weight impact tester has been published. The tester reportedly determines impact resistance of paint, lacquers, varnishes, plating, siding, plastics, and laminates. For more information on the CS-126G Falling Weight Impact Tester, contact Custom Scientific Instruments, 13 Wing Dr., Cedar Knolls, NJ 07927.

Electron Microscope

A high-performance transmission electron microscope is featured in a new full-color brochure. The literature details imaging systems, operation, focusing, and operation with high specimen throughput. For a copy of the EM 900 Upgrade Brochure, contact Irv Toplin, Carl Zeiss, Inc., One Zeiss Dr., Thornwood, NY 10594.

Spacer/Additive

Information has been released which focuses on a new alumina spacer/additive that can replace part of the titanium dioxide pigment in latex and solvent-based pigmented coatings without reducing optical or application performance characteristics. For details on SpaceRite® S-11 additive, contact Alcoa, Corporate News, 1656 Alcoa Building, Pittsburgh, PA 15219.

Styrene Pigment

A new polymer pigment to enhance the gloss and opacity of coated papers is the subject of recently released literature. The pigment is a solid sphere, polystyrene designed to provide the coating chemist with flexibility to develop new formulations. For more information on 76 RES 7116 pigment, contact Unocal Polymers, 1700 E. Golf Rd., Schaumburg, IL 60173-5862.

Heavy-Duty Drives

A line of large, heavy-duty drives designed specifically for mixing is the subject of a six-page, full-color brochure. These units are designed to handle long, overhung mixer shafts without steady bearings. Contact Betty Felix, LIGHTNIN, 135 Mt. Read Blvd., Rochester, NY 14611 for a copy of the Bulletin B-656, "The LIGHTNIN Super Powers."

Primer/Surfacers

Technical data sheets have been released on several new sandable primers/surfacers for composites. The literature provides product descriptions, applications, curing conditions, colors, and typical properties, etc. For copies of data sheets DS10-7418, DS10-7411A, and DS10-7410A, contact John H. Michel, Lord Corp., 845 Olive Ave., Ste. 207, Novato, CA 94945.

Sealless Valve

The introduction of a "sealless" thermoplastic solenoid valve has been made through literature. The valve is designed to be used in the handling of hazardous, poisonous, or dangerous vapors, gases, and liquids. For a free copy of a descriptive catalog, contact Plast-O-Matic Valves, Inc., 430 Rte. 46, Totowa, NJ 07512.

Spray Tips

A technical data sheet on adjustable spray tips for airless spray painting equipment has been issued. Available in six different sizes, the spray tips are designed to allow the user to adjust the width of the spray pattern or clean a plugged orifice by simply turning the adjustable knob on the tip. For further details, contact Titan Tool, Inc., 556 Commerce St., Franklin Lakes, NJ 07417.

Fog Exposure System

A salt fog exposure system developed to perform salt fog, condensing humidity and noncondensing humidity, and corrosive gas tests has been introduced. The system conforms to the requirements of a wide variety of international test methods including ASTM B117. Write Atlas Electric Devices Co., 4114 N. Ravenswood Ave., Chicago, IL 60613 for further information on the Atlas Omni-Fog dispersion system.

Radiation Curing Chemicals

The introduction of a new line of third generation reactive acrylate monomers has been made through literature. Two products in the series are monofunctional acrylates; the third is a diacrylate monomer. Write Henkel Corp., 300 Brookside Ave., Ambler, PA 19002 for more in-depth details on the Photomer® 8000 series.

Pearlescent Pigment

A new, bismuth oxychloride pearlescent pigment which has a special surface treatment for enhanced UV weathering stability has been introduced in literature. When the surface treated pigment is used in conjunction with selective resins, along with UV absorbers, minimal darkening occurs. For additional details, write The Mearl Corp., 41 E. 42nd St., New York, NY 10017.

IRDM Release 2 Infrared Data Software

Newly published technical information describes a PC-based infrared data manipulation software package designed to enhance FT-IR applications. Additional details on the IRDM Release 2 FT-IR software package may be obtained by writing to The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0012.

Books in Print . . .

An Infrared Spectroscopy Atlas for the Coatings Industry, Two Volumes, 1024 pp. List price: $200.00. Member price: $150.00—Meryl Cohen, Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422-2350, 215/940-0777.

ASTM Standards on Color and Appearance Measurement, 3rd Edition, 420 pp. List price: $55.00. Member price: $50.00—ASTM, 1916 Race St., Philadelphia, PA 19103-1187.

An Assessment of Plastics Processing Technologies in Canada and Europe. List price: $75.00 (plus GST)—The Canadian Plastics Inst., 1262 Don Mills Rd., Unit 48, Don Mills, Ontario, Canada M3B 2W7.

Systems and Specifications. 6th Edition, Volume 2. List price: $100.00—Terry Sowers, SSPC, Publications Dept., 4400 Fifth Ave., Pittsburgh, PA 15213-2683.

The Static SIMS Handbook of Polymer Analysis—Perkin-Elmer Corp., Physical Electronics Div., 6509 Flying Cloud Dr., MS E/11, Eden Prairie, MN 55344.

Water-Soluble Polymers, 536 pp. List Price: $99.95—American Chemical Society, 1155 Sixteenth St., N.W., Washington, D.C. 20036.

GC Column

A four-page brochure detailing a gas chromatography column that has been designed for the detailed GC analysis of petroleum process products has been printed. The instrument has 400,000 theoretical plates which allows quantitation of critical components individually or by class, such as: paraffins, olefins, naphthas, and aromatics. For a free copy of the brochure "DB™-Petro100," contact J&W Scientific, 91 Blue Ravine Rd., Folsom, CA 95630.

Thermal Energy Storage System

A low-temperature thermal energy storage system is the subject of recently released literature. The four-page brochure contains illustrations of the system's design options and typical configurations. For more information, request Form #6930 from Liquid Carbonic, Advertising Dept., 135 S. LaSalle St., Chicago, IL 60603.

Flowmeter

A two-page application bulletin covering a method of metering flow for custody transfer in water and wastewater applications is being offered. The literature illustrates the complete flowmetering system with a schematic diagram, and describes each component including a switch-over control unit and recorder/totalizer. Copies of Bulletin C4.1101-AB are obtainable from Leeds & Northrup, Sumneytown Pike, North Wales, PA 19454-0904.

Convertible Filter Housings

Convertible filter housings that hold either filter cartridges or filter bags are described in a four-page, full-color brochure. These housings are available in either carbon or stainless steel and are electropolished to resist adhesion of dirt and scale. Contact Rosedale Products Inc., 3730 Liberty, P.O. Box 1085, Ann Arbor, MI 48106, for more details on the Series 6300 and Series 8500 filter housings.

Analytical Instruments

A full-color, 44-page brochure highlighting instrumentation used in research, method development, quality control, production control, and quality assurance has been released. Training programs and other services are also described. For a free copy of the literature, "Complete Laboratory Solutions from Perkin-Elmer," write, The Perkin-Elmer Corp., 761 Main Ave., Norwalk, CT 06859-0012.

Coming Events

FEDERATION MEETINGS

For information on FSCT meetings, contact Federation of Societies for Coatings Technology, 492 Norristown Rd., Blue Bell, PA 19422 (215) 940-0777, FAX: (215) 940-0292.

1992

(May 17-20)—Federation "Spring Week." Board of Directors Meeting on the 17th; Incoming Society Officers Meeting on the 18th; Spring Seminar on the 19th and 20th. Sheraton Boston Hotel and Towers, Boston, MA.

(Oct. 21-23)—70th Annual Meeting and 57th Paint Industries' Show. McCormick Place, Chicago, IL.

1993

(Oct. 27-29)—71st Annual Meeting and 58th Paint Industries' Show. World Congress Center, Atlanta, GA.

1994

(Oct. 12-14)—72nd Annual Meeting and 59th Paint Industries' Show. New Orleans Convention Center, New Orleans, LA.

SPECIAL SOCIETY MEETINGS

1992

(Jan. 23)—Chicago Society. SYMCO '92—"Sharing Technology." Holiday Inn Crowne Plaza, Lisle, IL. (John DeVaney, Cabot Corp., Cab-O-Sil Div., P.O. Box 188, Tuscola, IL 61953).

(Feb. 26-28)—Southern Society. 19th Annual Waterborne, Higher-Solids, and Powder Coatings Symposium. Co-sponsored by the Department of Polymer Science at the University of Southern Mississippi (USM). New Orleans, LA. (Robson F. Storey and Shelby F. Thames, Co-Organizers, WBHS&PC Symposium, Dept. of Polymers Science, USM, Southern Station Box 10076, Hattiesburg, MS 39406-0076).

(Mar. 11-13)—Southern Society Annual Meeting. Grosvenor Resort Hotel, Orlando, FL. (Billy Lee, Kemira, Inc., P.O. Box 368, Savannah, GA 31402).

(Mar. 29-31)—Houston and Dallas Societies. Southwestern Paint Convention. South Shore Harbour Resort & Conference Center, League City (Houston), TX. (Dennis Crozier, Crozier-Nelson Sales, Inc., 2505 Collingsworth, Houston, TX 77026).

(May 1-2)—Pacific Northwest Society. Annual Symposium. (John Westendorf, Lipscomb Chemical Co., 2627 N.W. Nicolai St., Portland, OR 97210).

OTHER ORGANIZATIONS

1992

(Jan. 19-22)—The Roof Coatings Manufacturers Association (RCMA) Annual Conference & Expo '92—"Roof Coatings in a Global Environment." Orange Tree Resort and Conference Center, Scottsdale, AZ. (RCMA, 6288 Montrose Rd., Rockville, MD 20852).

(Feb. 18-20)—Hazardous Materials Management Conference and Exhibition/Northern California. San Jose Convention Center, San Jose, CA. (Tower Conference Management Co., 800 Roosevelt Rd., Bldg. E—Suite 408, Glen Ellyn, IL 60137–5835).

(Feb. 23-26)—Williamsburg Conference, "Comparison of Color Images Presented in Different Media." Co-sponsored by the Inter-Society Color Council and the Technical Association of Graphic Arts, Colonial Williamsburg, VA. (Milton Pearson, RIT Research Corp., 75 Highpower Rd., Rochester, NY 14623).

(Mar. 6-7)—108th Annual Convention and Paint and Paper Pro Show. Sponsored by Painting and Decorating Contractors of America (PDCA). Bally's Casino Resort, Las Vegas, NV. (PDCA, 3913 Old Lee Hwy., Ste. 33-B, Fairfax, VA 22030).

(Mar. 9-13)—PITTCON '92 Conference. New Orleans Convention Center, New Orleans, LA. (Pittsburgh Conference, Dept. CFP, 300 Penn Center Blvd., Ste. 332, Pittsburgh, PA 15235-5503).

(Mar. 9-13)—64th Introductory Short Course, "The Basic Composition of Coatings." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Mar. 11-13)—7th Annual Architectural Spray Coaters Association (ASCA) Conference. Saddlebrook Resort, Tampa, FL. (ASCA, 230 W. Wells St., Ste. 311, Milwaukee, WI 53203).

70th Annual Meeting and 57th Paint Industries' Show

McCormick Place North
Chicago, Illinois
October 21-22-23, 1992

October 21-23, 1992

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McCormick Place
Chicago, Illinois

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Sponsored by the
Federation of Societies for
Coatings Technology

(Mar. 17-18)—Electrocoat/92. Sponsored by *Products Finishing* magazine. Drawbridge Inn, Ft. Mitchell, KY. (Greater Cincinnati Airport Area). (Cindy Goodridge, Gardner Management Services, 6600 Clough Pike, Cincinnati, OH 45244).

(Mar. 17-18)—Polyacrylates and Initiators Symposium. Sponsored by Akzo Chemicals Inc. Contemporary Resort in Walt Disney World, Lake Buena Vista, FL. (Ginger Myers, Technical Development Manager, Akzo Chemicals Inc., One Livingston Ave., Dobbs Ferry, NY 10522).

(Mar. 22-27)—35th Annual Technical Conference of the Society of Vacuum Coaters (SVC). Hyatt Regency on the Inner Harbor, Baltimore, MD. (SVC, 440 Live Oak Loop, Albuquerque, NM 87122).

(Mar. 23-26)—WESTEC '92—29th Exposition & Conference. Spronsored by Society of Manufacturing Engineers (SME), ASM International, American Machine Tool Distributors' Association , and The Association for Manufacturing Technology. Los Angeles Convention Center, Los Angeles, CA. (SME Customer Service Center, One SME Dr., P.O. Box 930, Dearborn, MI 48121-0930).

(Mar. 24-26)—Surface Coating '92. Conference and Trade Show sponsored by Chemical Coaters Association International (CCAI). Indianapolis Convention Center, Indianapolis, IN. (CCAI, P.O. Box 54316, Cincinnati, OH 45254).

(Mar. 30-Apr. 3)—24th Introductory Short Course, "Paint Formulation." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Apr. 1-8)—Surface Treatment '92 Exhibition. Hannover Fairgrounds, Hannover, Germany. (Hannover Fairs USA Inc., 103 Carnegie Ctr., Princeton, NJ 08540).

(Apr. 5-10)—"Water-Based Coatings" Symposium. Sponsored by American Chemical Society, Division of Polymeric Materials: Science and Engineering. San Francisco, CA. (F. Louis Floyd, The Glidden Co., 16651 Sprague Rd., Strongsville, OH 44136, or John L. Massingill Jr., The Dow Chemical Co., Bldg. B-1603, Freeport, TX 77541).

(Apr. 7-10)—Davos Recycle '92—International Forum and Exposition. Congress Centre, Davos, Switzerland. (Horst Maack, President, Maack Business Services, Moosacherstrasse 14, CH-8804 AU/ZH, Switzerland).

(May 11-14)—Powder & Bulk Solids '92 Conference/Exhibition. O'Hare Exposition Center, Rosemont (Chicago), IL. (Cahners Exposition Group, Dept. Powder & Bulk Solids '92, 1350 E. Touhy Ave., P.O. Box 5060, Des Plaines, IL 60017-5060).

(May 11-15)—"Physical Testing of Paints and Coatings from Classical Methods to Modern Instrumental Techniques." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(May 19-21)—PaintCon '92. Conference and exhibition sponsored by *Industrial Finishing Magazine.* O'Hare Expo Center, Chicago (Rosemont), IL. (PaintCon '92, 2400 E. Devon Ave., Des Plaines, IL 60018).

(June 1-4)—Fifth International Symposium on Polymer Analysis and Characterization. Inuyama Hotel, Inuyama City, Japan. (Howard Barth, Du Pont Co., Experimental Station, P.O. Box 80228, Wilmington, DE 19880-0228).

(June 2-6)—"Advances in Emulsion Polymerization and Latex Technology." Short course sponsored by Emulsion Polymers Institute, Lehigh University. Bethlehem, PA. (Mohamed S. El-Aasser, Emulsion Polymers Institute, Lehigh University, 111 Research Dr., Bethlehem, PA 18105).

(June 14-18)—XXIth FATIPEC Congress. RAI International Congress Centre, Amsterdam, The Netherlands. (General Secretary Francis Borel, 34 Chemin du Halage, La Bonneville, Mery sur Oise, France).

(June 15-17)—Euroformula '92. International Trade Fair. RAI International Exhibition and Congress Centre. Amsterdam, The Netherlands. (RAI, Europaplein, 1078 GZ, Amsterdam, The Netherlands).

(July 13-17)—International Symposium on Surface Phenomena and Latexes in Water-Based Coatings and Printing Technology. Sponsored by Fine Particle Society. Riviera Hotel, Las Vegas, NV. (M.S. El-Aasser, Emulsion Polymers Institute, 111 Research Dr., Iacocca Hall, Lehigh University, Bethlehem, PA 18015).

(June 21-24)—ISCC 61st Annual Meeting and AIC 25th Anniversary. International symposium on "Computer Color Formulation." Princeton University, Princeton, NJ. (Danny Rich, ISCC Secretary, ACS Datacolor, 5 Princess Rd., Lawrenceville, NJ 08648).

(July 22-24)—"Basic Coatings for Sales and Marketing Personnel." Short course sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Airport Marriott Hotel, St. Louis, MO. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Sept. 14-18)—65th Introductory Short Course, "The Basic Composition of Coatings." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Sept. 28-Oct. 2)—25th Introductory Short Course, "Paint Formulation." Sponsored by University of Missouri-Rolla (UMR), Rolla, MO. Rolla Campus. (Norma Fleming, Sr. Coordinator, UMR, Continuing Education, 119 M.E. Annex, Rolla, MO 65401-0249).

(Oct. 25-30)—Fourth Corrosion and Protection Iberoamerican Congress and First Panamerican Congress on Corrosion and Protection. Mar del Plata, Argentina. (CIDEPINT, 52 entre 121 y 122, 1900 La Plata, Argentina, South America).

(Nov. 4–6)—'92 International Conference on Colour Materials. Sponsored by the Japan Society of Colour Material. Osaka Sun Palace, Expo Park Senri, Osaka, Japan. (S. Tochihara, Chairman of Executive Committee of the '92 ICCM, c/o Japan Society of Colour Material, Kitamura Bldg. 5F, 9-12, 2-chome, Iwamoto-cho, Chiyoda-ku, Tokyo 101, Japan).

Advertisers Index

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'Humbug' from Hillman

The Chinese diplomat and philosopher, Li Hung Chang, on his visit to New York asked his official guide, while he was being hurried from one subway train to another a few feet away, "Why do we change?"

"Oh, that train was a local."

"And what is this?"

"This is an express. It makes no stops 'til we reach Grand Central Station. We save six minutes."

A pause.

"And what," asked Ambassador Li, "Are we going to do with that six minutes?"

—*Treasury of American Anecdotes*—B.A. Botkin

From my treasure trove of old *Farmers' Almanacs* sent to me by the late Roy Tasse—here are some bits of selected nonsense:

Verbal Burbles

Electric pad	Seater heater
Ill hen	Sick chick
Humorous rabbit	Funny bunny
Irate father	Mad dad
Paid bill	Met debt
Crying bird	Sobbin' robin
Happy bird	Perky turkey
Doghouse	Mutt hut

—There was a man so rich that he put his Swiss money in American banks.

—The trouble with the younger generation is that it hasn't read the minutes of the last meeting.

—Show me a gall bladder sufferer who won't take his medicine and I'll show you a man with unmedicated gall.

—A politician is someone who never met a tax he didn't hike.

—The first touch of spring is the Internal Revenue Service.

—There is nothing like sealing a letter to inspire a fresh thought.

—The bulls and the bears are not as responsible for as many losses in the stock market as the bum steers.

—You can't be sure of anything. Just think of all those mothers of 30 years ago who had their daughters vaccinated where they thought it wouldn't show.

—More accidents are caused by pickled drivers than by traffic jams.

—A fad is something that goes in one era and out the other.

—A beautiful woman is one you notice. A charming woman is one who notices you.

—Why do shipments go by car and cargoes go by ship?

—1973 *Farmers' Almanac*

And how did you do on last month's "Nerd Quotient (NQ) Test"? If the test revealed that you are a "certified nerd" in computerese, all is not lost. My daughter-in-law, Pat, found author Darrell S. Corbin in the *Journal of Systems Management*, who offers hope. Here are several of his eleven suggestions on how to appear normal.

"1. Hide those tacky clothes! You don't have to toss them out. Just hide them. Sure, yellow socks go with anything. In fact, it's my favorite color, too. But not everyone agrees with us. The white ones you wear with your best suit or dress (for female nerds only) are also out. The dress for success gurus say dark is in. Get a bunch of black socks next time they're on sale. And if you want, wear the yellow ones underneath since black covers anything. By the way, it's best to wear matching socks at all times, unless you're a software engineer.

2. Get a haircut! Get your beard cut while you're at it. That goes for women, too. If you go to a real barber rather than the beauty operators in training, they'll even wash your hair. If you washed your hair a couple of weeks ago, you may not need it.

3. Get some accessories! O.K., so you already have a calculator watch with 43 scientific functions. But this is a definite nerd tip-off. Other clues are tie clasps or earrings with computer chips, 10-year pins, and pocket protectors. Worse yet, they'll think you're an engineer.

Men, buy some suspenders and get rid of the belt with your name on the back. I'm not sure how the suspenders stay on the pants, but they probably come with instructions. If you're really daring, you might try a bow tie, unless you live in Texas or Alberta. Women can wear bow ties anywhere.

4. Groom yourself! No, this isn't the same as grooming horses. Haven't you seen the commercials on TV where they spray that stuff under the arms? It 's called deodorant. And then there's the 'foo foo.' Some call if perfume or cologne, according to a guy down the hall. Get some of this and try it out. These two tricks alone will help take you out of the nerd category quickly.

5. Exercise! Normal people like to exercise now. Join a health club the next time they call you at home. Get the trial three-week package so you can at least get the decal to put on your car window. If you don't like sweating, just get some sweat spray. Or better yet, get a corset for the old paunch and it will be sure to make you sweat while also making you look athletic. Of course, there are some nerds who exercise now, but not many. They're really unusual."

More later, if I think you need it.

Oops, I almost forgot! Since this is being compiled in October, I almost neglected to wish all our happy and, perhaps, some disgruntled readers the HAPPIEST AND MOST JOYOUS OF HOLIDAYS!!!

—Herb Hillman
Humbug's Nest
P.O. Box 135
Whitingham, VT 05361


AFTER 2 YEARS
FIGHTING THE WEATHE
HYDROPEL* WINS!
Commercial Spar Varnish
Commercial Spar Varnish with Hydr